2000-30021/B01
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Public

TDA 00-30021

# PUBLIC VERSION

# FINAL REPORT

Book 1 of 2
Attachments A through I

## Development of Detailed Specification for the Software, Metering, Communications and Other Relevant Information Technology (IT) System Needed to Support The Philippine Electricity Market Operation

**Prepared for**
**The Department of Energy and**
**The National Power Corporation**
**of the Philippines**

**April 2005**


**By:**
***Utility Consulting International***
Cupertino, California U.S.A.



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# Final Report

## Development of Detailed Specification for the Software, Metering, Communications and Other Relevant Information Technology (IT) System needed to support The Philippine Electricity Market Operation

**For:**

***The Department of Energy and***
***The National Power Corporation***
***of the Philippines***

Appropriation No: 110/11001
Activity No: 00-30021
Reservation No: 0321397
Grant No: GH0321397
Contract No: TDA-GH 0321397

# Final Report

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- **TDA Grant Reference**

  **Appropriation No: 110/11001**
  **Activity No: 00-30021**
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  **Grant No: GH0321397**
  **Contract No: TDA-GH 0321397**

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Republic of the Philippines
**DEPARTMENT OF ENERGY**

# Certificate of Acceptance Of the Final Report

| | |
|---|---|
| Contract No: | TDA-GH0321397 |
| TDA Activity No: | 00-30021 |
| TDA Grant No: | GH0321397 |
| Project: | Development of Detailed Specification for the Software, Metering, Communications and Other Relevant Information Technology (IT) System needed to support The Philippine Electricity Market Operation for the Department of Energy and The National Power Corporation of the Philippines |
| Contractor: | Utility Consulting International (UCI), Cupertino, California, USA |

This is to certify that the Department of Energy has reviewed and approved the Confidential Version and the Public version of the Final Report, and that UCI has completed the project as contracted.

Chrysanthus Heruela
Project Manager
Contract No. TDA-GH0321397

Signature

April 15, 2005

Date



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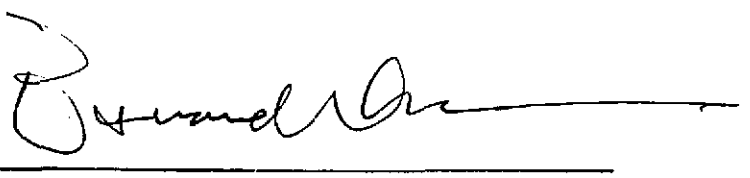

Edward H.P. Chan
Utility Consulting International

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# 1. Introduction

This is the Final Report for the DOE-UCI Contract (TDA-GH0321397).

In 2000, a new Philippines Electricity Market (PEM) [Note: now called the Wholesale Energy Spot Market (WESM)] was to be established in such a way that the power generation companies (generators) compete to provide electricity and that generation be dispatched purely on a competitive price basis, rather than on a minimum-cost basis. The purpose of this project, sponsored by the Philippines Department of Energy (DOE) and funded by the U.S. Trade And Development Agency (USTDA), is to specify the IT systems that will be required to support the PEM.

A contract (Contract TDA-GH0321397) was awarded by the Department of Energy to Utility Consulting International (UCI) on December 14, 2000 for the development of the detailed specification for the software, metering communications and other relevant information technology system needed to support the Philippine electricity market operation. The Terms of Reference were included in Annex I of the contract. The specific tasks to be performed by UCI to satisfy the TOR were agreed upon between the DOE and UCI, and were detailed in Annex IV of the Contract. Completion of the Tasks in Annex IV is the completion of the Contract.

A Contract Amendment was issued during project implementation to expand the work scope and schedule to support DOE's decision to implement an Interim Market in addition to the final market.

The project was completed by UCI and its subcontractor ATEA, with the active support of personnel representing the:

a. Department of Energy (DOE)
b. Energy Regulatory Board (ERB)
c. National Power Corporation (NRC)

This Final Report provides a summary of the efforts completed, with direct references to the contractual tasks and to the project deliverables.

# 2. Terms Of Reference And The Corresponding Tasks

The Terms of Reference of the contract are included in Annex I, and the Activities and Tasks are given in Annex IV.

The correlation between the Terms of Reference (TOR), the UCI Tasks defined in Annex IV to satisfy the TOR, and this Final Report are shown here for easy reference and comparison, as follows:

| Terms of Reference in Annex I | UCI Tasks Specified in Annex IV | Corresponding Sections in this Final Report and Attachments |
|---|---|---|
| *The Specifications Contractor shall develop detailed specifications for the software systems required to support operation of the new electricity markets consistent with the trading arrangements and final market rules to be adopted by the Philippines Electricity Supply Industry ("PESI"). The software systems will perform the following functions:*<br>*(i) communication of market information between market participants and the Market Operator;*<br>*(ii) production of the day-ahead hourly schedule of generation and biddable demand;*<br>*(iii) determination of ex ante hourly prices based on the day-ahead schedules;*<br>*(iv) determination of ex post hourly prices based on deviations of actual generation from the day-ahead schedule;*<br>*(v) reconciliation of hourly energy injections, off-takes and losses;*<br>*(vi) calculation of daily payments owed to/by generating entities;*<br>*(vii) calculation of daily payments owed to/by wholesale customers; and*<br>*(viii) monitoring of the behavior of market participants to detect the presence of anti-competitive "gaming."* | • *Task 4 – Development of MMS Configuration and Communications Design*<br>• *Task 7 – Development of the Detailed MMS Specifications*<br>• *Task 9 – Commercial Assistance* | • *Sections 3.4, 3.7, and 3.9*<br>• *Attachment F, Volume III Section 2 – Market Administration*<br>• *Attachment F, Volume III Section 3 – Market Operations Functions*<br>• *Attachment F, Volume III Section 4 - Financial Reconciliation Functions*<br>• *Attachment F, Volume III Section 5 – Data Exchange and Interface Requirements* |

| Terms of Reference in Annex I | UCI Tasks Specified in Annex IV | Corresponding Sections in this Final Report and Attachments |
|---|---|---|
| *The Specifications Contractor shall include in the specifications for each software system fully detailed data inputs and outputs (including formats), solution algorithms, maximum solution times, and degrees of precision required.* | • *Task 4 – Development of MMS Configuration and Communications Design*<br>• *Task 5 – MMS Interface Requirements*<br>• *Task 6 – Data Exchange Interface Documentation*<br>• *Task 7 – Development of the Detailed MMS Specifications* | • *Sections 3.4, 3.5, 3.6, 3.7*<br>• *Attachment F, Volume III Section 2 – Market Administration*<br>• *Attachment F, Volume III Section 3 – Market Operations Functions*<br>• *Attachment F, Volume III Section 4 - Financial Reconciliation Functions*<br>• *Attachment F, Volume III Section 5 – Data Exchange and Interface Requirements* |
| *The specifications will result in efficient database management, report generation and automated dissemination of market information and will accommodate a number of relational databases. Secure data communications will be required for all systems and the specifications will include requirements for suitable encryption software. Detailed specifications for the communication, metering, computer and peripheral equipment required to support the operation of the software systems will be included.* | • *Task 4 – Development of MMS Configuration and Communications Design*<br>• *Task 5 – MMS Interface Requirements*<br>• *Task 7 – Development of the Detailed MMS Specifications* | • *Sections 3.4, 3.5, 3.7*<br>• *Attachment F, Volume III Section 5 – Data Exchange and Interface Requirements*<br>• *Attachment F, Volume III Section 6 – System Performance and Sizing Requirements*<br>• *Attachment B*<br>• *Attachment C*<br>• *Attachment D* |
| *Before starting the specification development effort, the consultant must become familiar with NPC's existing generation scheduling and dispatch systems and also with the EMS and SCADA systems being procured for installation at NPC's National Control Center ("NCC"). The market operations software must be able to interface with both the existing ("EMS") control systems as well as the new NCC systems when operational.* | • *Task 1 – Familiarization with Existing Systems*<br>• *Task 2 – Familiarization with Market Rules and Grid codes*<br>• *Task 3 – Submittal of the Inception Report* | • *Sections 3.1, 3.2, 3.3*<br>• *Attachment F, Volume III Section 1 – Introduction*<br>• *Attachment F, Volume III Section 5 – Data Exchange and Interface Requirements*<br>• *Attachment A* |
| *The Specification Contractor shall also prepare the documents required to solicit proposals from patential suppliers of the power trading and pooling software systems. These will include:*<br>*(i) letter of transmittal;*<br>*(ii) background information document;*<br>*(iii) terms of reference;*<br>*(iv) software specifications document;* | • *Task 8 – Submittal of the Draft MMS Specification*<br>• *Task 9 – Commercial Assistance* | • *Sections 3.8, 3.9*<br>• *Attachment G*<br>• *Attachment E*<br>• *Attachment K*<br>• *Attachment M* |

| Terms of Reference in Annex I | UCI Tasks Specified in Annex IV | Corresponding Sections in this Final Report and Attachments |
|---|---|---|
| *(v) hardware requirements document;*<br>*(vi) instructions for proposal preparation;*<br>*(vii) evaluation criteria to be used; and*<br>*(viii) draft turnkey contract.* | | |
| *The Specifications Contractor shall assist NPC with the evaluation of the proposals for the development of the software systems and support NPC in the related contract negotiations. Two person-months of effort will be committed to this task.* | • *Task 10 – Vendor Prequalification*<br>• *Task 11 – Bid Evaluation and Vendor Selection*<br>• *Task 12 – Assist in Final Contract Preparation* | • *Sections 3.10, 3.11, 3.12*<br>• *Attachment F, Volume I Section 1 – Instructions to Bidders; Clause C – Preparation of Bids*<br>• *Attachment F, Volume I Section 1 – Instructions to Bidders; Clause E – Bid Opening and Evaluation*<br>• *Attachment F, Volume I Section 1 – Instructions to Bidders; Clause F – Postqualification and Award of Contract*<br>• *Attachment F, Volume I Section IV – General Conditions of Contract*<br>• *Attachment F, Volume I Section IV – Special Conditions of Contract*<br>• *Attachment H* |
| *The Specifications Contractor shall perform the following tasks.*<br>*1. The Specifications Contractor shall produce an inception report within two weeks of commencing work and provide monthly progress reports and make presentations to the CLIENT and NPC thereafter.*<br>*2. It shall produce a draft final report that includes the software specifications document, at the end of the 3rd month of the project.*<br>*3. A final report will be submitted within 30 days following the receipt of tripartite comments on the draft report. Five copies of each report shall be provided to the CLIENT and NPC and three* | • *Task 3 – Submittal of the Inception Report*<br>• *Task 8 – Submittal of the Draft MMS Specification*<br>• *Task 12 – Assist in Final Contract Preparation*<br>• *Task 13 – Training and Skill Transfer*<br>• *Task 14 – Production of the Final Report* | • *Attachment A*<br>• *Attachment E*<br>• *Final Report on Development of Detailed Specification for the Software, Metering, Communications and Other Relevant Information Technology (IT) System Needed to Support The Philippine Electricity Market Operation (this document)* |

| Terms of Reference in Annex I | UCI Tasks Specified in Annex IV | Corresponding Sections in this Final Report and Attachments |
|---|---|---|
| *copies to the TDA.*<br><br>*The draft final report will include the documentation to be submitted to the Asian Development Bank in accordance with the Guidelines for the Use of Consultants. This report will also include the tender documents for a competitive solicitation of the turnkey contract.* | | |
| *The deliverables associated with this Project are as follows:*<br><br>*a) an inception report within two weeks of commencing work;*<br><br>*b) monthly progress reports and associated monthly presentations to the CLIENT and NPC;*<br><br>*c) a draft final report including the draft software specifications, at the end of the 3rd month; and*<br><br>*d) a final report submitted within 30 days following the receipt of comments on the draft report.* | • *Task 3 – Submittal of Inception Report*<br><br>• *Task 8 – Submittal of the Draft MMS Specification*<br><br>• *Task 14 – Production of the Final Report* | • *Final Report on Development of Detailed Specification for the Software, Metering, Communications and Other Relevant Information Technology (IT) System Needed to Support The Philippine Electricity Market Operation (this document)*<br><br>• *Attachment A*<br><br>• *Attachemnt E* |
| *In addition to the foregoing, the Specifications Contractor shall prepare a five-page, single-spaced summary of the specifications, accompanied by charts, diagrams and illustrative graphics, that describes the principal elements of the pooling and settlement system, the functional relationships among those elements, and the underlying structure of the Philippine power markets. The purpose of the document is to support the efforts of the TDA and other governmental and multilateral agencies in presenting the scope and results of the TDA-funded activities in the Philippines to interested utilities and regulatory agencies in other nations that are introducing markets for power. The Specifications Contractor shall deliver three copies of a draft of the summary document to TDA at the same time as delivery of the draft project report, and shall submit twenty copies of the final summary document, incorporating such changes as TDA has requested, at the same time as delivery of the final project report.* | • *Task 8 – Submittal of the Draft MMS Specification*<br><br>• *Task 14 – Production of the Final Report* | • *Attachment E*<br><br>• *Attachment N* |

The correlation between the **Terms of Reference in Amendment 1**, the UCI Tasks, and this Final Report are shown here for easy reference and comparison, as follows:

| **Terms of Reference from Amendment No.1**<br><br>**UCI Tasks** | **Corresponding Sections in this Final Report and Attachments** |
|---|---|
| TASK A1: Produce a set of market rules for the operation of the interim market.<br><br>It is essential that the market participants be precisely informed on how the interim market will operate. The existing rules developed by the Australian consultant must be reviewed, evaluated, and revised to create a set of Interim Market Rules for the following objectives:<br><br>Changes to reflect scheduling of all resources & transfers<br>Changes to reflect how operating costs will be recovered in interim mode<br>Changes to reflect ancillary services<br>Changes to reflect metering<br>Changes to cover participant enrollment and prudential assessment<br>Changes to cover requirements in system adequacy evaluation<br>Resulting changes to settlements systems<br>Potential changes to calculation of market pricing<br>Addition of statements to cover transitional arrangements<br>Changes re: security analysis for congestion management, incl. Modeling<br>Changes to reflect GE-EMS connectivity/limitation<br>Changes to reflect existing s/w (GE-EMS) and other off-the-shelf s/w | • *Section 3.11.1*<br>• *Attachment I*<br>• *Attachment J* |
| TASK A2: Prepare Market Management System (MMS) Simplified Specification For Interim-Market<br>In view of the differences between the ultimate-market solution and the interim-market approach, the completed IT design and procurement specifications will need to be reviewed and modified to create a new or modified set of high-level specifications to reflect the Interim Market plan and design. This will cover the following:<br><br>Changes to cover provisions of backup and restore<br>Changes to reflect lack of disaster recovery provision<br>Changes to reflect "off the shelf" dispatch algorithms<br>Additions to cover migration from interim solution to ultimate design<br>Changes to adapt to interim EMS interface<br>- Interim communications & data exchange (all systems)<br>New s/w: interim Market interface, partial MMS, interim settlement & metering<br>Changes necessary to enable transition from interim to full market mode | • *Section 3.11.2*<br>• *Attachment F* |

| Terms of Reference from Amendment No.1<br><br>UCI Tasks | Corresponding Sections in this Final Report and Attachments |
|---|---|
| TASK A3: Prepare An Overall Project Plan<br><br>Produce a detailed project plan to cover the whole project, including the transition from the Interim Market to the ultimate full market. The plan will cover:<br><br>Interim market<br>Transition to final market design<br>Roll out<br>Testing<br>Training | • *Section 3.11.3*<br>• *Attachment L* |
| TASK A4: Procurement Assistance<br><br>Consultant shall prepare bidding documents and selection procedure to allow DOE to make a selection of Supplier or Suppliers within a short time (within two weeks); and Consultant shall assist in such selection process. | • *Section 3.11.4* |

# 3. Tasks Performed By UCI

## 3.1 Task 1 – Familiarization With Existing Systems

UCI commenced work on the project by conducting a careful and complete analysis of the existing situation within NPC regarding relevant systems, processes, and practices. The methodology used was multi-faceted. The UCI team of consultants:

a. Prepared detailed lists of information regarding the current situation;

b. Reviewed these information requests with knowledgeable personnel from NPC and DOE;

c. Reviewed technical specifications of existing systems and operating practices documents;

d. Reviewed on-going plans for systems developments and process changes;

e. Visited existing control centers and discussed system operations with control center personnel;

f. Reviewed detailed descriptions of the existing communications system, operating efficiencies and performance during critical periods of electric network operation.

The result of these efforts, conducted by the UCI consultant team with the active assistance of NPC and DOE personnel, was an understanding of the starting point for preparation of the Market Management System. Equally important was a greater understanding of the view of the NPC-DOE team on the strengths and weaknesses of the current IT systems and processes.

## 3.2 Task 2 – Familiarization With Market Rules And Grid Codes

In parallel with developing an understanding of the baseline for the Market Management System, UCI conducted a detailed review of the market, within which the MMS must operate. The methodology comprised multiple tasks:

a. Review of NPC Grid and Distribution Codes, proposed Power Reform Bill / Law that could impact market operations and other documents related to the planned market;

b. Detailed review of the proposed Market Rules based on UCI experience with creation of electricity markets throughout the world;

c. Based on review of the proposed Market Rules, UCI provided information supporting suggested changes, both to general market operation and to improve the efficiency of MMS development;

d. UCI conducted and participated in a series of meetings with NPC-DOE to ensure a common understanding of planned market operations.

UCI then prepared business process diagrams reflecting the planned flow of information during market operation. The diagrams included process flow during both normal and emergency situations and defined responsibilities of and interactions between Market and System Operators.

The process diagrams were provided to NPC-DOE and reviewed with them to further ensure a common understanding of planned market operations.

## 3.3 Task 3 – Submittal Of Inception Report

Completion of Tasks 1 & 2 provided the basis for the Inception Report. This document:

a. Provided summaries of the efforts of Tasks 1 & 2;

b. Identified key issues to be addressed on a high priority basis;

c. Provided a road map for completion of the many tasks required for a coordinated development, and identified responsible organizations;

d. Defined changes required to existing SCADA systems to ensure compatibility with the planned MMS and readiness when needed for integration;

e. Included updated business process diagrams and an overview of the market operations functions – offers and bids, electric system security concerns, algorithm to be used for preparing generation schedules, settlement process, data and information storage requirements, and audit and security issues;

f. Provided assessment of meter data retrieval issues and recommendations for upgrades and additions;

g. Discussed security issues for the MMS and market operations;

h. Provided recommendations for addressing all issues/problems raised during the analyses.

The Inception Report was provided to NPC-DOE in May 2001 as **Deliverable # 1** of this project. It represented completion of Tasks 1, 2, and 3 and is included herein as:

- **Attachment A – Inception Report - Deliverable #1**

## 3.4 Task 4 – Development Of MMS Configuration And Communications Design

The overall system configuration for the MMS and the complementary communications network were addressed next. This required a solid estimate of market sizing criteria. UCI prepared a detailed list of sizing parameters and initial estimates based on experience in similar markets. These were provided to NPC-DOE and reviewed and discussed in a series of conferences. The sizing parameters addressed:

a. Number of market participants, numbers of bids/offers per participant and restrictions on revisions to bids/offers;

b. Number of metering points, locations, and frequency of data retrieval;

c. Required MMS and EMS applications and frequency of data exchange between the two systems;

d. Number of electric network elements, data to be gathered from them and frequency of data retrieval;

e. Electric network elements to be included in the market dispatch algorithm, run-time requirements and frequency of running the program;

f. Storage requirements for collected and calculated data to meet long-term analysis and audit requirements;

The parameters were reviewed for consistency among themselves and with other markets and used as the basis for defining the MMS system configuration and communications network.

The overall system configuration was based on experience with high availability/high reliability energy management systems, field-proven throughout the world. In addition, consideration was given to geographic constraints, availability of experienced technical personnel and cost and time to implement the system.

The system configuration was based on distributed system architecture with highly secure and available communications links among the system elements and protected interfaces to external systems. The network elements included:

a. Servers for meter data collection from meter data points;

b. Servers for data exchange with market participants;

c. Servers for overall operation and for running the market dispatch algorithm;

d. High-speed data links to the EMS;

e. Servers for data storage for audit and data retrieval;

f. Network monitor for internal and external communications systems.

The communications network required to meet the many and varied data exchanges for the overall system was defined for each data exchange element:

a. Dial-up telephone lines for meter data retrieval;

b. Internet communications for market participants;

c. Dual high-speed Ethernet connections for intra-server communications;

d. Dual high-speed Ethernet connections with the EMS.

The design and performance requirements for all systems, as well as recommendations for procurement and testing, were included.

These data regarding sizing, system configuration and communications network were provided to NPC-DOE as **Deliverable #2** the Interim Report in June 2001. It represented completion of Task 4 and is included herein as:

- **Attachment B – Interim Report – Deliverable #2**

## 3.5 *Task 5 – MMS Interface Requirements*

The detailed and complete definition of interfaces between systems from different suppliers is the key to minimizing integration problems, to meet critical schedules and ultimately to ensure the system meets established goals. UCI addressed these issues as its next task. The interfaces defined were as follows:

a. SCADA/EMS – Optimum market operation requires close coordination between the Market Operator and the System Operator as enabled by the interface between the MMS and the SCADA/EMS. UCI evaluated the communications options with the existing SCADA/EMS, including discussions with the system supplier and review of current and emerging communications technologies. The system data defined during previous tasks was used as the basis for data exchange requirements. A detailed definition of requirements was prepared.

b. NOTE: The Report on EMS Interface was prepared as a separate document to facilitate further discussion and possible system upgrades with the EMS supplier, without providing data on other interfaces to that supplier.

c. Metering and Settlements Systems – Interface with the metering systems was defined based on interface requirements for the existing meter data collection systems and sizing parameters previously established.

d. Rules for the Settlement system were based on system sizing parameters and proposed settlement criteria.

e. Electronic Funds Transfer (EFT) – A separate interface definition was prepared for Electronic Funds Transfer. These criteria were based on existing EFT interfaces, the high requirement for system security, and system sizing parameters.

f. General Interfaces – A web-based interface for market participants, potential casual users and future additions was defined. This was based on standard Internet interface criteria..

The results of this Task are given in:

- **Attachment C - Interface Requirements - Deliverable Part 1 of 2**
- **Attachment D - Interface Requirements - EFT - Deliverable Part 2 of 2**

## 3.6 Task 6 – Data Exchange Interface Documentation

Further detail on the data exchange formats between the MMS and market participants was provided, based on system sizing parameters and rules and constraints imposed by the market rules. The results are incorporated into the Draft Technical Specification (Deliverable #4, Attachment E).

## 3.7 Task 7 – Development Of The Detailed Market Management System Specifications

The data collected and prepared during all previous Tasks provided the basis for development of the detailed Market Management System specifications. UCI prepared the required specification, combining these project specific data with technical criteria proven to result in successful projects, and provisions for system evolution based on previous experience.

The completed MMS specification included detailed requirements in the following areas:

a. Market Administration Functions

- Market E-commerce
- Participant Registration
- Market Timetable
- Market Audit
- Market Security

b. Market Operations Functions

- Offers/Bids Processing
- Information Submittal
- Dispatch Process and Engine
- Market Clearing
- Dispatch Constraints

c. Financial Reconciliation Functions

- Metering Process
- Settlements Process
- Processing Payments

d. Data Exchange and Interfacing

- Energy Management System

- Market Participants
- Metering and Settlement Data

e. System Performance and Sizing

- Critical and Non-Critical Functions
- System Utilization
- User Response Time
- Market Applications
- Market Activity
- Availability and Security

f. Hardware and Software Platforms

g. Database Requirements

h. Documentation

i. Quality Assurance and System Testing

j. Project Organization, Training and Maintenance Support.

## *3.8 Task 8 – Submittal Of The Draft MMS Specification*

UCI provided the draft specification prepared in Task 7 to NPC-DOE in August 2001. The title of the document is:

**Market Management System for the Philippines Electricity Market:**
**Specification for System and Services**

It is included in this Final Report as:

- **Attachment E - Draft Technical Specification - Deliverable #4**

The Specification was reviewed by NPC-DOE personnel and comments were provided to UCI. After discussions and clarifications, the specification was updated and re-issued a few times before it was finalized for formal bidding. These submittals represented completion of Tasks 7 and 8. The specification is included as the Volume III, Technical Specification, in the Request for Proposal. It is included in this report as:

- **Attachment K – Technical Specification of the Market Management System (Deliverable #5)**

## 3.9 Task 9 – Commercial Assistance

This task involved preparing the necessary Terms and Conditions, Instructions to Bidders, Special Conditions, Bid Evaluation Procedure, in accordance with the requirements of financing institution. This task was performed twice, as the DOE changed the financing source from the Asian Development Bank (ADB) to the World Bank; and later changed again to the ADB. Therefore, two versions of the complete set of Bidding Document were prepared by UCI for use by the DOE.

The first one was prepared for project financing by the World Bank. The document format and commercial requirements were in accordance with the World Bank requirements, providing all information required by the World Bank. The Bidding Document, also referred to as the "Request for Proposal", was submitted to DOE for reviewed, discussed in meetings, revised, and then completed and submitted in November 2001. The document was used for bidding and bid evaluation was performed. This document is included in this Final Report as:

- **Attachment G – Bidding Documents Commercial Requirements - IBRD Version. (Deliverable # 6)**

The second version of the Bidding Documents was prepared for project financing by the Asian Development Bank. The document format and commercial requirements were in accordance with the Asian Development Bank requirements, providing all information required by ADB. It was prepared based on revising the technical as well as the commercial requirements of the World Bank version, and submitted for DOE's use in October 2002. This version of the Bidding Documents was revised and used by DOE in re-bidding the project under ADB funding. (ABB Systems Control of California was awarded the contract.) This document is included in this Final Report as:

- **Attachment M – Bidding Documents ADB Version.**

In this task, for both versions of the document, UCI prepared the commercial requirements for the procurement of the MMS, incorporating the Bid Document Requirements of the World Bank (and later, those of the Asian Development Bank), and ensuring consistency with the procurement policy of the DOE. The Bidding Documents provided references to the MMS specification for all technical and project support requirements. The document included:

a. Technical Specifications, prepared in Task 7 and Task 8;

b. Description of the bidding process with contacts, meetings and schedule information;

c. Terms and Conditions based on the requirements of the World Bank (and later, those of the ADB);

d. Payment terms and detailed price schedule forms;

e. Questionnaire to ensure complete and comprehensive offers.

## 3.10 Task 10 – Vendor Prequalification

UCI prepared a comprehensive prequalification document to establish those potential suppliers with qualifications, interest and capacity to complete the MMS on the schedule required.

The document provided:

a. Project Description – an overview of the system and support requirements;

b. Commercial Considerations – guidance on the form of and requirements for the contract;

c. Questionnaire and Information Request – requesting specific information to determine qualifications for this procurement.

The prequalification document was issued to seven companies well known in the industry to have active efforts in similar or related projects. These companies and their contacts are given in:

- **Attachment H – Prequalification Documents**

The responses to the prequalification document were evaluated by DOE-NPC and UCI to select suppliers able to demonstrate:

a. Experience in completing projects of similar size and complexity;

b. The system and software components required for system implementation;

c. A history of on-time project delivery and good customer support; and

d. Strong company commitment, including financial resources, to the business and project.

e. UCI then prepared all transmittals necessary for release of the bid documents to the selected bidders.

## 3.11 Additional Tasks To Define And Specify An Interim System Under Contract Amendment No. 1

During the implementation of the project the need for an interim market system was identified. The need was to meet stringent schedule requirements for market system deployment and the initiation of market operations. It was felt that suppliers would not be able to supply the full system required for the ultimate market on the original implementation plan and that an interim system would provide the means to let the system evolve in capacity and functionality with market participation.

This decision resulted in Amendment 1 to the contract, which included four tasks.

### 3.11.1 *TASK A1 – Produce A Set Of Market Rules For The Operation Of The Interim Market*

UCI initiated development of the interim market rules with the preparation of a conceptual design document. Then, UCI made a thorough review of the market rules developed by the Australian consultant. These rules were evaluated in the context of thee planned interim market and the need to assure secure and efficient market operation in the shortest possible time. In addition, questions and issues raised since the original market rules had been released were given consideration.

The methodology used was the same as that used during earlier analyses. UCI prepared an edited version of the rules and provided them to NOC-DOE for their review. Conferences were then held to reach a common understanding.

The iterative process addressed the full set of rules with emphasis on:

a. Participant enrollment and prudential assessment
b. Recovery of operating costs
c. Resource scheduling
d. Metering
e. Security analysis and system modeling
f. Connectivity constraints
g. Calculation of market prices
h. Settlement systems
i. Transition to the Final Market issues

The UCI-suggested modifications of the WESM rules (rules drafted by PHB/Freehill for the DOE under AusAID Technical Assistance) were reviewed and agreed upon between UCI and NPC-DOE, and used as the basis for DOE's preparation of the official Interim Market rules and were used as the basis for UCI's preparation of the Interim Market Management System.

The documents prepared by UCI in this task are included in this Final Report as:

- **Attachment I: Interim Market Conceptual View**
- **Attachment J: Interim Market WESM Rules by UCI – Deliverable of Task A1**

### 3.11.2 *TASK A2 – Prepare Market Management System (MMS) Simplified Specification for Interim - Market*

The Market Management System specification (by then already prepared by UCI in Task 8) was reviewed in detail to incorporate changes to reflect the interim market rules as well as other decisions made to ensure completion of the system on schedule. The changes included:

a. Elimination of disaster recovery provisions

b. Acceptance of "off the shelf" dispatch algorithms

c. Sizing and capacity reductions throughout the specification

d. Interface constraints due to existing systems

e. Use of interim communications and data exchange technology

f. Reduction of performance requirements

g. Provisions to ensure a smooth transition from Interim to Final MMS

The revised specification was prepared, reviewed, approved and released as Volume II of the Bid Document.

It is included herein as **Deliverable of this Task A2**:

- **Attachment F – Technical Specification of the Interim Market Management System (IMMS)**

### 3.11.3 *TASK A3 – Prepare An Overall Project Plan*

UCI prepared and submitted a plan for completion of the project, including:

a. Interim MMS development and deployment

b. Testing of Interim System in Market Operations

c. Completion of Final MMS and rollout

d. Transition from Interim to Final MMS

e. Training for Operations and Maintenance personnel

The plan, in the Microsoft Project format, was coordinated with NPC-DOE.

A picture copy of this plan is included in this Final Report as:

- **Attachment L : IMMS Schedule**

### 3.11.4 TASK A4 – Procurement Assistance

The bidding documents for the Interim and Final MMS were prepared by UCI and released to the suppliers selected during the pre-qualification process. The submitted bids were reviewed in parallel by NPC-DOE and UCI. The process used for vendor selection of the IMMS was conducted in parallel an in conjunction with Task 11 (Bid Evaluation and Vendor Selection of the MMS).

A report on the Bid Evaluation of the IMMS is also included in the:

- **Attachment O – Confidential Bid Evaluation Report**

## 3.12 Task 11 – Bid Evaluation And Vendor Selection

UCI provided a structured and comprehensive methodology for Bid and Vendor evaluation Commercial information to responsible NPC-DOE personnel for their evaluation. UCI distributed relevant proposal materials to its own experts in power applications and information technology in addition to the complete review by system consultants. These reviews resulted in preliminary scoring for each technical and commercial area and a list of detailed questions concerning each offer. UCI merged the comments and evaluations of NPC-DOE in coordination with NPC-DOE.

UCI provided each supplier with a set of questions, combining questions from all reviewers for the individual supplier. In addition, UCI scheduled individual supplier meetings and demonstrations at the NPC offices in Quezon. These meetings were used to discuss the questions raised during the reviews, to see the systems being proposed and to meet the supplier personnel who would be active on the project.

UCI then updated its technical evaluation matrices based on information received during the meetings (backed by written submittals) and observations of the systems being offered and personnel to be involved. The updated matrices were provided to NPC-DOE and merged with their evaluations.

UCI provided a Bid Evaluation Report, which is included the:

- **Attachment O – Confidential Bid Evaluation Report**

## 3.13 Task 12 – Assist In Final Contract Preparation

The selected contractor is ABB Systems Control of Santa Clara, California. UCI assisted in reviewing the Contract Document prepared by DOE to meet the procurement requirements of the Asia Development Bank.

## 3.14 Task 13 – Training And Skill Transfer

An important consideration for this project was the transfer of information concerning market operations and related issues from experienced UCI personnel to NPC-DOE personnel. This consideration was a consistent theme throughout the project. With each major deliverable, UCI provided the rationale for choices made and comparisons to previously deployed market systems. Tutorials and seminars were provided on:

- How the market system will operate
  a. Overall Market Operations and Market Rules
  b. Responsibilities – System and Market Operators
- How power system security will be handled in a market environment,
- How disagreements with energy traders can be resolved,
- How power system emergencies will be managed,
- How technical constraints (e.g. capacity of physical system) have to be balanced against commercial interests,
- How IT systems work in a market environment,

These tutorials and seminars were coordinated with NPC-DOE personnel on an as-needed basis throughout the project.

In addition, UCI provided training on **Market-Surveillance,** covering the following subjects::

I. Purpose of Market Surveillance function
II. Market Surveillance flow chart of functional relationships
  a. Market performance
  b. Compliance with market rules
  c. Monitoring & reporting of market activities
  d. Detecting and addressing market anomalies
  e. Identifying gaming
  f. Technical compliance (may be another unit)
  g. Market behavior & analysis
III. Tools for market monitoring
  a. Your market rules, protocols, tariffs
  b. Market competencies
  c. Terms and definitions
  d. Contingencies and action plans for response
  e. Expectations of performance

f. Authorities: audit, planning, and surveillance (differences)

IV. Monitoring
   a. What to monitor
   b. How to monitor
   c. Tracking & reporting

V. Market factors & relationships
   a. A/S
   b. Energy trading
   c. Supply
   d. Planning
   e. Reliability
   f. Social and ethical responsibility

## 3.15 Task 14 – Production Of The Final Report

This document is the required Final Report.

As part of the Final Report and in accordance with Annex 1 of the Contract, UCI has prepared a separate summary of the specifications:

- **Attachment N - Short Report for USTDA**

The document describes the principal elements of the pooling and settlement systems, the functional relationships among those elements and the underlying structure of the Philippines power markets. The document is intended to support the efforts of the TDA and other governmental agencies in presenting the scope and results of the TDA-funded activities in the Philippines to interested utilities and agencies in other countries.

This effort completes the Final Report and this project.

# 4. Attachments To This Final Report

1. Attachment A – Inception Report – Deliverable #1
2. Attachment B – Interim Report – Deliverable #2
3. Attachment C – Interface Requirements Deliverable #3 Part 1 of 2
4. Attachment D – EFT-RFP Apr 11-2002 – Deliverable #3 Part 2 of 2
5. Attachment E – DRAFT Technical Specification – Delivery #4
6. Attachment F – Technical Specification for IMMS – Deliverable of Task A2
7. Attachment G – Bidding Document Commercial Requirements IBRD
8. Attachment H – Pre-Qualification Document – Letter with 3 attachments
9. Attachment I - Interim Market Conceptual View
10. Attachment J - Interim Market WESM Rules by UCI – Deliverable of Task A1
11. Attachment K - Technical Specification for MMS, incorporated into Bid Document as Volume III – Deliverable #5
12. Attachment L- IMMS Schedule
13. Attachment M – DOE Bidding Document ADB version
14. Attachment N- Short Report for USTDA
15. Attachment O - CONFIDENTIAL Bid Evaluation Report – UCI

## 5.0 LIST OF POTENTIAL BIDDERS

ABB Systems Control
451 El Camino Real
Santa Clara, California 95050
USA
Attn: System Sales

Alstom ESCA Corporation
11120 NE 33rd Place
Bellevue WA 98004
USA
Attn: System Sales

GE-Harris Corporation
P.O. Box 430
Melbourne FL 39202-0430
USA
Attn: System Sales

Hi-Q Systems Limited
The Barn, Micheldever Station
Winchester
Hampshire SO21 3AR
United Kingdom
Attn: Mr. Ray Spears, General Manager, Energy Group

Logica UK Limited
Babbage House, Station Approach
Leatherhead
Surrey KT22 7LG
United Kingdom
Attn: Mr. Mike Mockford, Operations Director

Real Time Engineering Limited
Academy House, Academy Park
Gower Street
Glasgow G51 1PR
Scotland
Attn: System Sales

Siemens Energy Management and Information Systems
7225 Northland Drive
Brooklyn Park MN 55428-1540
USA
Attn: System Sales

# Attachment A

# Inception Report

# Deliverable #1

# INCEPTION REPORT

## Development of Detailed Specification for the Software, Metering, Communications and other Relevant Information Technology (IT) System Needed to Support the Philippine Electricity Market Operation

**For**

**The Department of Energy**

**And**

**The National Power Corporation**

**Of the Philippines**

**Prepared By:**

**Utility Consulting International**

**May 8, 2001**

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# 1. INTRODUCTION

The National Power Corporation (NPC) is a government-owned utility having responsibility for electricity generation and transmission throughout the Philippines. In a bill before the Philippines Congress, the Philippines government is proposing that the electricity industry be restructured and that NPC be privatized.

A new Philippines Electricity Market (PEM) will be established such that the power generation companies (generators) will compete to provide electricity, and that generation will be dispatched purely on a competitive-price basis, rather than the current minimum-cost basis.

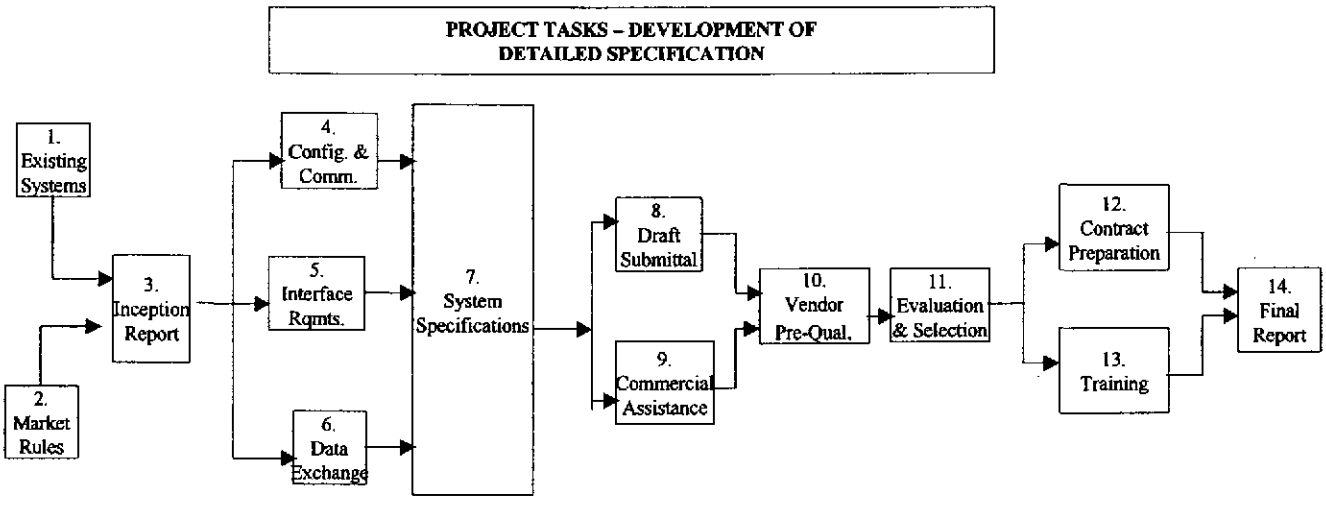
The purpose of this project, sponsored by the Philippines Department of Energy (DOE) and funded by the U.S. Trade And Development Agency (USTDA), is to specify the IT systems that will be required to support the PEM. This includes an evaluation of the functions that will be available in the new Energy Management System (EMS) under procurement from GE Harris, and the specification of the additional functions that will be required for a complete Market Management System (MMS). The Market Management System will comprise a number of subsystems, including the metering, settlements, participant interfaces, and communications systems. The UCI project will address each of these individual subsystems and specify the functional requirements for each.

# 2. PROJECT SCOPE

This report is a project deliverable of Contract (DOE-UCI) TDA-GH0321397, a Study Contract for:

> "Development of Detailed Specification for the Software, Metering, Communications and other Relevant Information Technology (IT) System Needed to Support the Philippine Electricity Market Operation"

The specific tasks required as part of this Study are described in Annex IV – Schedule Of Events/Activities, shown diagrammatically below:




The Study specifically addresses the Information Technology (IT) requirements to support the Philippine Electricity Market Operation. For the purpose of completing this project in accordance with the project schedule, such requirements will be based on the Market Rules issued in January 2001. A set of detailed functional specifications appropriate for bidding by multiple qualified bidders, will be prepared. The Study also includes the qualification of the bidders and assistance with final vendor(s) selection.

Required facilities, personnel requirements, and organizational changes within the various involved companies and entities to conform to the Market Rules, are not included in the Project Scope.

# 3. THE INITIAL TASKS

The initial two project tasks:

* Task 1 – Familiarization with Existing Systems

* Task 2 – Familiarization with Market Rules and Grid Codes

were initiated before the first project meeting and were completed after the first project meeting held in the week of March 26, 2001 in Manila.

This Inception Report itself is Task 3 of the Study, documenting what was learned during Tasks 1 and 2, and ensuring a common understanding of the starting point of the Project. This report will also be the basis for the detailed work required to complete the set of specifications for the IT systems needed for market operations.

The meeting related to Task 2: "Familiarization with Market Rules and Grid Code", was also held in Manila the week of March 26, 2001. This meeting provided a forum for discussing UCI's understanding of the Market Rules and Grid Code. DOE-NPC provided updates on potential changes to the Market Rules, with the rationale behind such changes. This provided the needed information for UCI to understand how the Market will be operated. UCI provided summary information on the conduct of a few other markets, the rationale for this conduct and the results achieved to date.

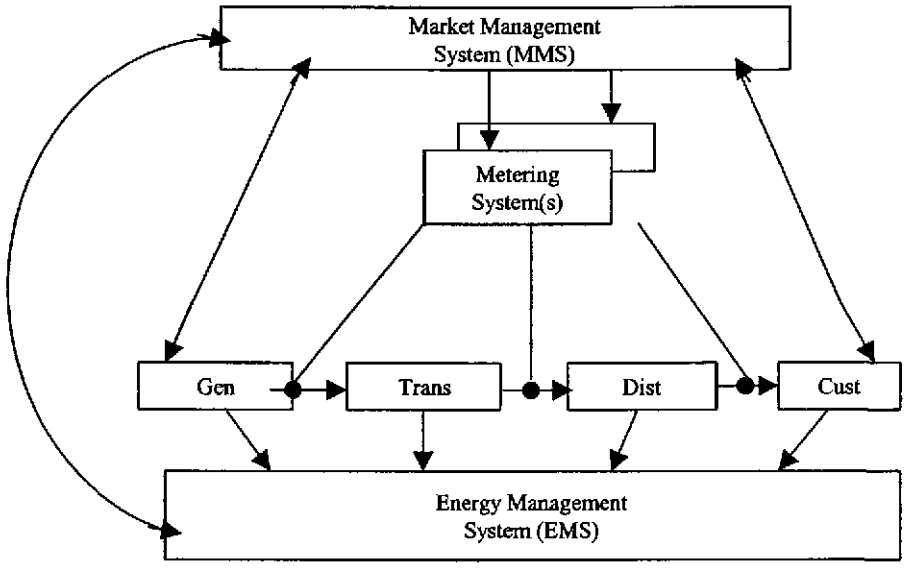
UCI prepared a set of process diagrams to facilitate discussions and understanding of the Market Rules. These process diagrams are included in this report as Attachment A. Note that they reflect the published Market Rules of January 2001.

There is now a common understanding of the conduct of the Market, to the extent that the functionalities of the Market Management System, the proposed function assignment vis-à-vis the Energy Management System and the expansion needed, the Metering, and Communications Systems.

# 4. OVERVIEW OF IT-INFRASTRUCTURE SUPPORTING THE PEM

The IT infrastructure required to support PEM Operations consists of four major systems:

- Energy Management System (EMS)
- Market Management System (MMS)
- Communications Network
- Metering System




Notes:

1. Communications Network is a combination of
   -- Internet
   -- Dedicated Communication Lines
2. Market Management and Energy Management Systems are fault tolerant with high availability.
3. Metering System is a collection of single systems, with back-up provisions.

The effort of UCI in the coming weeks will be to prepare the functional requirements specifications for each of these four systems. Four individual specifications will be prepared. The basis for these specifications is the January 2001 Market Rules and will include the following considerations:

- The Market Management System may be physically separated from the Energy Management System but the systems will be connected via a high-speed secure local area network, details of which will need to be specified by the supplier of the MMS.
- The responsibilities of the Market Operator (MO) will be in accordance with the Market Rules but some of the functions for which the MO is responsible may be contained in the EMS rather than the MMS.
- The PEM is now planned to be one market with three regions, Luzon, Viscayas and Mindanao. There is some consideration being given to having three separate markets with the same rules, but with three systems, each in its own region. Note that this consideration could be impacted by the detailed communications review as noted below in that section.
- UCI is assuming that plans for system and infrastructure improvements, e.g., upgraded LANs, MV-90 data collection systems, will be carried out by DOE/NPG as now planned. This will be the basis for preparation of the detailed functional specifications.

The next two major tasks to be undertaken by UCI relative to the overall market system are:

TASK ITEM

- 4 "... reflect the expected number of Participants, the procedures and frequency of offering/bidding, the methodology for collecting power system information, the volumes of meter data, the duration of historical and archival storage, and the various types of applications for the system under consideration."

EFFORT

- Prepare preliminary list of data, periodicity and archiving requirements for all functions;
- Review and discuss with cognizant customer personnel;
- Finalize list, which will include requirements for redundant storage

DELIVERABLES

- Section defining system-sizing parameters to be included with the final MMS specification.

TASK ITEM

- 4 "... conceptually and functionally design the MMS configuration and the communications network for the market system. ...The configuration will cover:

  - MMS system elements
  - Interface to the EMS and other systems
  - Meter retrieval systems
  - Interface to the Market Participants systems
  - Redundancy, backup and disaster recovery options
  - Communications networks"

EFFORT

- Prepare system diagram with possible equipment locations, concerns and options for working session with customer personnel;
- Meet with DOE-NPC to review the material and trade-offs. Make decisions required to complete the design;
- Update agreements and get final approval of all concerned.

DELIVERABLES

- System Overview document to be used as introductory material in every Specification and Recommendations document.

# 5. PRELIMINARY ASSESSMENT ON CHANGES TO THE NEW EMS

NPC has contracted for an Energy Management System (EMS) with GE-Harris to provide real-time control and operation of the electrical network.

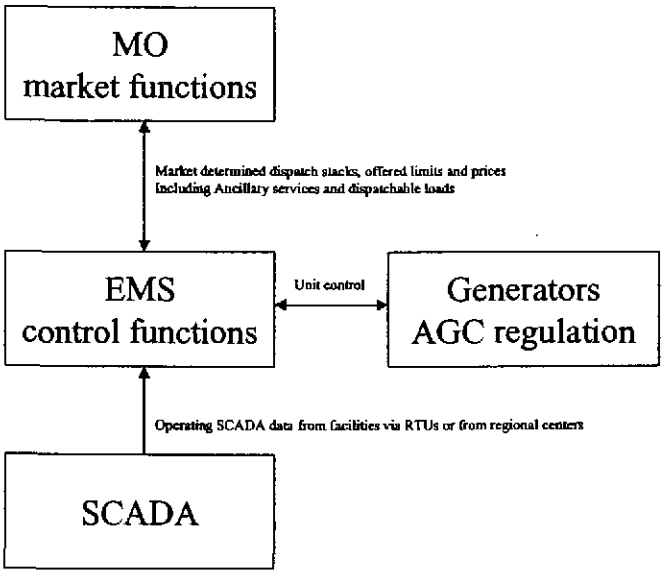
The system was specified and contracted for several years ago and is at present undergoing testing at the supplier's facility in Melbourne, Florida, USA.

At the time the contract was let, NPC recognized the eventual need for a Market Management System and included a number of market-related functions in the procurement specification. However, the specification for this new EMS was prepared well before the development of the Market Rules, and there will be changes required in the EMS to accommodate such rules.

UCI recognizes the desirability of capitalizing as much as possible on the work authorized as part of the EMS procurement in implementing the Market Management System. At the same time the control of the PEM by the Market Operator must be assured. The location of the functions is not as important as the control of the algorithms and processes. The assignment of functions to systems, i.e., EMS or MMS, should be based on optimal system operations with consideration for existing systems and committed plans. There is also the need to minimize the impact on implementation activities and to contain costs associated with Market implementation. The goal will be to take full advantage of the potential of the new Harris EMS.

The major change will be shifting the responsibility for generation dispatch scheduling from the System Operator to the Market Operator. This will necessitate periodic transfers of data between the two systems as well as changes in functionality in the EMS. In addition, the critical issue of responsibility and response in the event of emergency situations needs to be coordinated between the System Operator and Market Operator.

As depicted below, the assignment of functions among the System Operator and Market Operator is necessary to ensure coordination:




**EMS-MO Market Applications Interfaces**

UCI has reviewed the Volume 2: Energy Management System Technical Specification and excerpts of the Minutes of Meeting dated 10-27-00, between NPC and GE-Harris. Based on these reviews, the discussions held in Manila, telephone conversations with Harris, as well as our understanding of the Market Rules, UCI identified a list of most likely changes required for the Harris EMS.

It should be emphasized that UCI is providing only a preliminary assessment of the changes, which will be necessary to the functions. Other changes or different changes may emerge during the detailed specification preparation process and the detailed interface definition process of Task 5 of this Study.

The following is a list of the most likely changes required for the Harris EMS currently under procurement. The "Specification References" refers to NPC's Volume 2: Energy Management System Technical Specification.

| SPEC. REF. | FUNCTION | COMMENT |
|---|---|---|
| 3.6 | OPERATIONS SCHEDULING | GENERAL – The System Operator will operate the EMS but the Merit Order of the dispatch must originate with the Market System. Any manipulations or changes to the dispatch from the Market System may invalidate the process and introduce noncompliance with Market Rules.<br>This consideration must take precedence throughout the EMS functional requirements and implementation. |
| 3.6.1 | SHORT-TERM LOAD FORECAST | The Similar-Day Load Forecast offered by GEH should be acceptable. |
| 3.6.2 | EQUIPMENT OUTAGE SCHEDULER | No changes required. |
| 3.6.3 | UNIT COMMITMENT | UC will be replaced by a Day-Ahead Dispatch function in phase 3 of EMS delivery. This function is required by the Market Rules, with specific requirements to be established prior to Market commencement. Some changes in the process of calculating Day-Ahead Dispatch are anticipated. |
| 3.6.4 | CURRENT OPERATING PLAN | Changes will need to be made in accordance with the comment above for 3.6 and the deletion of UC. |
| 3.7 | CENTRAL DISPATCH | The Central Dispatch function will require changes to:<br>• Utilize the Market Optimization Dispatch Algorithm developed jointly be the MO and SO, but under control of the MO;<br>• Ensure that the dispatch is conducted strictly in accordance with the Market Dispatch except under declared Emergency conditions;<br>• Specify the Emergency conditions and the actions to be taken. |
| 3.7.1 | OPERATIONS MONITOR | No Change |

| SPEC. REF. | FUNCTION | COMMENT |
|---|---|---|
| 3.7.2 | MERIT ORDER DISPATCH | MOD must be changed as noted in 3.7 above. |
| 3.7.3` | AUTOMATIC GENERATION CONTROL | The definitions and responses of Unit Control modes need to be revised to meet Market Rules requirements for:<br>• Zonal Reserves<br>• Ancillary Services |
| 3.7.4 | POWER ALLOCATION | Power Allocation will need to be changed to reflect the primacy of Market Dispatch. |
| 3.7.5 | AGL PERFORMANCE MONITOR | No Change |
| 3.7.6 | DISPATCH OPTIMIZER | The Dispatch Optimizer will need to be replaced by the Market Optimization Algorithm and the Central Dispatch Process of the Market Rules. |
| 3.7.7 | CENTRAL DISPATCH USER INTERFACE | This section must be revised to reflect the fact that Central Dispatch will be operated by the MO and should be consistent with other MO interface screens. |
| 3.8 | ANCILLARY SERVICES | In accordance with the Market Rules, the SO must contract for any ancillary services required in addition to reserves established as part of Market Dispatch. This section needs to reflect that. The ancillary services must be scheduled and processed through the MO.<br><br>In addition, the definition of and response to Emergencies needs to be fully established as a prerequisite to changes in the process. |
| 3.8.1 | LOAD FOLLOWING AND *FREQUUENCY* REGULATION | See Comment above under 3.8. |
| 3.8.2 | SPINNING REESERVE | Reserves will be as established by the Market. |
| 3.8.3 | SCHEDULE IMBALANCE COMPENSATION | Deleted. |
| 3.8.4 | LOSS COMPENSATION | Deleted |

| SPEC. REF. | FUNCTION | COMMENT |
|---|---|---|
| 3.8.6 | SECURITY RE-DISPATCH | The requirement and process used for real-time Security Re-Dispatch are specifically addressed in the Market Rules. Re-dispatch outside of the Market Rules will not be allowed. |
| 3.8.7 | BACKUP SERVICE | Deleted. |
| 3.8.8 | BLACK-|START CAPABILITY | No change |
| 3.9 | COMPLIANCE MONITOR | The Market Rules require the MO to monitor the Market to ensure compliance. It is anticipated that this will include specific monitoring functions within the EMS related to Central Dispatch. These functions must be under the control of the MO. |
| 3.9.1 | OBJECTIVE | See above. |
| 3.9.2 | FUNCTIONAL DESCRIPTION | Additional function and reporting requirements are anticipated based on the MO's definition of compliance requirements. |

The details of the required changes and the EMS-MMS interface will be established as part of Task 5 of the Study in accordance with the Project Task Schedule.

The task in establishing the interface between the MMS and the EMS is:

TASK ITEM

- 5 – "UCI shall identify and specify the necessary inputs and corresponding formats necessary for the SO system to interface seamlessly with the MMS and identify/specify the necessary interface facilities if these were not provided for ion the NCC contract."

EFFORT

- Prepare recommendations based on understanding of the existing EMS and plans, and the Market Rules, including Emergency conditions;
- Meet with GE-Harris to discuss all aspects of the interface;
- Define functions to be run in the EMS and the MMS and the responsible Operator, Market or System;
- Define the interface requirements including data, protocol and performance;
- Review with NPC-DOE personnel.

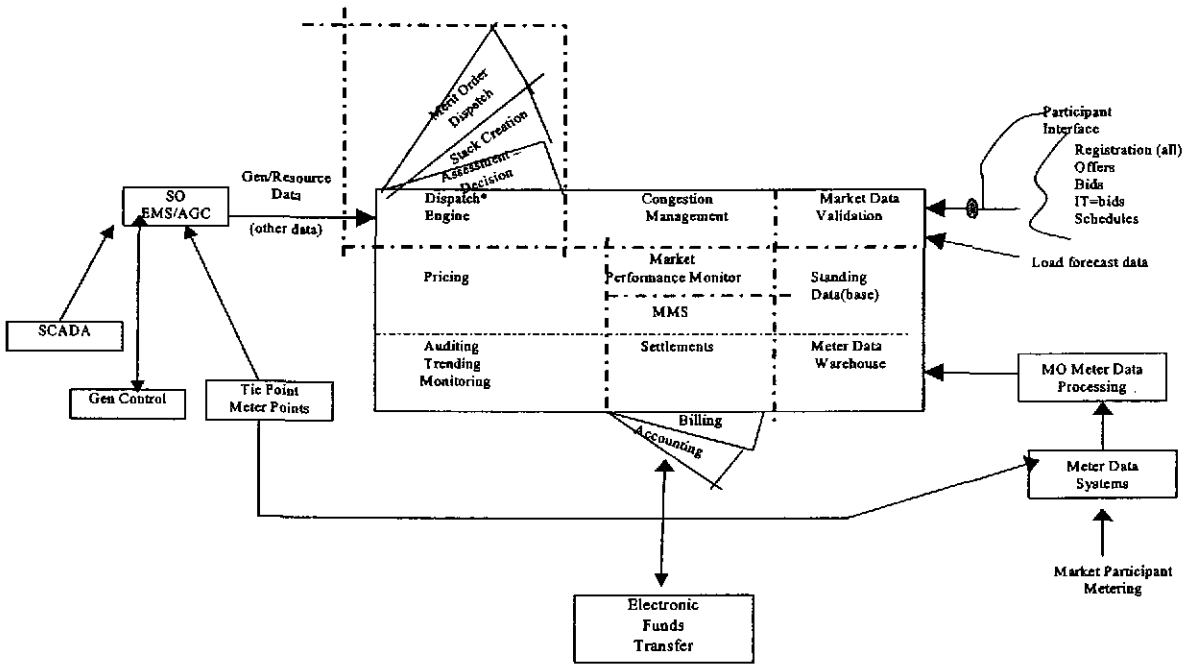
DELIVERABLES

- Specification for Changes to the EMS and the interface definition;
- Interface definition section to be included in the MMS specification.

# 6. MARKET MANAGEMENT FUNCTIONS

The following diagram is an overview of the main components making up the Market Management System, showing interfaces with other systems and Market Participants.

Block Diagram of MMS




## 6.1 Market Management System (MMS)

The Market Management System is the major component to be specified and realized as an entirely new system. In addition to handling the flow of data among the various subsystems, the MMS will provide the new functions required to support the Market Rules and the tools and capabilities needed to ensure successful Spot Market Operation. The major functions of the system are in four areas:

### 6.1.1 Operations

- Offer/Bid Processing
- Week Ahead/Day Ahead Projections
- Market Optimization Algorithm

- Market Dispatch
- Market Price Determination
- Market Suspension
- Monitoring the Market
- Archives

### 6.1.2 Metering

- Data Transfer and Collection
- Installation Database
- Metering Database
- Data Integrity and Security
- Archives

### 6.1.3 Settlements Management

- Settlement Amount Determination
- Electronic Funds Transfer
- Payments
- Settlements Surplus
- Prudential Requirements
- Disputes
- Reports and Archives

### 6.1.4 Support

- Authorization Control
- Audit Control
- File Tracking

UCI will undertake the following when specifying the central MMS functions:

- Identify and illustrate the operating data exchange among all of the subsystems
- Review the central MMS functionalities supporting the Market Rules

- Complete functional specification of market applications, including data exchange

## 6.2 *Participant Interface*

Experience shows that a participant's acceptance of a forthcoming market is greatly enhanced if the barriers to participation are reduced. It is therefore recommended that as part of the Market Management Systems procurement, the basic Participant interface will also be included. This of course will not prevent participants from designing and building their own systems.

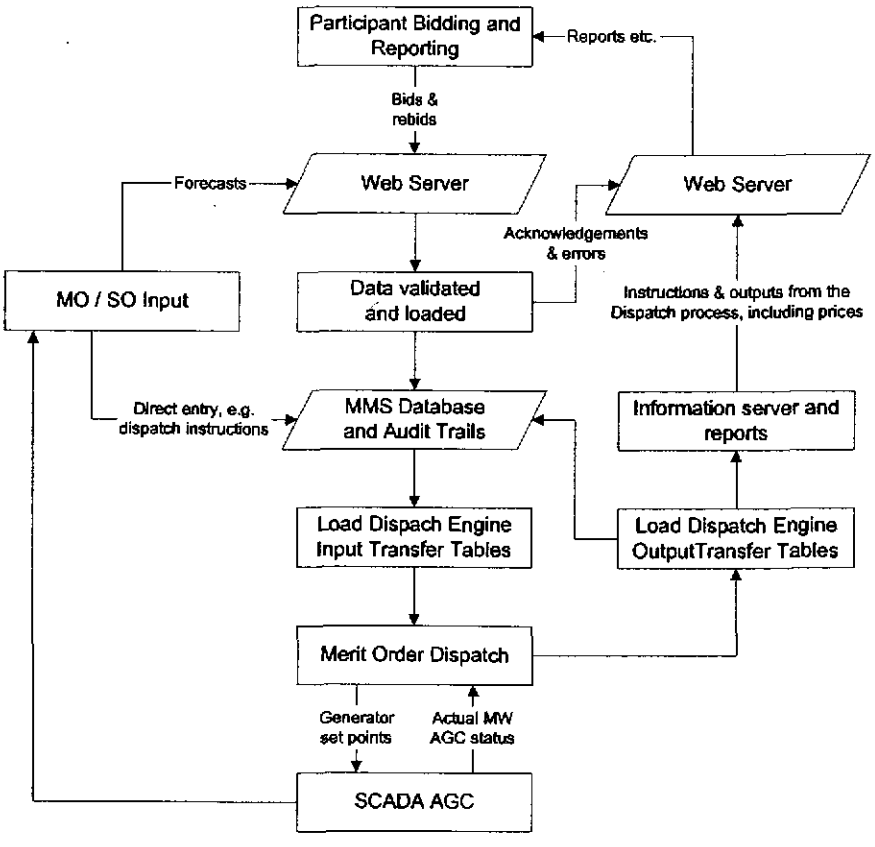
The interface will enable participants to submit bids into and receive information from the market through a process of file transfer to and from the Central Market Management System (MMS).

In line with modern practices it is deemed desirable that this interface be provided using web browser technology and it should operate on any PC that has been connected to the wide area network. It is expected that in time most participants will have their own trading systems and will use the standard MMS interface file formats and API's rather than the default interface.

Participants in PEM should be able to use the default interface to:

1. Prepare and submit bids.
2. Re-bid based on changes in plant availability and operation.
3. Monitor system instructions sent to plant equipment, dispatch instructions sent by system operators to plant operators, and market notices sent by System Operators.
4. Obtain continuous updates on market prices, dispatch schedule, and pre-dispatch schedules.
5. Retrieve data on national market metering and settlement values.
6. Generate ad hoc reports.
7. Record participant standing data, such as information about units and registration details such as the bank account for settlements and contact names.

The overall flow of data from bidding through to dispatch and reporting is shown in the diagram below.




UCI will undertake the following when specifying the Participant Interface functions:

- Identify and illustrate the operating data exchange between the participant Interface and the market management system
- Identify the hardware requirements relating to the Participant Interface
- Review the functionalities to determine compatibility with MO functions
- Review the functionalities and compliance with market rules
- Complete technical specification of participant interface, including data exchange

## 6.3 System Configuration

The Market Management System will be a high-availability networked system with multiple processing nodes, each sized to meet ultimate system performance requirements.

Detailed specifications will be prepared as part of future study tasks and will include, in addition to detailed functional requirements:

- Functions/applications per processing node
- Database sizing – initial and ultimate

- User Interface Requirements
- Users and functions
- Data Link Interfaces – protocols, data and periodicity
- Arching Requirements
- Availability and Reliability Criteria
- Performance Requirements
- Acceptance Criteria and Process
- System Support

The next phase of development for the Market Management System includes:

TASK ITEM

- 5 – "For settlements UCI shall prepare a specification on the rules (formula from the Market Rules) for settlements processing and how the results are passed to the accounts systems."

EFFORT

- Based on Market Rules, prepare flow charts of the Settlements process and algorithms to be used;
- Review with NPC-DOE personnel;
- Update as required; provide trace ability to the Market Rules

DELIVERABLES

- Section on Settlements to be included in the MMS specification.

TASK ITEM

- 5 – "Another important interface is the 'electronic funds transfer system to facilitate billing and settlements for all market participants."

EFFORT

- Investigate the availability of EFT for the convenience of Market Participants and the Market Operator, and the associated costs.

DELIVERABLE

- Recommendation for EFT provider for the PEM.

TASK ITEM

- 5 – "... specify a general interface so that market participants can build their own applications and access the central system..."

EFFORT

- Review capabilities of planned Market Participants technical staff relative to IT systems;
- Define software package to provide to Participants.

DELIVERABLE

- Section to be included in the MMS specification.

TASK ITEM

- 6 – "...design the detailed data exchange formats, which must reflect DOE-ERB-NPC needs and the Philippine Market Rules."

EFFORT

- Investigate template development tool for preparation of required forms;
- Prepare sample data exchange forms for Market Participants;
- Review with DOE-ERB-NPC personnel and possibly Market Participants.

DELIVERABLES

- Sample Data Exchange Forms for the MMS Specification;
- Section on data exchange between the Market Operator and the Market Participants for the MMS Specification.

# 7. COMMUNICATIONS

NPC operates its own Wide Area Network, the main backbone of which is provided by a 12 Mb/s PDH infrastructure. This network is made up of a microwave system (90%) and a fibre optic network (10%).

In terms of the actual access links, the nodes are accessed as follows:

1. Microwave – 70% of all node
2. Power Line Carrier – 20% of all nodes
3. UHF analogue – 5% of all nodes
4. Fibre Optics – 5% of all nodes

NPC also provides a Data Communications network which currently comprises a 10 Mb/s LAN and fractional E1 / T1 WAN.

NPC has recognized both the need to improve the Communications Network throughout the country, and the difficulties to do so due to geographic and climatic conditions. Programs are in place to expand the network and to increase bandwidth where required. Nonetheless, the uncertainty of communications between and within regions in times of extreme weather conditions, e.g., typhoons, must be recognized in developing Market Operations.

The discussions with NPC personnel and the reviews of the existing and planned communications network raised concerns in two areas:

- Inter-region communications – The available capacity on existing communications networks appears to be quite limited. In addition, the reliability of the networks, especially in times of severe weather conditions, has not been acceptable for operation of mission-critical systems.
- Intra-region communications – Here too the issue is both available capacity and reliability under severe weather conditions.

UCI has the detailed communication network diagrams and specifications and will review these as part of the specification effort. Input for these reviews will also come from Task 4 of the Study with the identification of the number of Market Participants and their locations as well as the amount and frequency of data to be exchanged.

As noted above, this analysis, especially as regards inter-region communication reliability, may have far-reaching impacts on the overall market(s) operation.

UCI will assign communications personnel to this review and analysis in accordance with the study project task plan. The review will include not only adequacy and the potential improvement of existing systems and technologies but alternate technologies such as satellite communications.

Of special importance to the overall design are:

- Market Operator – System Operator Communications – The operation of the market and maintenance of the security of the electric network go hand in hand. The division of responsibilities between the Market and System Operators is such that high-availability, secure communications between systems is mandatory.

The EMS now under contract is planned for delivery and installation in a newly constructed facility on the NPC campus. Present plans are for the MMS to be located in a different building on the same campus. The campus backbone consists of multimode fiber gigabit Ethernet, connecting the buildings and distributed throughout the buildings. There are plans in place to upgrade the backbone capability to provide 100 Mb/sec. bandwidth. The task to be undertaken now is to, based on the anticipated data exchange between the two systems, especially at burst or emergency conditions:

- Analyze total traffic on the backbone segment between the two facilities;
- Review geographic routing of the cables with regard to security;
- Analyze communications equipment to be used throughout the network;
- Analyze need for multiple and separate cable routing.

Based on these analyses, specific requirements for the campus network improvement will be included in a separate Communications Network specification.

- Market Participants – Market Operator Communications – Operation of the Market requires the ability of Market Participants to submit Offers and Bids in accordance with the Timetable and to receive information regarding Market Prices and Operations as needed from the Market Operator. These communications, while not as critical to the operation and security of the network as the SO-MO interface, are vital to the operation of the Market.

The electronic communications medium selected for this role will undoubtedly be the Internet or Intranet dependent upon security and performance requirements. This will require secure high-availability servers for the Market Operator web site to be the central point of all communications with Market Participants. IT infrastructure needed for these communications includes:

- Analysis of total volume of communications based on number of Market Participants and amount of data to be exchanged.
- Analysis of Market Participant access to required communications network.
- Establishment of default Participant interface as noted above.

Based on these analyses, the requirements for the Market Participants communications infrastructure will be included in the separate specification.

- Metering Data Collection – The Market Operator needs timely and secure access to metering data from measurement nodes throughout the system. The design of the Metering System itself is addressed in Section 7.0 but the communications capability to ensure the collection of data must also be addressed. Once the Metering System is specified, areas to be investigated are:

- Amount of data from each metering point to its collection point and the total data for each collection point.
- Communications medium to be used between Metering Collection Points and the Meter.
- The need for high-availability or backup collection capability, including the System Operator.
- Periodicity of data transfer to the Market Operator based on Market Rules – a key consideration.
- Communications medium to be used between Metering Collection Points and the Market Operator.

Based on these analyses, communications requirements for Metering Data will be a third portion of the separate Communications Specification.

These specifications will be the next task in this Study:

TASK ITEM

- 4 –".. shall evaluate the present communications infrastructure as it stands and recommend any changes that will be necessary for market implementation. The schedule, tasks, and budget for the following steps will be addressed:
  - Design
  - Metrics
  - Procurement
  - Testing
  - Installation
  - Redundancy
  - Communication networking and protocol requirements"

EFFORT

- Participate in all aspects of the System Configuration definition activities;
- Provide detailed summaries of Communications needs, with technical approach and cost and schedule estimates.

DELIVERABLES

- Communications section related to Participants communications to be included in the MMS specification.
- Recommendations for changes to the MO-SO network interface;
- Recommendations for Communications infrastructure upgrades and extensions, including those needed for Metering.

# 8. METERING DATA RETRIEVAL

Initial information provided by NPC indicates that considerable work will soon be completed with respect to the replacement of a significant number of meters to support the PEM. By the time the market opens the majority of meters will be of suitable revenue quality (mostly SV4AR) and will be of either Vectron or Schlumberger manufacture. The following table summarizes the numbers of meters by Genco and by voltage type:

| | 230 KV | | 138 KV | | 115 KV | | 69 KV | | 34.5 KV | | 13.8 KV | | Others | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PT | CT | PT | CT | PT | CT | PT | CT | PT | CT | PT | CT | A-base | Sw/Bd |
| Genco 1 | 45 | 45 | | | | | | | | | | | 15 | 13 |
| Genco 2 | 12 | 12 | | | 9 | 9 | 3 | 3 | 3 | 3 | | | 9 | 9 |
| Genco 3 | 15 | 15 | 30 | 30 | | | 3 | 3 | | | 3 | 3 | 17 | 17 |
| Genco 4 | | | 6 | 6 | | | 3 | 3 | | | 3 | 3 | 5 | 5 |
| Genco 5 | | | 72 | 72 | | | 6 | 6 | 3 | 3 | | | 36 | 36 |
| Genco 6 | 90 | 90 | | | | | 3 | 3 | | | | | 35 | 33 |
| **Total** | **162** | **162** | **108** | **108** | **9** | **9** | **18** | **18** | **6** | **6** | **6** | **6** | **117** | **113** |

The physical Meters appear to support all of the necessary functions to provide suitable revenue data to the market management systems and have capabilities including:

1. The ability to handle multiple billing types
2. Multi-tariff capability
3. Data recording functions
4. Data acquisition functions
5. Support for an internal clock (externally synchronised)
6. Local digital display of data
7. Power quality measurement
8. Programmability
9. Alarm and diagnostic functions
10. Communication capability

Whilst the physical meters are well catered for, there appears to be little specified in the way of the IT systems that will be necessary to support the PEM. Currently NPC have only specified that the meter data should be collected at three central locations (one on each of the main islands) and have indicated a preference for the MV-90 system. This falls far short of the requirements for the market operations.

The Market Rules are very specific with regard to requirements for meter data services and verification of accuracy and the security of the meter data itself. The Metering specification to be prepared by UCI will reflect these requirements, including the structure and locations of both the Installation and Metering databases.

A prime and early consideration is the content and structure of the metering database. This must be specified to ensure that all metering systems are procured with the capability of meeting the interface requirements and that the devices being procured and installed have the capabilities and functions required.

Requirements for aggregation and storage, both short-term and long-term, must also be developed based on the total number of Market Participants and Market Rules regarding data required for settlement and archival requirements.

It is anticipated that the Metering System, including the Metering database itself, will be co-resident with the Market Management System.

The Installation database(s) will be contained within the MV-90 systems but available to the Market Operator via a communication link.

Note that the discussion relative to the possibility of having three markets would impact the physical location of the Market Management Systems. Should there be three market management systems, they would probably move to the same locations as the meter data collection systems.

UCI will specify the meter data processing and storage functions that will be required to support the PEM. These functions will include but will not be limited to:

1. Acquisition of Meter reads
2. Meter data quality checking
3. Handling missing meter data
4. Exception Reporting
5. Maintaining versions of data
6. Registering meters
7. Deleting Meters
8. Transferring Meters
9. Handling orphaned meter reads
10. Aggregation / re-aggregation
11. Data substitution principles
12. Data delivery
13. Archiving of data
14. Providing access to data
15. Man-machine interface requirements

UCI will undertake the following when specifying the metering functions:

1. Identify and illustrate the operating data exchange between the metering system and the Market Management System

2. Identify the hardware requirements relating to the Metering System
3. Review the metering system functionalities to determine compatibility with MO functions
4. Review the metering System functionalities and compliance with market rules
5. Complete technical specification of metering applications, including data exchange

The following task will be performed during the next phase:

TASK ITEM

- 5 – "For Metering this will detail how the data is collected, aggregated, validated and stored, and how this is passed from the market participants to the central system."

EFFORT

- Prepare proposed metering system, consistent with the System Configuration and present plans for meter data acquisition; coordinate with Settlements sub-task;
- Review overall plan with NPC-DOE personnel;
- Provide overall summary of meter data acquisition, warehousing and use.

DELIVERABLES

- Meter Data Collection Requirements Specification – Meters to the communications port to the MMS;
- Meter Data Handling – Section to be included in the MMS specification.

# 9. SECURITY PROVISIONS

Security in Information and Data Exchange refers both to the integrity of the information and data exchanged and to the protection of Confidentiality of all parties involved. Security in this system will be assured by the following:

## 9.1 Internet

Internet Security is a rapidly evolving and improving process. The use of Digital Certificates, physical and software firewalls and protocols such as SSL 3.0 will be reviewed in areas of:

- Electronic Funds Transfer
- Participant Restricted Access
- Confidentiality of Data

The conflicting needs of free and open access to Market data and the protection of individual Participants' rights will be addressed.

## 9.2 Data Links

The selection of the Communications protocol provides one level of security for data exchange. Physical locations of all equipment and selection of communications media will also be done with security in mind.

## 9.3 General

Specific provisions for Security and Confidentiality will be included in every specification prepared as part of this Study.

# 10. IDENTIFICATION OF POTENTIAL PROBLEMS

The specification and development of a system for the operation of the Philippines Electricity Market is a significant undertaking and presents significant risks to success. Fortunately, the tasks and effort involved have been undertaken before in other markets and NPC can take advantage of those experiences, both positive and negative. Following are what UCI considers the major potential obstacles to success and its recommendations to eliminate or mitigate the risks involved.

## 10.1 Overall Projects Coordination

The project being undertaken by UCI is to define the functional requirements for the IT infrastructure required for Market Operations and to aid in the selection of the supplier. As discussed in our meetings in Manila, significant other work (not in UCI's Work Scope) is required to complement and augment these activities, including:

- Facilities for Systems
- Transition from Existing to New Structure
- Personnel Training
- Market Participant Training
- Participant Working Relationships
- Financial and Technical Process Methodology
- Overall Project Management
- Public Relations
- Marketing the Concept

Success of the PEM is dependent upon ensuring that everyone involved recognizes the need to contribute and to work and coordinate with others.

Recommended Solution – Develop a multifunctional market oversight function and a very strong project management function to coordinate all aspects of the projects. Gain backing of DOE, NPC and ERB

## 10.2 Market Rules Changes

The Market Rules are still in an evolutionary state, with changes being made to accommodate different participating groups and to improve overall operation. This will continue for some time, including during the MMS implementation phase. The threat is changes could be used to delay decisions, increase costs and to delay market commencement.

Recommended Solution – There are two parts of the recommendation:

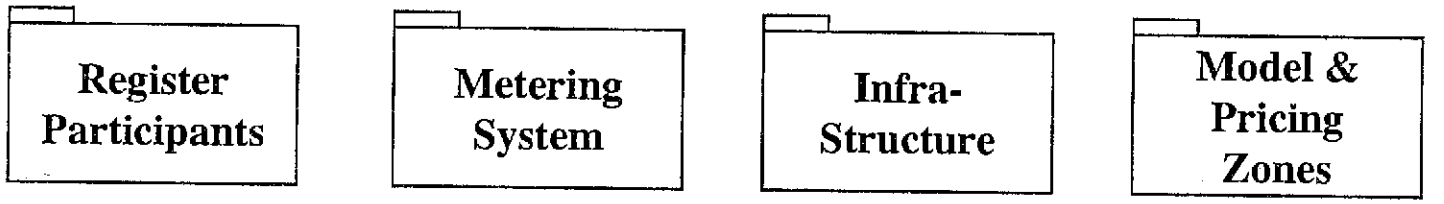
1. Make Market Rules decisions quickly and do not look back. Follow the one-year review plan.
2. Insulate the specification and the vendor-supplied design inasmuch as possible from the Rules. Provide flexibility and change only when necessary.

UCI's work and the specification being prepared will be based on the January 2001 version of the Market Rules.

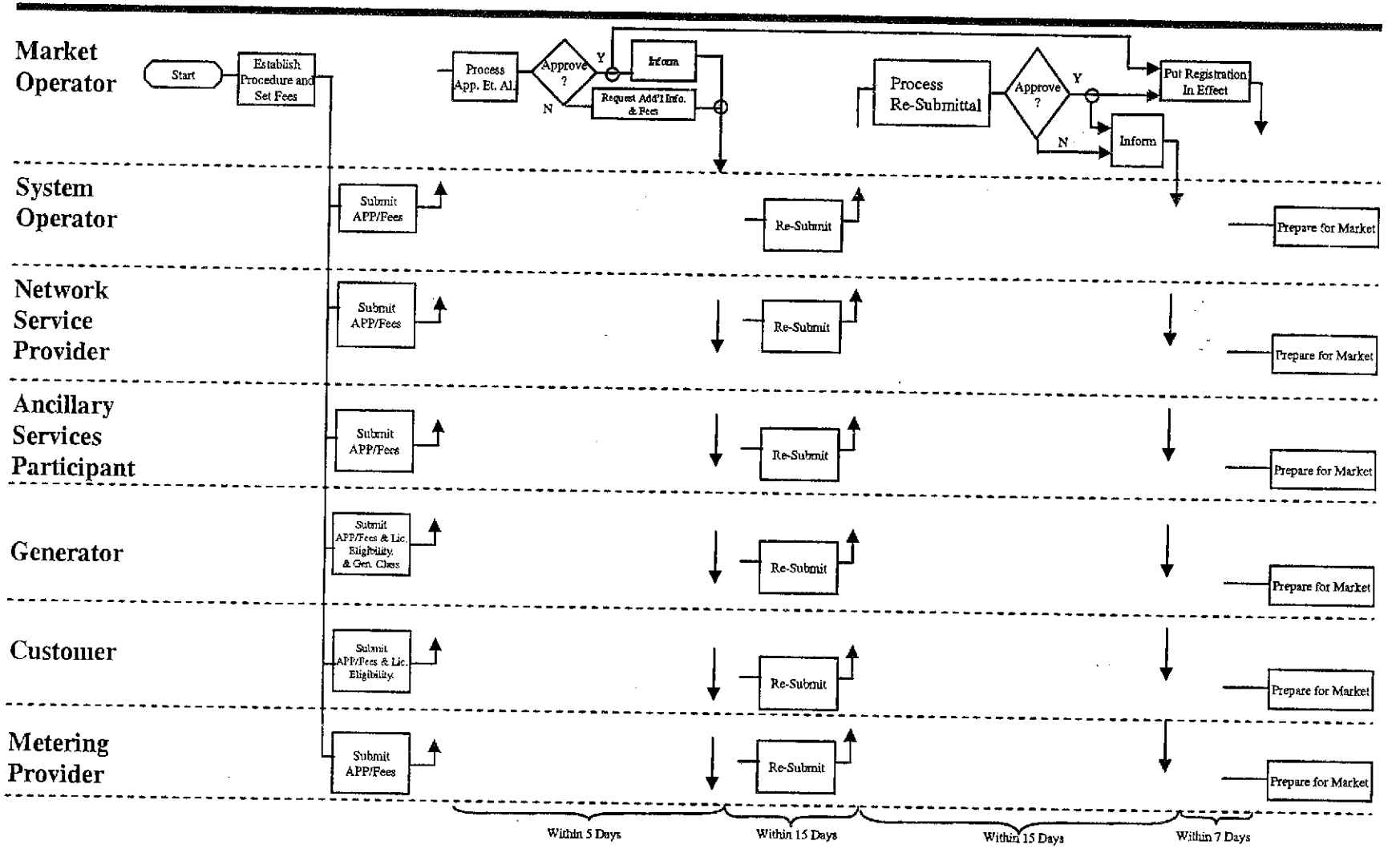
# ***APPENDIX***

## PROCESS DIAGRAM

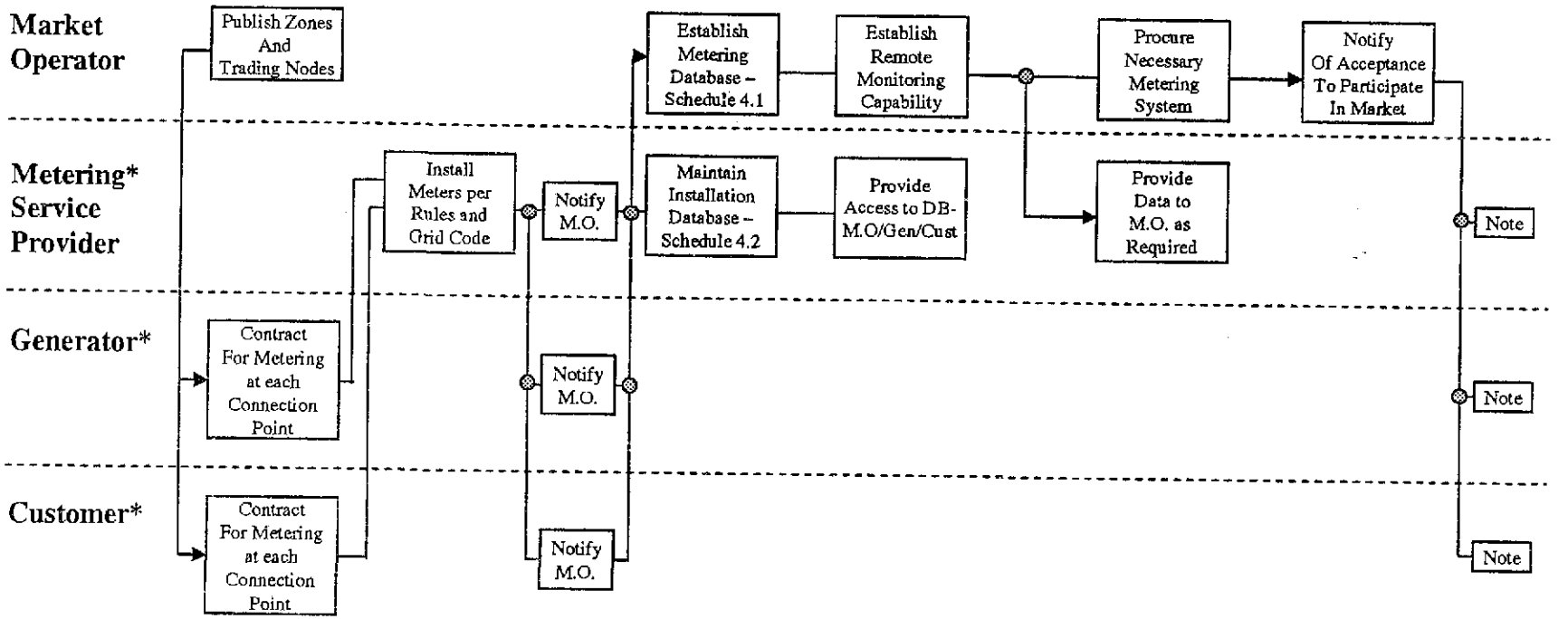
# *Process Diagrams - Pre-Commencement*



# *Pre-Commencement – Participant Registration*

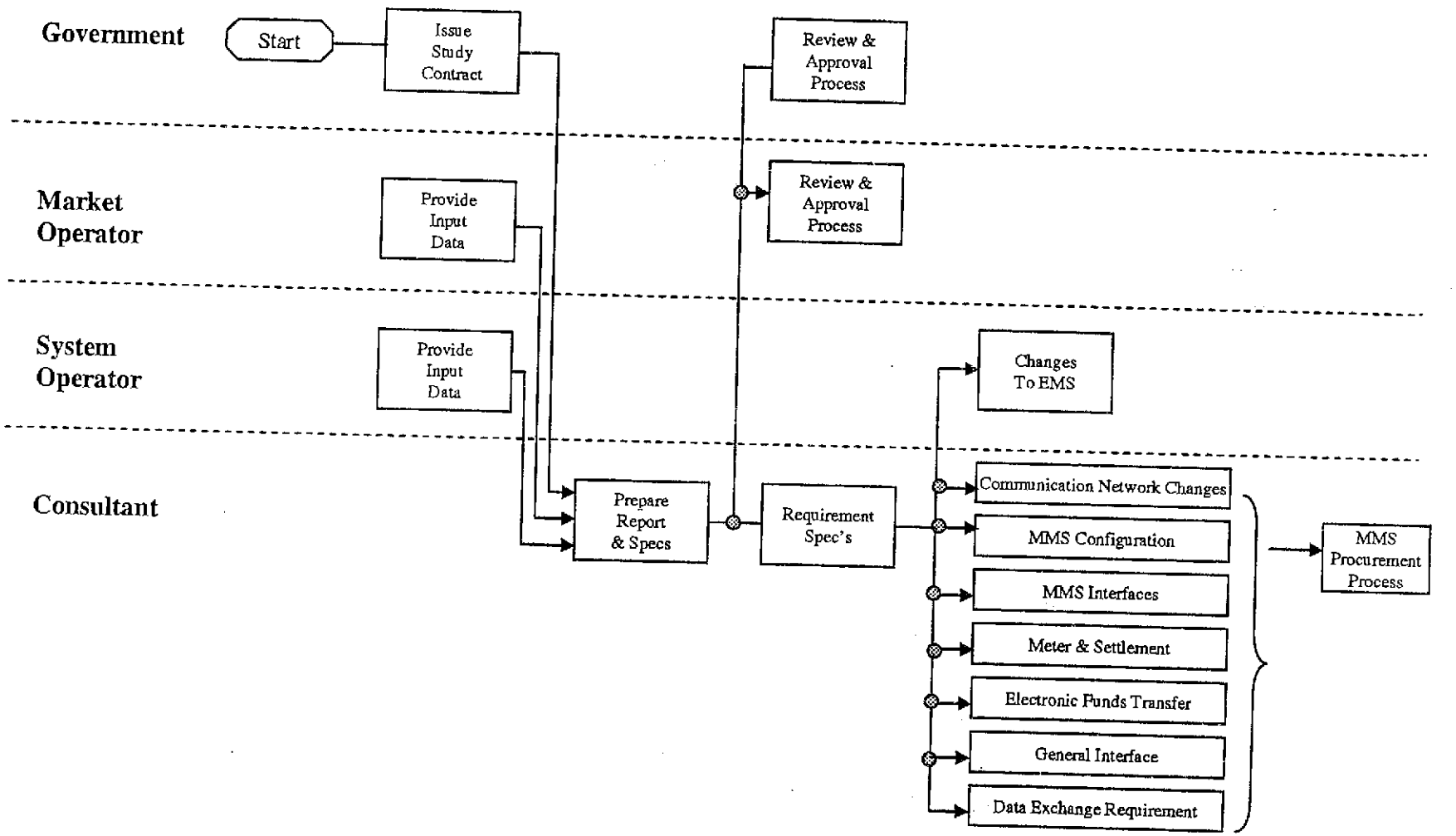


# *Pre-Commencement-Metering System*

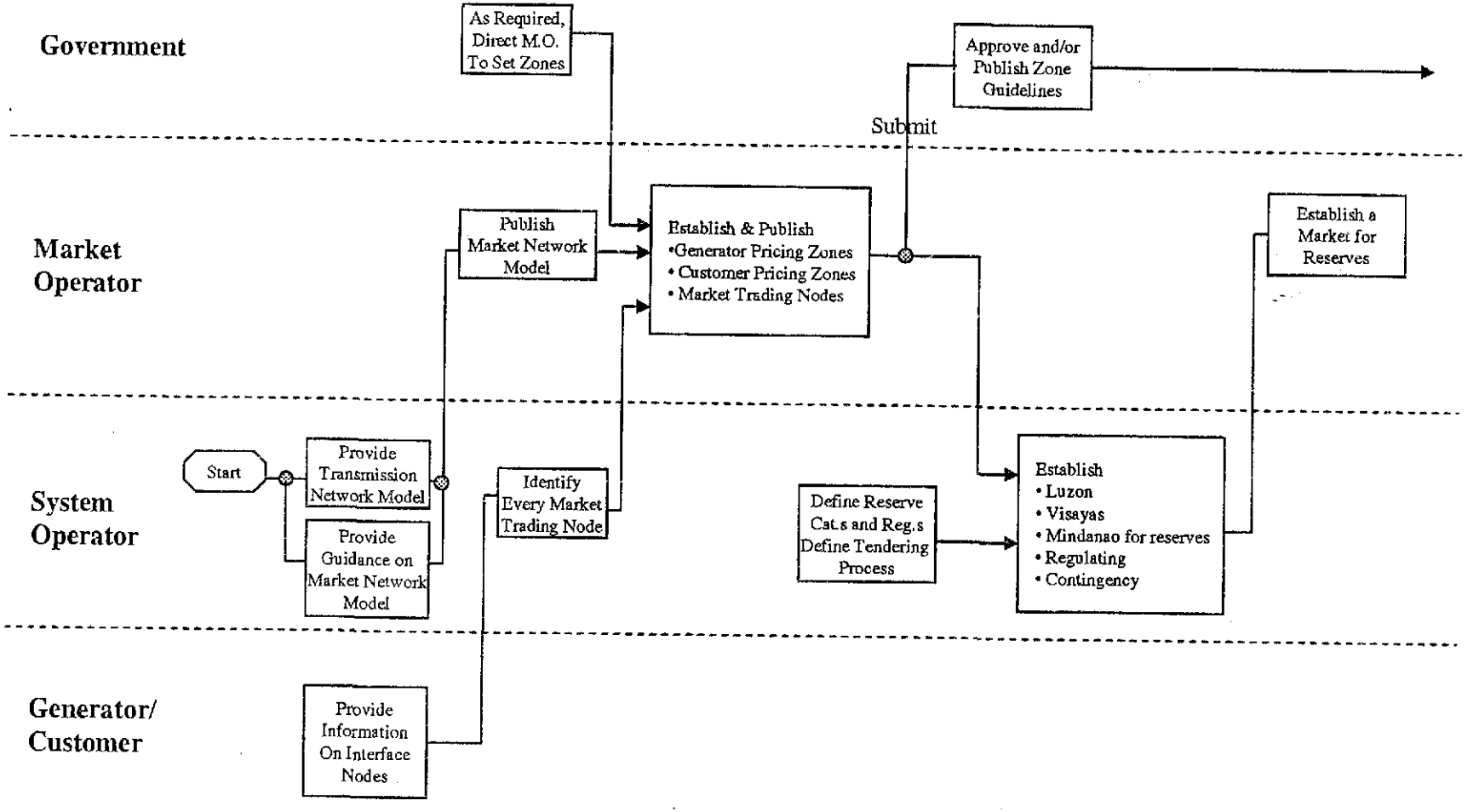



*Prerequisite = Registration

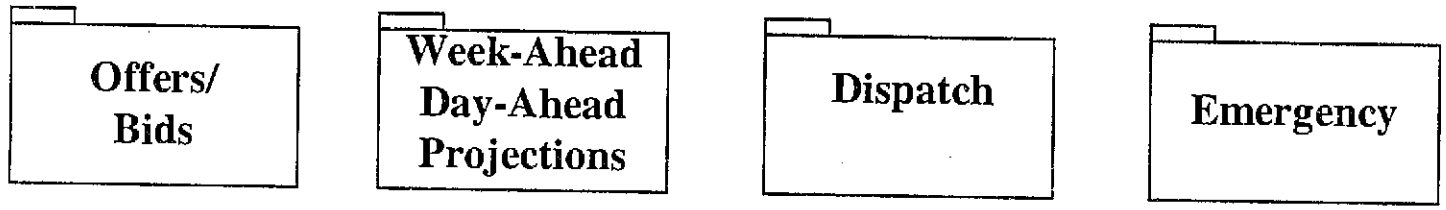
# *Pre-Commencement Infrastructure*



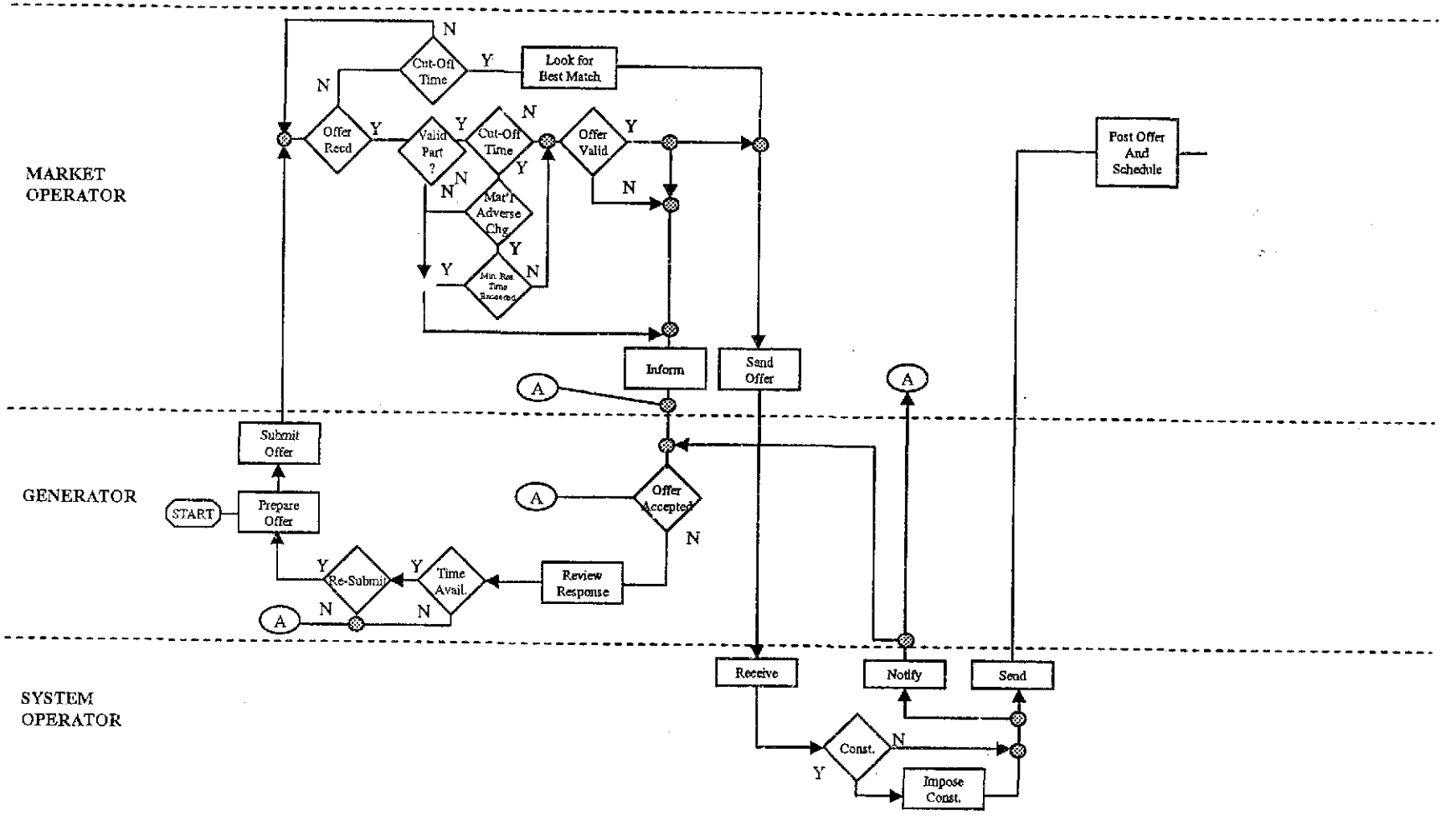
# *Pre-Commencement*
# *Market Network Model and Pricing Zones*



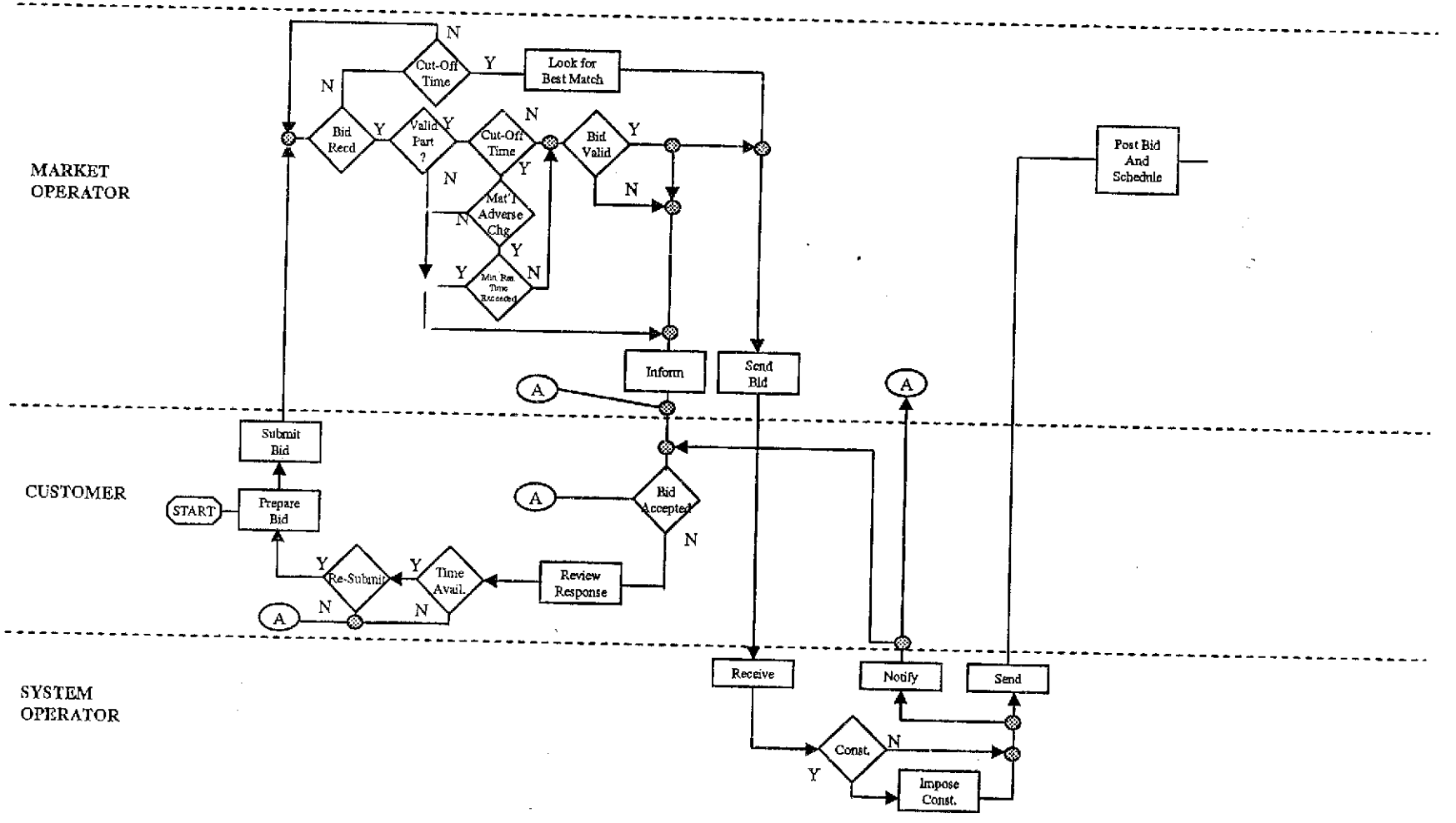
# *Process Diagrams - Market Operations*



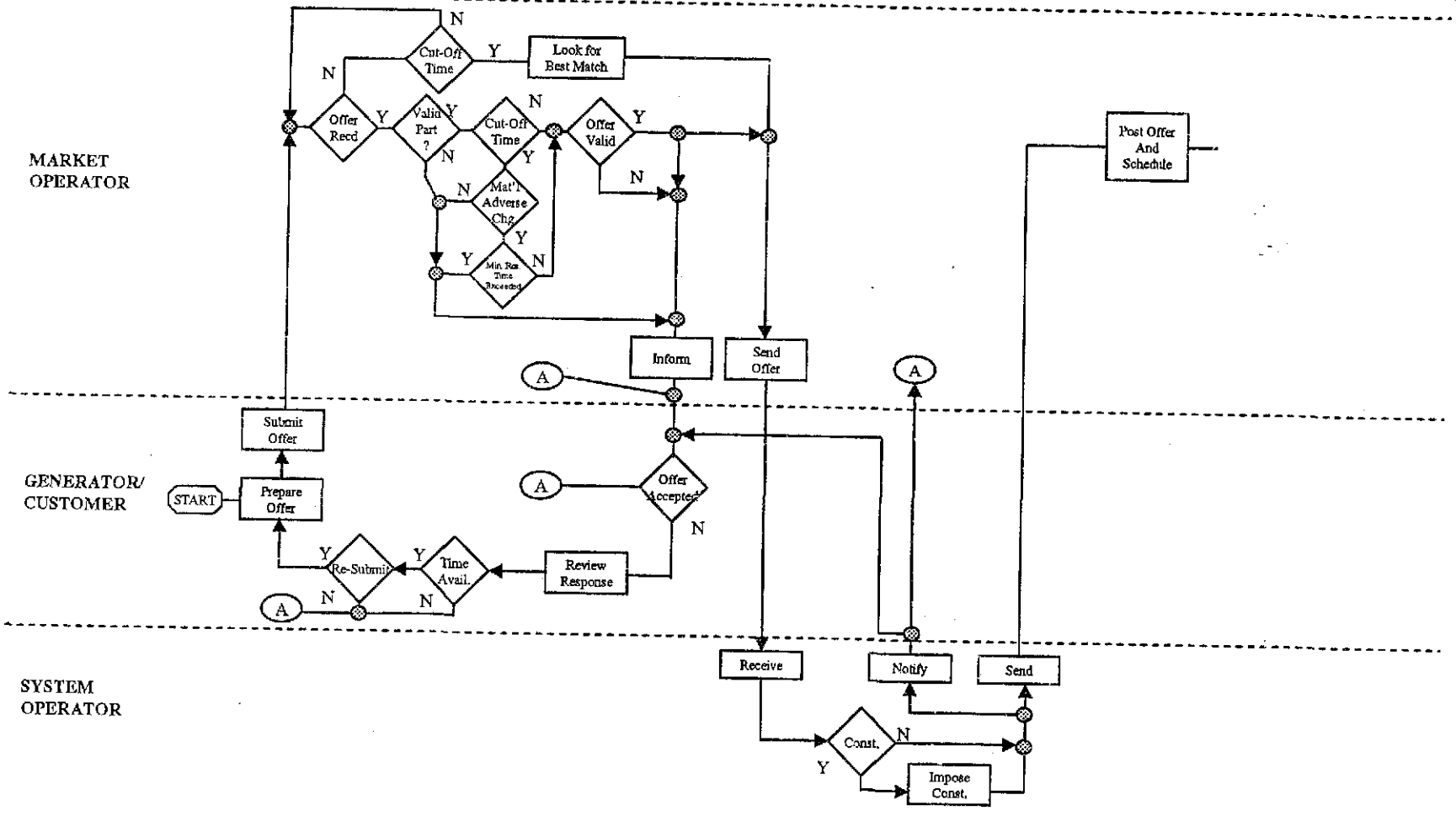
# *Generator Offer Processing*



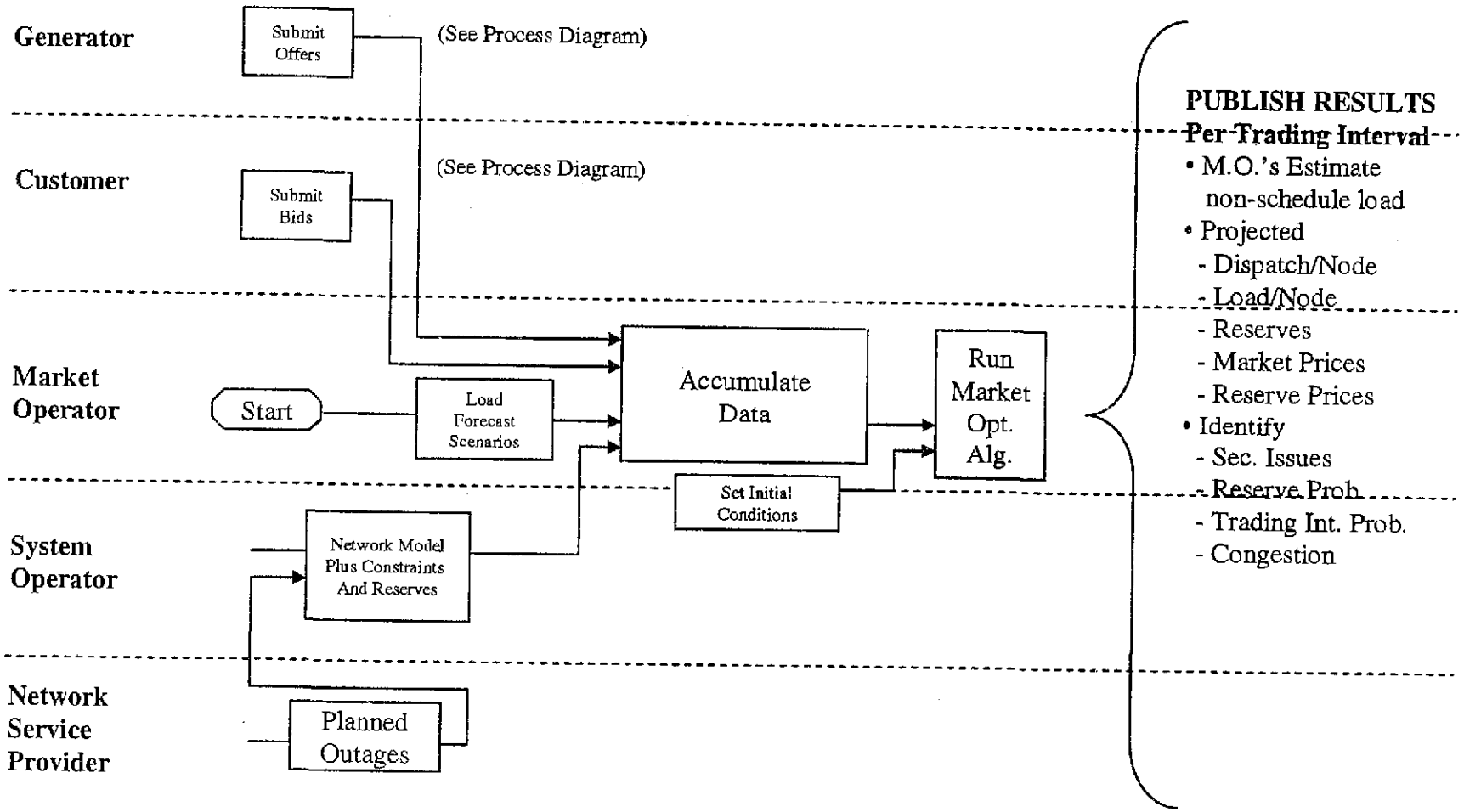
# *Customer Bid Processing*



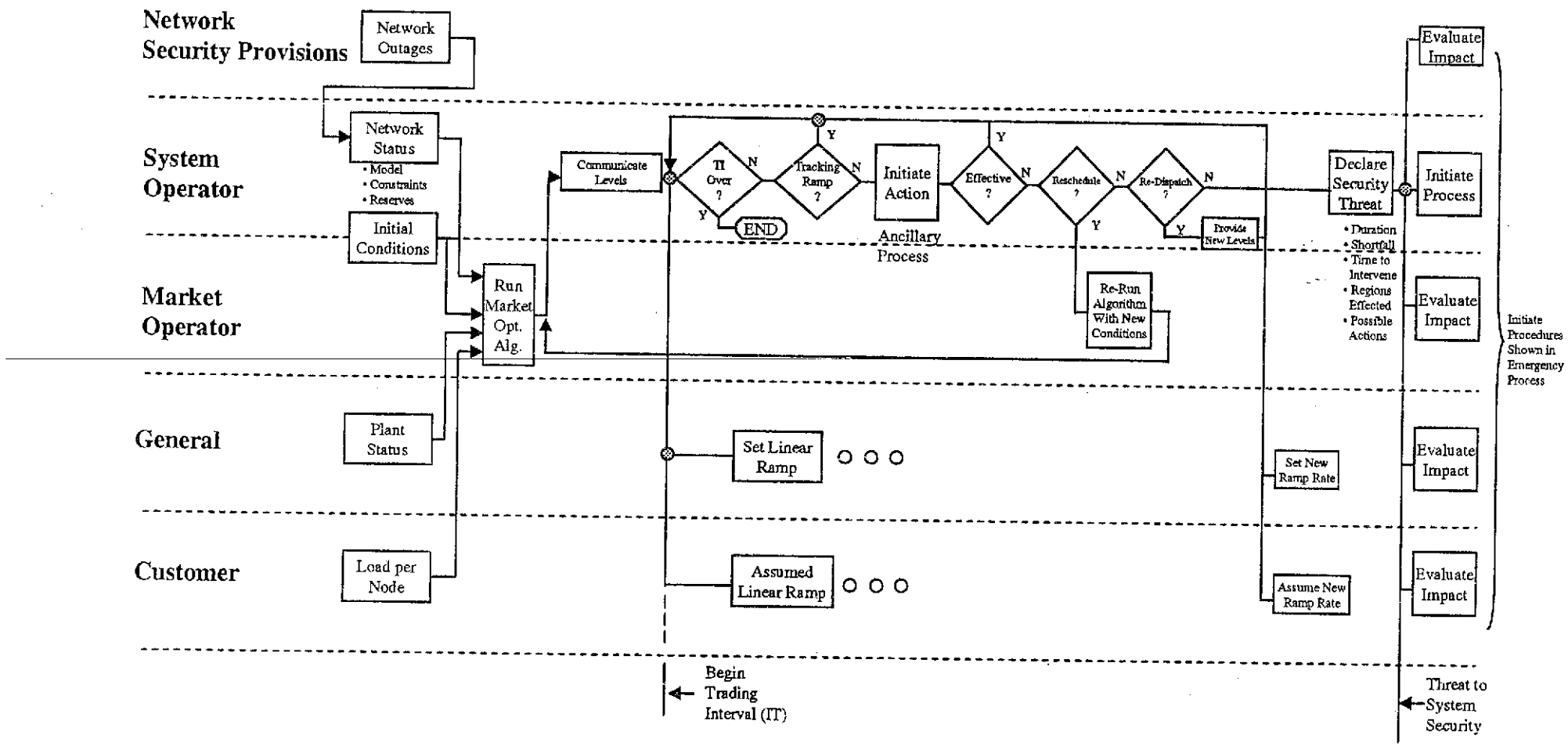
# *Reserve Offer Processing*



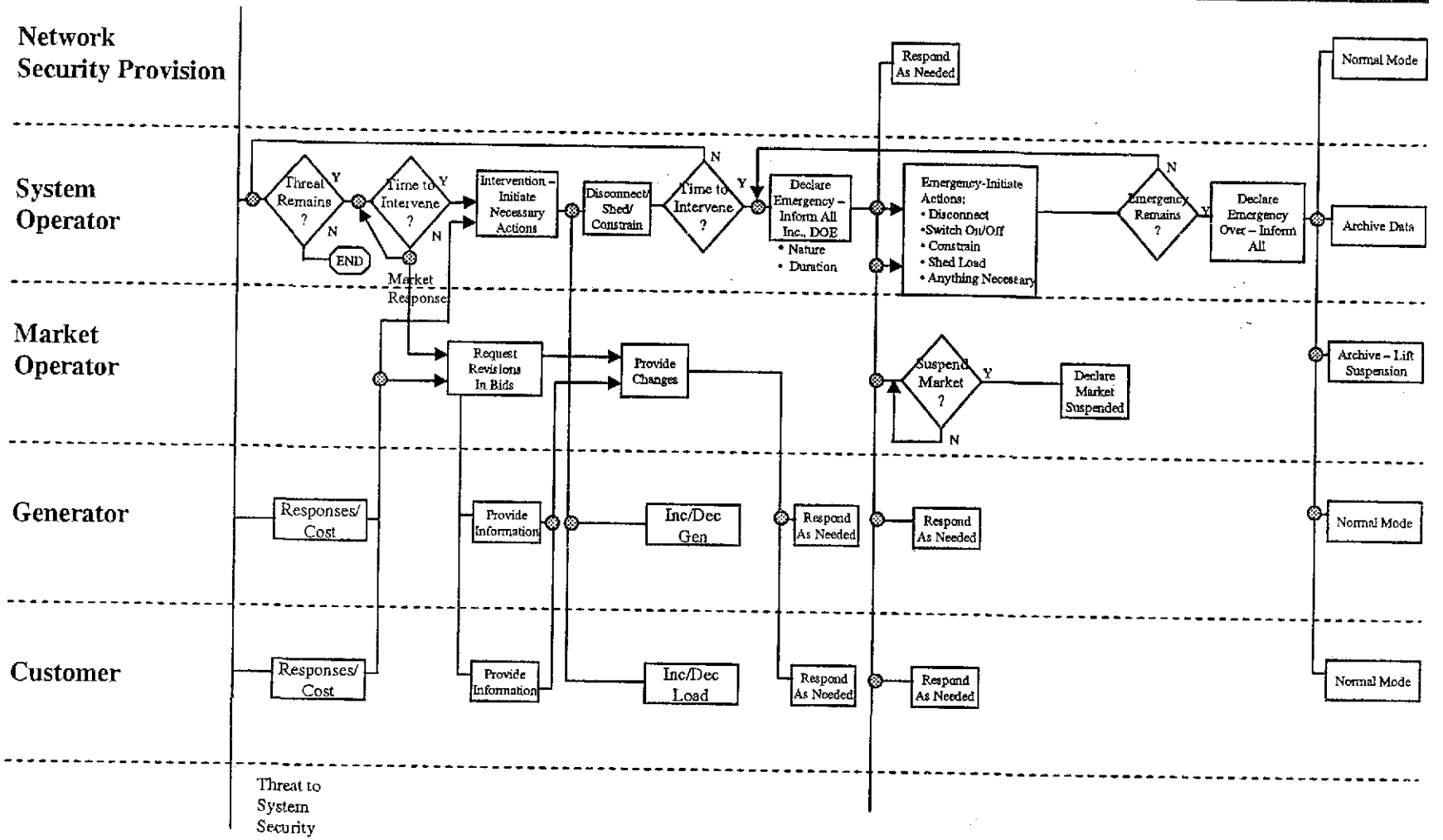
# *Market Operations – Week-Ahead/Day-Ahead Projections*



# *Market Operations - Dispatch*



# *Market Operations - Emergency*



# Attachment B

# Interim Report

# Deliverable #2

# INTERIM REPORT

**Development of Detailed Specification
for the Software, Metering, Communications and
Other Relevant Information Technology (IT) System
Needed to Support
the Philippine Electricity Market Operation**

for
The Department of Energy
and
The National Power Corporation
of the Philippines

Prepared By:
UTILITY CONSULTING INTERNATIONAL

Dated:
June 2001

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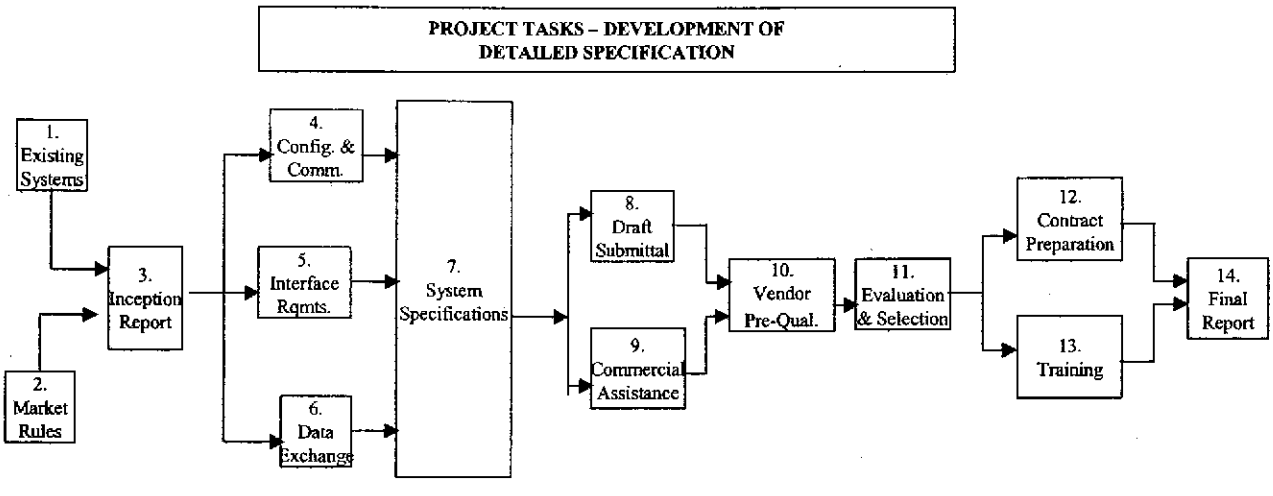
# 1. INTRODUCTION

The National Power Corporation (NPC) is a government-owned utility having responsibility for electricity generation and transmission throughout the Philippines. In a bill before the Philippines Congress the Philippines government is proposing that the electricity industry be restructured and that NPC be privatized.

A new Philippines Electricity Market (PEM) will be established such that the power generation companies (generators) will compete to provide electricity, and that generation is dispatched purely on a competitive-price basis, rather than the current minimum-cost basis.

The specific tasks required as part of this Study are described in Annex IV – Schedule of Events/Activities, shown diagrammatically below:



**Task 1 – Familiarization with Existing Systems** and **Task 2 – Familiarization with Market Rules and Grid Codes** were completed during meetings in Manila the week of March 26, 2001. **Task 3 – Submittal of the Inception Report** was completed on May 8, 2001.

This Interim Report is to address:

- **Task 4 – Development of MMS Configuration and Communications Design;**
- **Task 5 – MMS Interface Requirements;** and
- **Task 6 – Data Exchange Interface Documentation.**

The report provides data and information regarding alternative system implementations and specific configuration recommendations. In addition, it provides the structure for DOE-NPC-ERB and UCI to work together to provide additional data and to decide on preferred system approaches.

The completed work will be used in the next phase of the project, **Task 7 – Development of the Detailed Market Management System Specifications.**

# 2. SYSTEM CONFIGURATION

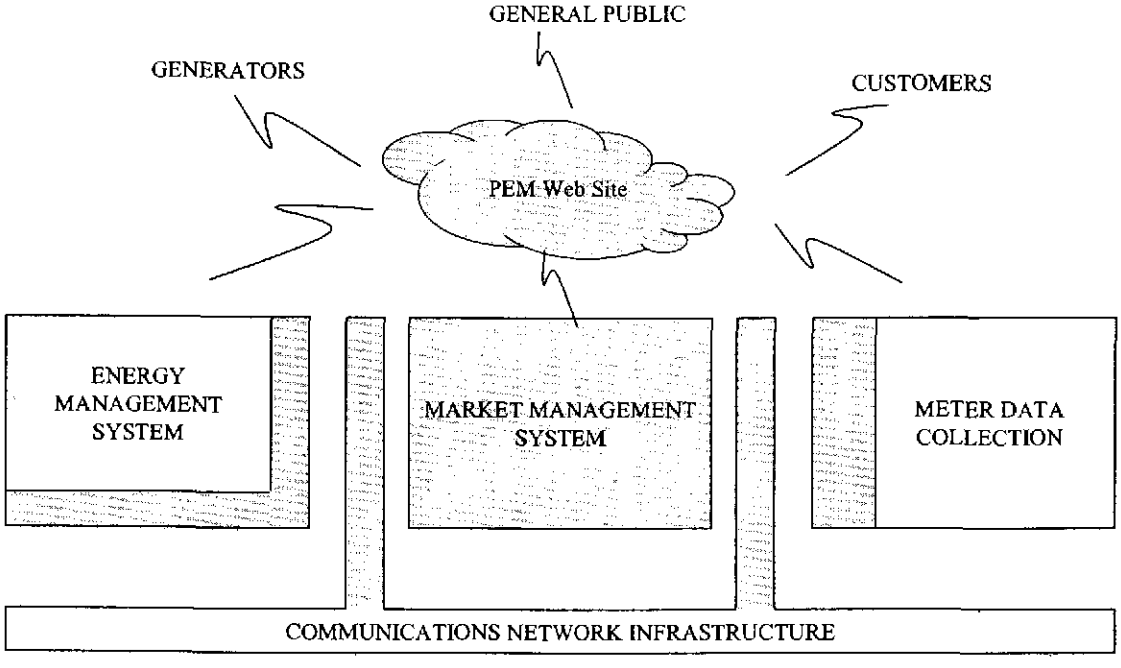
The system configuration for the Information Technology (IT) System needed to support the Philippines Electricity Market Operations includes both new system components and existing system components distributed throughout the Philippines.

## 2.1 System Overview

Figure 2-1 provides an overview of the PEM IT Functions by major functional areas:

- Market Management System – A new system to be specified as part of this project;
- Energy Management System – The GE-Harris system, to be upgraded as necessary to meet market requirements;
- Meter Data Collection – Comprising ongoing meter and metering system upgrades and new functions required for market operations; and
- Communications Network Infrastructure – The existing network infrastructure, to be extended to meet market communications requirements.

**Figure 2-1 – Philippines Electricity Market (PEM) Information Technology (IT) Functions**

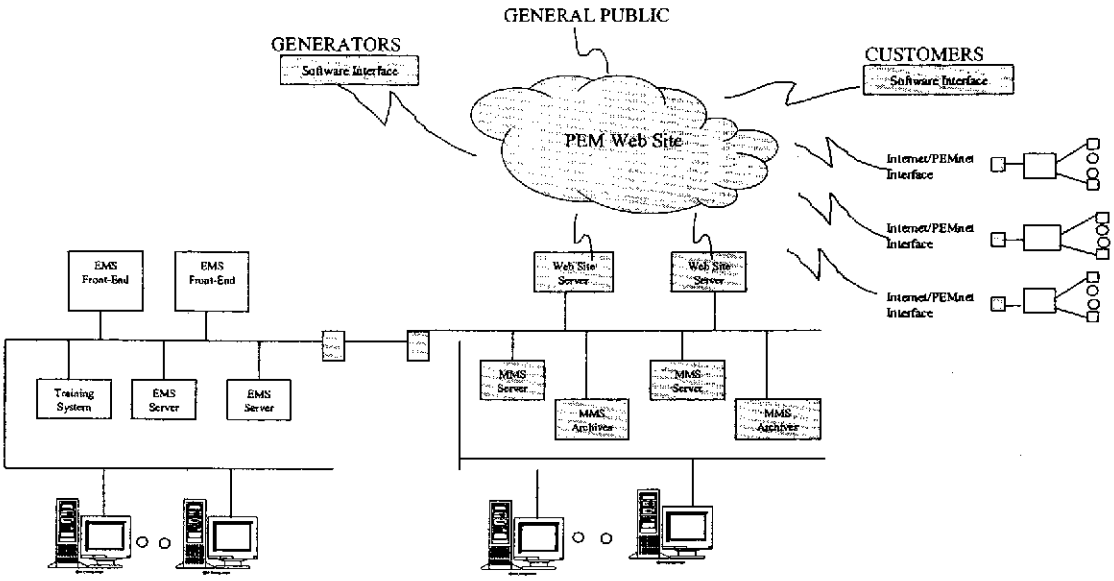



NOTE: Shaded area indicates additions and extensions for market operations

Figure 2-2 is a block diagram representation showing the interconnection of the major system components and the communications media used between them. Communications is discussed further in Section 3. Communications Network.

The requirement for a Disaster Recovery System and its potential location and configuration should be discussed between DOE-NPC-ERB and UCI. The requirements for the IT equipment and functions included need to be consistent with overall Disaster Recovery goals, provisions and procedures.

**Figure 2-2 - PEM IT Overview**




NOTE: Shaded area indicates additions and extensions for market operations

The Market Management System includes all functions needed by the Market Operator for both real-time system operation and market settlements.

## 2.2 Geographic Locations

The elements of the PEM IT system include:

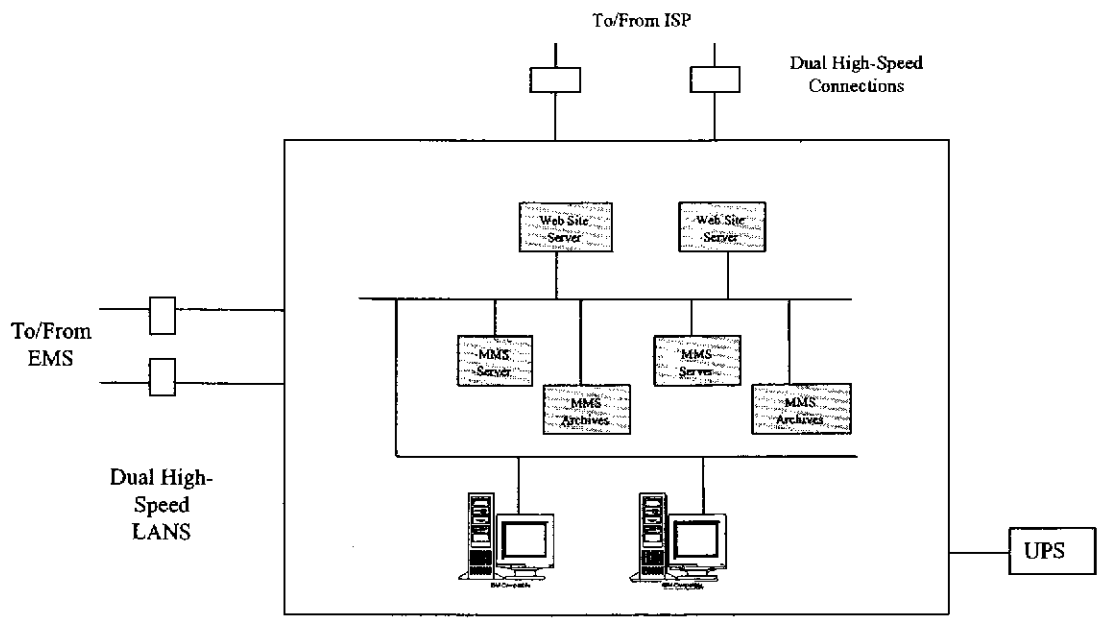
- Metering devices located at market trading nodes in Luzon, Visayas and Mindanao;
- Itron MV-90 meter data collection systems located in each of the three regions;
- Market Participant interface software downloaded to each MP; and
- Communications infrastructure at all locations.

The major portion of the system will be located on the National Power Corporation campus in Quezon City. The existing EMS, the new MMS and the servers used to interface to the Internet web site will all be located on this campus. Final locations have not as yet been determined. However, the final decisions must ensure that the MMS and EMS are in separate buildings, each with its own entrance, infrastructure, and security facilities. The Market Management System must be under complete control of the Market Operator and in no way dependent upon the System Operator for facilities, security, or personnel. The independence of market operations must be assured.

## 2.3 Market Management System

A conceptual block diagram showing the major components of the MMS is shown in Figure 2-3. Note that provisions for system security, including use of firewalls, will need to be addressed as part of the communications design, with requirements included in the MMS specification.

**Figure 2-3 – Market Management System**



The inclusion of an Uninterruptible Power Supply for the MMS should be discussed, including the designation of critical system components to be supplied.

The block diagram of the MMS is for conceptual purposes only. Details of the actual system configuration may vary, as long as the intent and the function, performance, availability and other requirements are met. An open architecture that facilitates the maintenance, expansion and upgrading of the MMS is mandatory.

The final system configuration will include:

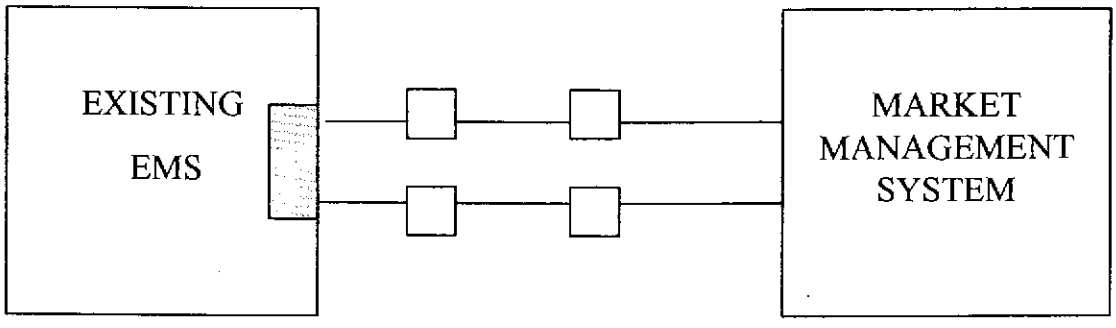
- Two (2) Market Management Servers sized and configured to meet system performance requirements;
- Two (2) MMS Archives Nodes with the capacity to handle all storage and warehousing requirements;
- Two (2) Web Site Servers sized and configured to accommodate the projected data traffic and user requests;
- Twelve (12) User Interface Stations for use by operators for real-time dispatch, meter management and settlement processing;
- Dual Local Area Networks configured to meet system throughput, security and availability requirements.

## 2.4 Energy Management System

Figure 2-4 shows the additions necessary to the existing EMS to accommodate the high-speed LAN connection to the MMS. The final decisions as to LAN routing and network components will be made once final locations are determined.

UCI recommends use of dual high-speed LANs with separate routing and power supply to increase Availability.

**Figure 2-4 – Energy Management System Additions**

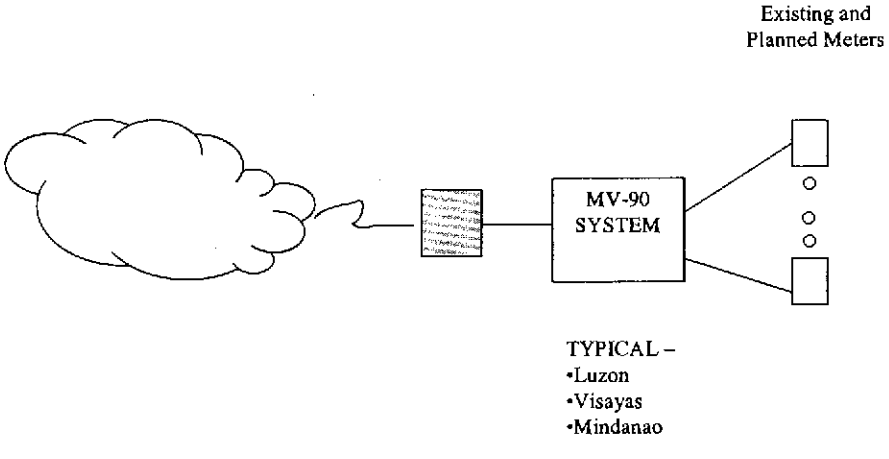



The equipment selected should be based on that now being used to extend the LAN infrastructure of the NPC campus. These equipment components should be delivered by the same suppliers and covered under the same type maintenance agreement. It is assumed that the Market Operator will have a separate contract with the appropriate IT functions to maintain its local network.

## 2.5 *Meter Data Management System*

The Meter Data Management System will take advantage of the extensive work now being done by NPC to upgrade its metering capabilities. Figure 2-5 gives a block diagram typical for the three regions.

**Figure 2-5 – Meter Data Management Systems**



The individual meters at each market trading node will include the capability of interfacing to the Itron MV-90 data collection system via dial-up telephone lines. Assurance that meters are configured to provide all measurements needed for market operations must also be confirmed as part of the Metering Provider registration process.

Interface to the MV-90 systems from the MMS will be via the Internet system designed for market operations. This is described further in Section 3 below. The additions required to the MV-90 systems to accommodate these interfaces will be dependent upon the specific Itron configurations being installed. Where and if possible, the use of standard Itron components will be specified. If this is not possible, separate PC-based interface nodes will be specified.

# 3. COMMUNICATIONS NETWORK INFRASTRUCTURE

The Communications Network Infrastructure for the PEM will be fundamental to the market's success. Timely and secure transmittal of data between Market Participants and the Market Operator will encourage acceptance of the market. The integrity and consistency of metering data will ensure accurate settlements with Market Participants. Reliable and timely exchange of data between the Market and System Operators is mandatory for real-time market operations and maintenance of system security.

The Inception Report outlined the concerns about the use of the existing NPC Wide Area Network for market operations for both inter-region and intra-region communication. Concerns are in both reliability, especially in times of severe weather conditions, and available capacity. The Inception Report also outlined the requirements for the three IT System communications components:

- Market Operator - System Operator
- Market Participants – Market Operator
- Metering Data Collection

UCI has been working with DOE-NPC-ERB to pursue alternative communications possibilities, specifically looking at outsourcing an Internet Web Site for Market Participants – Market Operator and Metering Data Collection communications. UCI feels quite strongly that this path should be pursued further on a high priority basis.

There will then be two parts of the PEM IT Communications Network Infrastructure.

## 3.1 EMS-MMS LAN

As noted in Section 2 above, UCI recommends that the high-speed local area network for intra-campus communications in the NPC facility be extended to include EMS-MMS

connectivity. Final specification and design of the connection can only be made after final locations of the EMS and MMS have been determined. However, general requirements can be established:

- Dual LANs are required to ensure high availability;
- Separate geographic paths should be taken for each LAN to protect against physical breaks;
- LANs should be high-speed, consistent with present designs;
- Routers and firewalls should protect against excess and unwanted traffic;
- Separate power sources should be used for individual networks;
- Networking equipment should be considered critical to market operations;
- Uninterruptible power supplies should include support of networking equipment.

## 3.2 PEM Web Site

UCI recommends that DOE-NPC-ERB continue to pursue outsourcing a Web Site for Philippines Electricity Market Operations. The following summarizes UCI's view on what is designated the PEM Web Site. It will be the basis for the required procurement specification for this most important system component.

### 3.2.1 Introduction

The Philippines Electricity Market is being established by the Philippines Government to facilitate the sale and purchase of electricity throughout the country. The administration of the market is under the direction of the Market Operator acting on behalf of the government. An important element of the PEM will be the electronic communication system to be used by all participants in the market.

### 3.2.2 Scope

The PEM Web Site will be used:

- throughout the Philippines for communications between and among the participants in the market, specifically the Generators, Customers, Network Service Providers, and Meter Service Providers in Luzon, Visayas and Mindanao. The Market Participants will be located throughout the regions, but all must have local and immediate access.
- for meter data collection, providing the interface between the Market Management System and the three Meter Data Collection Systems located in the regions.
- by the Market Auditor and by Government agencies to monitor market activities and by the Market Operator to disseminate information to the general public. The site must be available for those purposes.

### 3.2.3 Functions

The web site is to be used both during market pre-commencement for Participant registration purposes, as an integral part of market operations, and to effect settlements. The functions to be accommodated are:

- Registration – All Participants in the PEM need to be registered with and approved by the Market Operator. The Market Rules provide the qualifying criteria for each Participant and the information required for submittal. The site shall provide the required forms for registration and a register of Participants. The MO shall have control over the criteria and the forms used for registration, and the capability of manually de-registering Participants.
- Offers and Bids – The main on-going use of the PEM web site will be the submittal of Offers, including reserves, by Generators, and Bids and Offers by Customers, for each trading interval in accordance with the requirements of the Market Rules. The web site shall be designed to handle the maximum number of offers and bids and re-submissions as defined in the Performance portion of the final specification.
- Acceptances and Rejections – The means for the MO to signal acceptance or rejection of the submitted offers and bids shall be provided.
- Week-ahead and Day-ahead Projections – The projections of week-ahead and day-ahead projections for each trading interval shall be published on the web site.
- Market Information – The MO shall use the site to publish all required information regarding the market, including previous day details of dispatched generation or dispatched load, and dispatched reserves for each scheduled generating unit and scheduled load in each trading interval.
- General Information – The PEM web site shall have the capability of publishing general information as required by the Market Operator or under the direction of the Government.

- Meter Data Collection – The MMS will periodically and on demand request data from the three regional meter data collection systems. These data will provide the information used to establish final prices for each trading interval for each Market Participant.
- Settlements Data – The preliminary and final individual financial statements associated with market operations will be forwarded and responded to via the web site.
- Electronic Funds Transfer – Actual payments of all statements will be authorized via the web site and funds dispersed using the Electronic Funds Transfer capability.

### 3.2.4 Access

The PEM Web Site will be used for the competitive buying and selling of power on a real-time basis. As such a great deal of the information on the site is both sensitive and proprietary. Access to specific portions of the site shall be controlled and subject to the security provisions detailed below. The site shall have at least fifteen levels of access, including the following:

- Market Administrator – Highest level of access. No limitations. Control of passwords and security controls.
- Market Auditor – Unlimited access to all data on the site including archives and current data.
- Market Operator – Unlimited access to all information submitted and published, currently available on the site. Used by the MO to operate the market.
- System Operator – Access to all information regarding the electric network and data required for the security of the system; specifically no market information.
- Network Service Provider – Access only to the details of their network; no market information.
- Meter Service Providers – Access to Participants Register, the Metering information database and general market information.
- Generators – Access to those data directly effecting them such as day-ahead and week-ahead projections and Market Information;
- Customers – As above for Generators.
- General Public – Will be restricted to specific information designated by the Market Rules for general publication.

### 3.2.5 Forms and Templates

All of the information to be exchanged and/or posted on the PEM Web Site shall be enterable via forms expressly created for this purpose using templates available to the Market Operator

Default forms shall be built using a standard template editor. These forms shall be reviewed by representatives of the Market Participants as well as by the Market Operator. Specific requirements are:

- Creation and modification of templates shall be possible using simple data entry procedures by authorized MO staff;
- Templates shall be implemented using standard technologies, preferably as XML or as spreadsheet tables with Comma Separated Values (CSV);
- All templates shall contain the template identification number, the version number and the effective date of implementation;
- Descriptions of all templates shall be posted on the web site;
- Transition to new or updated templates/forms shall be under the control of the MO and on a non-interference basis with market operations;
- Ease of use by the Market Participants of all templates and forms shall be a high priority;
- All changes to templates and installation activities shall be logged and archived.

### 3.2.6 Participant Interface

Acceptance of the web site and interface by the Market Participants is of vital importance to the ultimate success of the PEM. It may be necessary to include software packages to facilitate web site use and acceptance. This will be part of the procurement process.

### 3.2.7 Availability

The availability of the PEM Web Site for operation of the market is critical to the success of the market. The site shall meet the requirement for 99.98% availability.

### 3.2.8 Security

The security of the PEM web site is of foremost importance. With the sole exception of web pages designed for use by the general public, security shall be assured by at least the following:

- A Public Key Infrastructure (PKI) using standard 1024 bit digital certificates capable of signing shall be used to verify the identity of participants. The PEM web site shall ensure that:
  - The certificates used are registered in the Certificate Registry;
  - Certificates are current and valid, by verifying the Certificate Authorities signature and checking the validity period;
  - The participant has initiated communications from the specified IP address or host, in the event that the "CN" field is an IP address or name;
  - The certificate has not been revoked;

- Secure Sockets Layer version 3 (SSLv3) and/or Transport Layer Security (TLS) version 1 or above, IP Security or equivalent shall be used for authentication. The following SSL selections or alternatives with equivalent performance characteristics shall be provided:
  - Asymmetric Algorithm: RSA
  - Symmetric Algorithm: RC4 (128-bit)
  - Digest Algorithm: SHA-1
  - Record Size: Largest size feasible.
- Strong encryption with a minimum 128-bit key shall be required.
- The web site shall provide for lockout of individual participants in the event of authentication failures, automatic logout on loss of connection and automatic closing of all files and applications in the event of logout.

### 3.2.9 Site Monitor

All activity occurring on the PEM web site shall be monitored and the following events recorded for review by selected access levels:

Registration of all Participants

- Registration of all individuals with access beyond that of the general public;
- Logons to the site;
- Unsuccessful logon attempts;
- Logoff and loss of connection;
- Updates of information shown on the web pages;
- Downloads of files or results of queries;
- Upload of files;

- Submitted Forms;
- Acceptance and Rejection Notices;
- Attempts by individuals to access restricted data;
- Web site application failures;
- Web site communications failures;
- Failed attempts for access from unauthorized ports;
- Any other security breaches.

The log of these events shall include the following information at a minimum:

- Time, to the millisecond, and date of the event;
- Logon name of individual and certificate number;
- Targeted URL address;
- Success or failure of interaction;
- Type of Event;
- Archive of the associated data;
- Security Alarm flag to indicate an unusual aspect of the event.

Access to the security log will be limited to authorized security engineers, the Market Auditor and the PEM Web Site administrator.

# 4. SYSTEM SIZING PARAMETERS

The definition of System Sizing Parameters will dictate the processing power, memory and network bandwidth of system components, in addition to influencing overall system architecture. Provided below are tables listing the parameters which need to be defined in preparation for developing the set of specifications.

UCI recommends that DOE-NPC-ERB review the lists for completeness and the parameters themselves for estimates prior to meeting with UCI to establish final numbers. The parameters include lists from the existing EMS specification; these should be reviewed to reflect today's electric network configuration.

Note that the parameters definition should reflect ultimate anticipated system growth, but that increased size will be reflected by increased cost estimates from potential suppliers.

The following tables summarize the system sizing parameters for the Market Management System.

| Table | Item |
|---|---|
| 4-1 | Infrastructure |
| 4-2 | Power System |
| 4-3 | Operations Scheduling |
| 4-4 | Real-time Dispatch |
| 4-5 | Metering Data |
| 4-6 | Market Participants |
| 4-7 | Settlements |
| 4-8 | Web Site Traffic |

Table 4-1
INFRASTRUCTURE

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| Zones | | | | |
| Trading Nodes | | | | |
| Meter Collection Points | | | | |
| Generators | | | | |
| Customers | | | | |

Table 4-2
POWER SYSTEM SIZING

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| External Companies | 28 | 22 | 16 | 66 |
| Generators | 233 | 126 | 68 | 427 |
| Distribution Companies | 35 | 21 | 26 | 82 |
| Substations | 121 | 72 | 53 | 246 |
| Buses | 332 | 164 | 152 | 648 |
| Switching Devices | 4704 | 1817 | 1784 | 83-5 |
| Transmission Lines | 402 | 265 | 351 | 1018 |
| HVDC Lines (connected to region) | 1 | 2 | 1 | 4 |
| Fixed Tap Transformers | 172 | 70 | 113 | 335 |
| TCUL Transformers | 73 | 63 | 39 | 175 |
| Phase Angle Transformers | 0 | 0 | 1 | 1 |
| Loads – Conforming | 131 | 99 | 83 | 313 |
| Loads – Nonconforming | 3 | 1 | 2 | 6 |
| Load Scheduling Zones (Section 4.3.2.3) | 6 | 5 | 3 | 14 |
| Zones (for determining congestion) | 11 | 7 | 5 | 23 |
| Fixed Shunts | 143 | 46 | 51 | 240 |
| Network Islands (frequency regions for generation control) | 1 | 1 | 1 | 3 |
| Network Islands (as a result of a disturbance) | 4 | 5 | 2 | 12 |

Notes:

- Distribution companies refer to those who sell energy to their customers. Large companies like Meralco are counted only once although they are supplied from more than one feeder. Companies that buy electricity directly from NPC for their own use are not included in this count.
- IPPs are referred to in the "External Companies". The total number of companies is counted; each company may have more than one generating unit.
- The figures here include future additions based from Power Development Plan except entries for Distribution Companies and Network Islands.
- "Switching Devices" includes CBs and disconnect switches.

Table 4-3
OPERATIONS SCHEDULING SIZING REQUIREMENTS

| SIZING PARAMETER | QUANTITY |
|---|---|
| Short Term Load Forecasting | |
| Number of Simultaneous Users | 5 |
| Number of Stored Load Profiles | 365 |
| Maximum Number of Forecast Hours | 336 |
| Forecast Areas | 10 |
| Load Forecast Save Cases (study mode) | 10 |
| Transmission Outage Plan | |
| Number of Outage Schedules | 100/day |
| Number of Forecast Hours | 336 |

Table 4-4
REAL-TIME DISPATCH SIZING REQUIREMENTS

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | *LUZON* | VISAYAS | MINDANAO | TOTAL |
| Generation | | | | |
| Generators | 233 | 126 | 68 | 427 |
| Plants | 40 | 30 | 23 | 93 |
| Controllable Units | 233 | 126 | 68 | 427 |
| Forbidden Operations Regions | 233 | 126 | 68 | 427 |
| HVDC Interconnections | 1 | 2 | 1 | 2 |
| Controllable Loads | 100 | 31 | 48 | 179 |

Table 4-5
METERING DATA

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| Data Collection Points | | | | |
| Meter Points | | | | |
| Max. Meter Reads/Hour | | | | |
| Meter Readings Accessible – (Months) | 16 | 16 | 16 | ____ |
| Meter Readings Archived – (Years) | 7 | 7 | 7 | ____ |

Table 4-6
MARKET PARTICIPANTS

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| Generators | | | | |
| Gen. Offers/Day | | | | |
| Gen. Max. Offers/Hour | | | | |
| Customers | | | | |
| Customer Bids/Day | | | | |
| Customer Max. Bids/Hour | | | | |
| Offers/Bids Accessible - (Months) | | | | |
| Offers/Bids Archived - (Years) | | | | |

Table 4-7
SETTLEMENTS

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| Settlements/Day | | | | |
| Settlements Accessible - (Months) | | | | |
| Settlements Archived - (Years) | | | | |

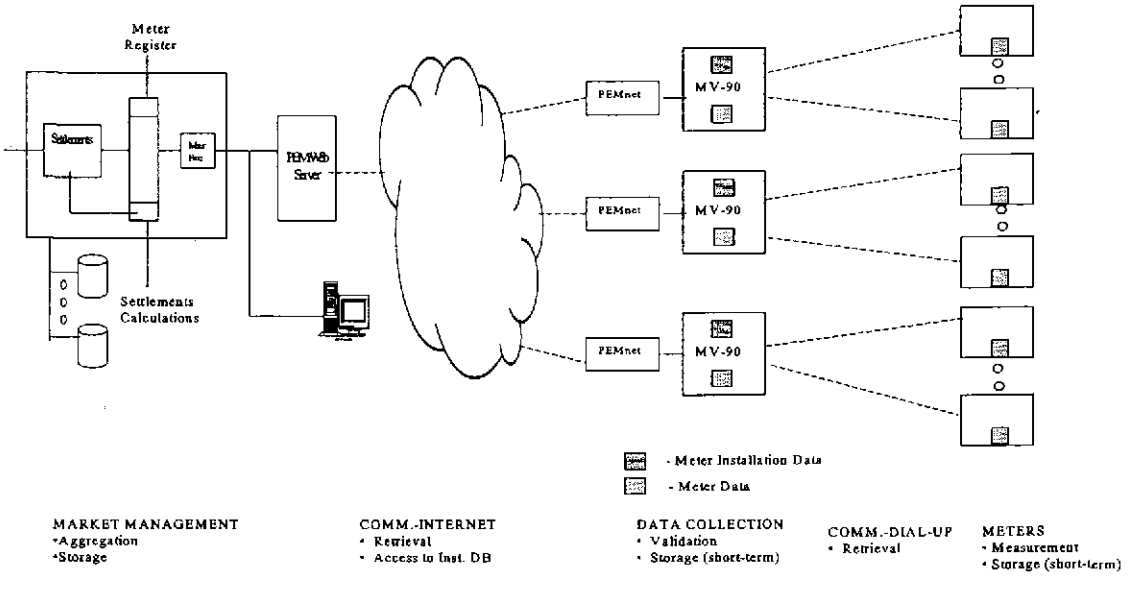
Table 4-8
WEB SITE TRAFFIC – HOURLY MAXIMUM

| SIZING PARAMETER | QUANTITY | | | |
|---|---|---|---|---|
| | LUZON | VISAYAS | MINDANAO | TOTAL |
| Generators | | | | |
| Customers | | | | |
| Meter Readings | | | | |
| Participants | | | | |
| General Public | | | | |

# 5. METER DATA MANAGEMENT SYSTEM

The Meter Data Management System (MDMS) consists of existing and new meters, existing and new meter data collection systems, upgrades of the meter data collection systems, portions of the Market Management System and utilizes both dial-up telephone communications and the new PEM Web Site. Figure 5-1 gives an overall diagram of the system.

**Figure 5-1 – Meter Data Management System**




The MDMS is critical to the reliable operation of the PEM and acceptance of the market by participants and regulatory agencies. It is essential that the various elements that make up the system perform as specified. The following discusses the main issues associated with the system components, starting with the meters and advancing to the system.

## 5.1 Metering Devices

NPC is actively engaged in a project to upgrade its metering devices, installing more modern meters with additional capabilities as well as remote communications. Once all market trading nodes have been defined, meters at each location will need to be reviewed to ensure that market operations requirements are met.

## 5.2 Communications Dial-Up Network

It is proposed that the existing telephone network be used for retrieval of data from meter devices. It has been assumed that the reliability and availability of these systems for meter data collection has been considered as part of the metering upgrade project. This should, however, be discussed and confirmed.

## 5.3 Meter Data Collection Systems

NPC is installing Itron MV-90 systems in each of the three regions, Luzon, Visayas and Mindanao. Given the definition of market trading nodes, the ability of each system to handle its required capacity can be determined and the systems upgraded if necessary.

Each of the three systems will also need to be reviewed to determine compatibility with the proposed PEM Web Site. Here too the systems will need to be upgraded with Itron components or perhaps augmented by PEM Web interface boxes. These would be PCs with interfaces to the MV-90 systems for data collection and the Web Site for data response.

The MV-90 systems will include the Installation Database, which will be available to the Market Operator through the MMS.

## 5.4 PEM Web Site Interface

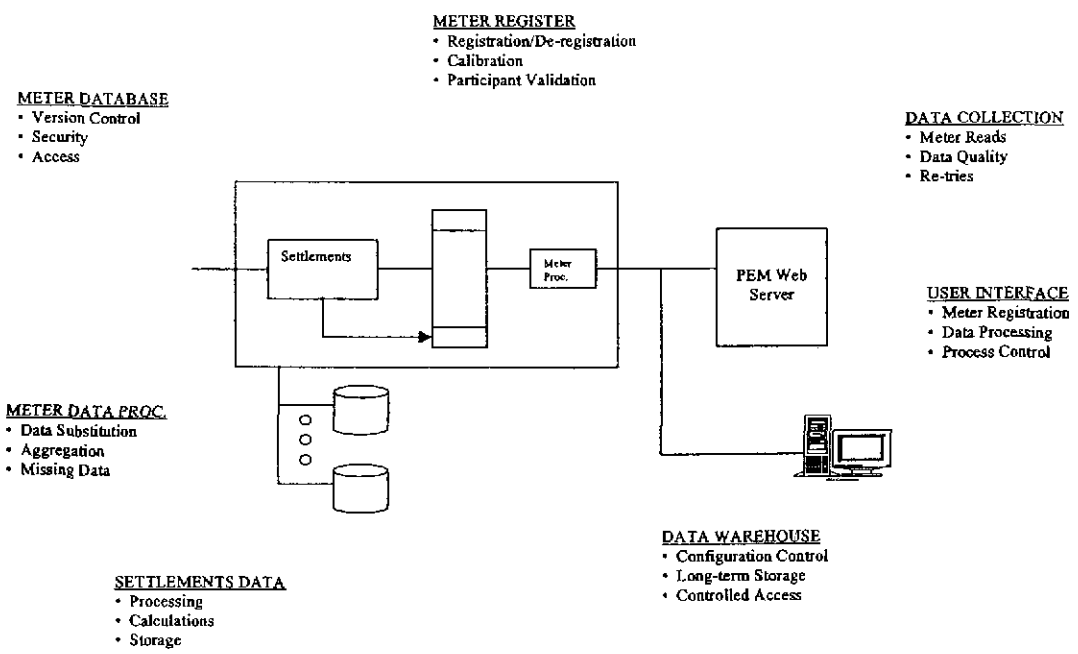
The use of the Internet or a restricted portion of the Internet for collection of metering data by the MMS will require special security precautions and thorough review of the techniques used to ensure security. The requirements specification for the PEM Web Site will reflect those needs.

DOE-NPC-ERB must consider the administration of the web site not only in terms of monitoring it on a routine basis but as to ownership and control of this most important system component.

## 5.5 Market Management System

Figure 5-2 provides an expanded view of the MMS, providing more information concerning the metering functions included in the MMS.

**Figure 5-2 – Meter Data Management System**



These functions are:

- Meter Register – The database which lists all meters in the system with identifiers for providers, registration status and calibration requirements as per market rules is included in the MMS.
- Data Collection –The periodic and on-demand retrieval of metering data from the MV-90 systems. This function will also assess data quality based on reasonability and provide for retries as necessary.
- Meter Data Processing – Capability for data substitution, accounting for missing data and aggregation/re-aggregation are part of the MMS.
- Meter Database – The meter database will include all data collected and calculated with appropriate location and time identifiers. Control of access to these data will be as specified in the market rules.
- Settlements Data – The Meter Database will be augmented by a Settlements Database, which will include all data calculated and used in financial statements.
- Data Warehouse – Longer-term storage of all meter and settlement data will be in redundant data warehouses sized for ultimate system capacity and mandated duration requirements.
- User Interface – Provisions will be made for manual changes to the meter registry, controlled changes to data, data acquisition requests and changes in process by authorized users.

# 6. EMS-MMS INTERFACE DEFINITION

The interface between the existing Energy Management System provided by GE-Harris and the proposed Market Management System must reflect the assigned division of duties between systems. In evaluating this division, UCI has considered two somewhat divergent possibilities:

- Optimum use of the functions now under development for the EMS under the designation "Market Functions".
- Strict adherence to the definition of Market Operator and System Operator functions as defined in the Market Rules.

In the following, UCI has come down on the side of strict adherence to the Market Rules, reasoning that this will provide the basis for a more open procurement process to the benefit of DOE-NPC-ERB. GE-Harris will have the option of offering an alternative that meets specification functional requirements while taking advantage of its work on the EMS.

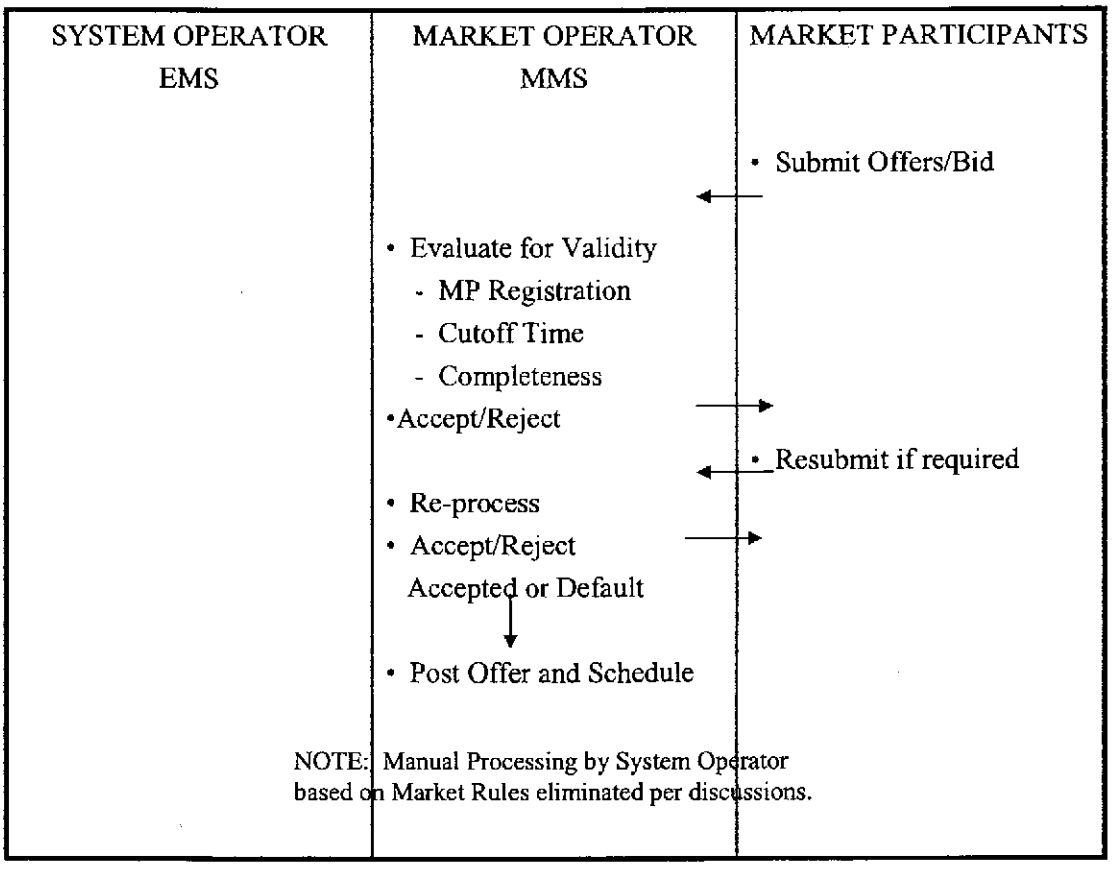
## 6.1 Process Diagrams

The Inception Report included as an attachment shows process diagrams depicting the division of responsibility between the Market Operator and System Operator. These are the basis for the simplified diagrams below concerning Offers/Bids, Projections, Dispatch, and Emergency procedures. The intent is to highlight the interface between the EMS and the MMS, and to provide specific UCI recommendations for market operations implementation:

### 6.1.1 *Offers/Bids Processing*

The processing of Offers and Bids from Generators and Customers for both delivered energy and reserves will be handled entirely within the MMS. Figure 6-1 summarizes interaction between the Market Operator and Market Participants (Generators and Customers). Note that this is a market-only process, independent of the System Operator.

**Figure 6-1**

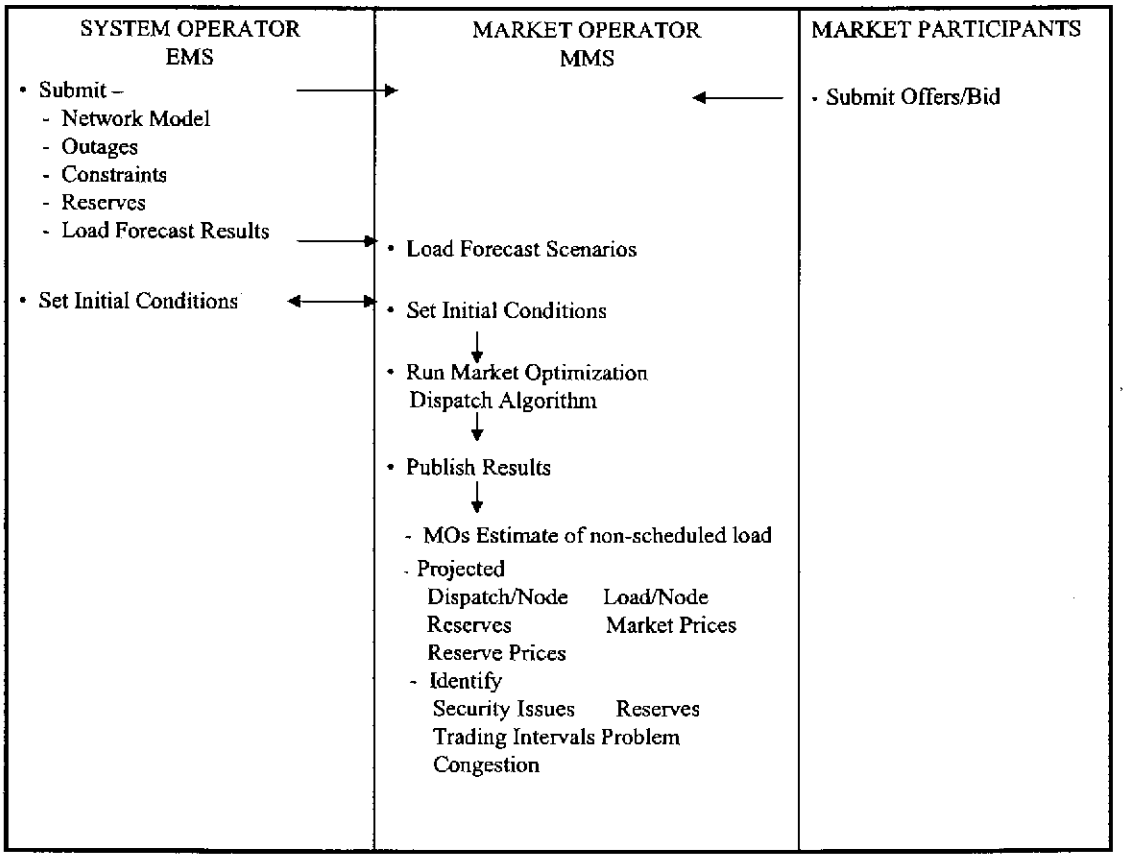



All communications between the MO and MIs will be via the PEM Web Site, using forms prepared specifically for those purposes. All activities will be monitored and archived.

### 6.1.2 *Day-Ahead, Week-Ahead Projections*

The calculation of Day-Ahead and Week-Ahead projections of energy use and prices will be made in the MMS using the Market Optimization Dispatch Algorithm defined by the Market Rules. The process is shown in Figure 6-2.

**Figure 6-2**




Input data required from the EMS is:

- Network Model (transmitted only on change)
- Outages Schedule
- Transmission Constraints
- Generator Outputs by Unit
- Load Forecast by Trading Node
- Reserves and Ancillary Services Requirements

The results of the projections will be made available to all Participants, including the System Operator, via the PEM Web Site.

### 6.1.3 *Dispatch*

The MMS will develop the Dispatch Schedule to be used by the EMS based on the final Offers and Bids received from Market Participants, and updated information from the EMS, as noted above under Projections, using the Market Optimization Dispatch Algorithm.

The results of the Dispatch run will be transmitted to the EMS for use during the next Trading Interval unless updated by the MMS or an Emergency condition declared.

Note that this process assumes a simple dispatch algorithm, at least for the initial phase of market operation. The more complex process requiring iterative runs within the EMS of an AC Load Flow should be deferred until a later date.

Figure 6-3 presents the flow of data up to the beginning of the Trading Interval while Figure 6-4 maps the process through the TI.

**Figure 6-3**

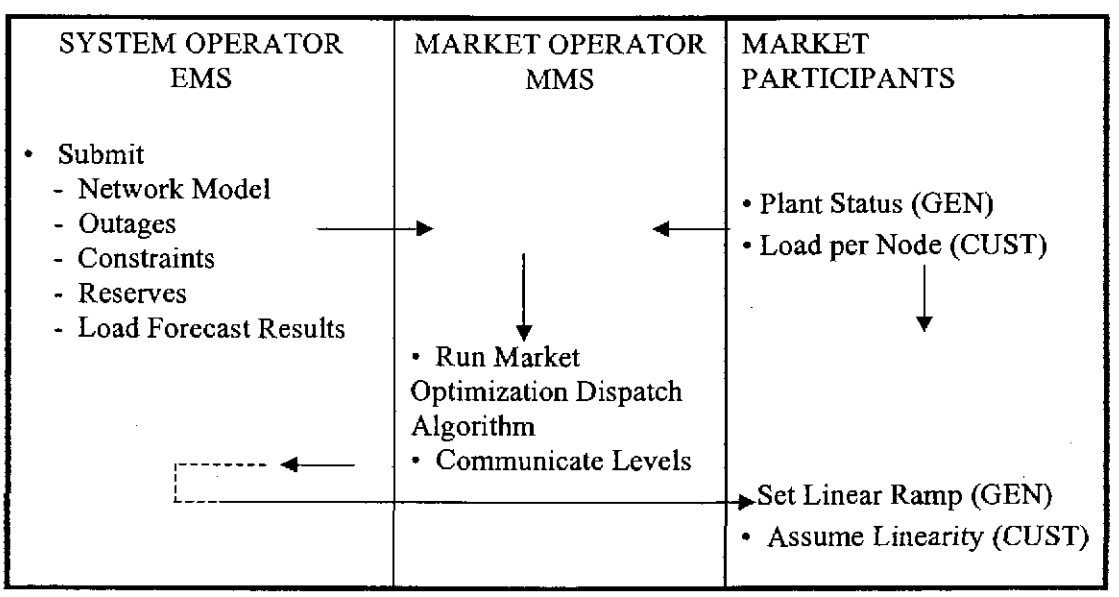
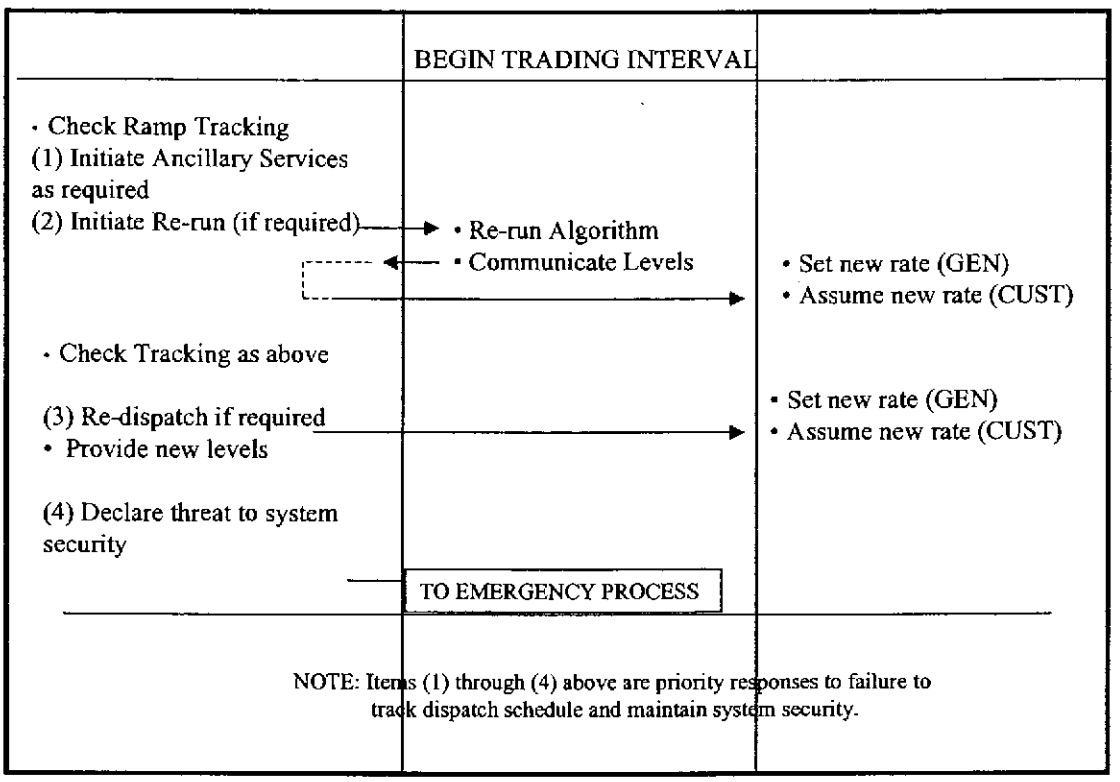


**Figure 6-4**

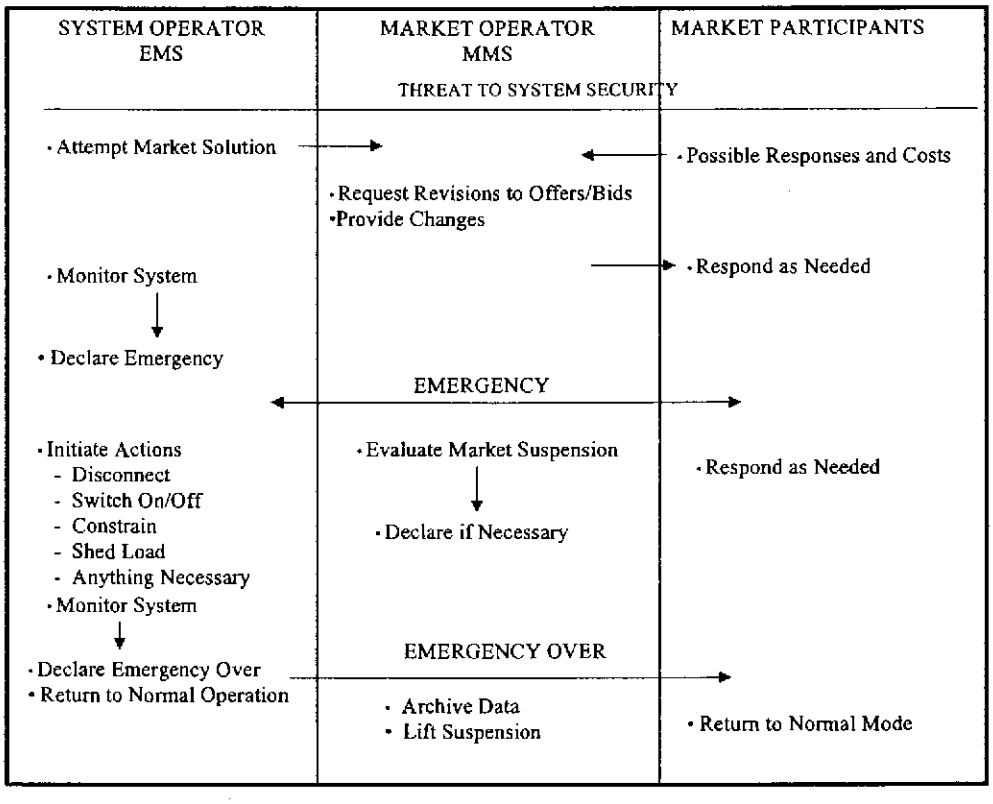



### 6.1.4 *Emergency*

The declaration of an Emergency condition is a legitimate concern of the Market Rules. While response to an Emergency situation is mandatory and identification as early as possible is to be encouraged, the declaration of an Emergency to cede control from Market to System Operator can lead to the collapse of a viable market.

Figure 6-5 summarizes the process for all Participants up to and through a declared Emergency.

**Figure 6-5**




Extensive discussions and compromise between Market and System Operators in the definition of Emergency conditions and the controlled responses to them will be necessary prior to market commencement.

## 6.2 EMS-MMS Detailed Interface

The specific data to be exchanged between systems, periodicity of transfer, and the projected volume will be based to a great extent on the data provided by GE-Harris in their document regarding Market Functions.

UCI intends to work from this document both to take advantage of the work to date and to minimize as much as possible the impact on the EMS. The tables will, however, be modified and augmented as necessary to reflect the Market Rules segmentation as shown

in the process diagrams. The data from GE-Harris will need to be available for review and modification at the next meeting between UCI and DOE-NPC-ERB.

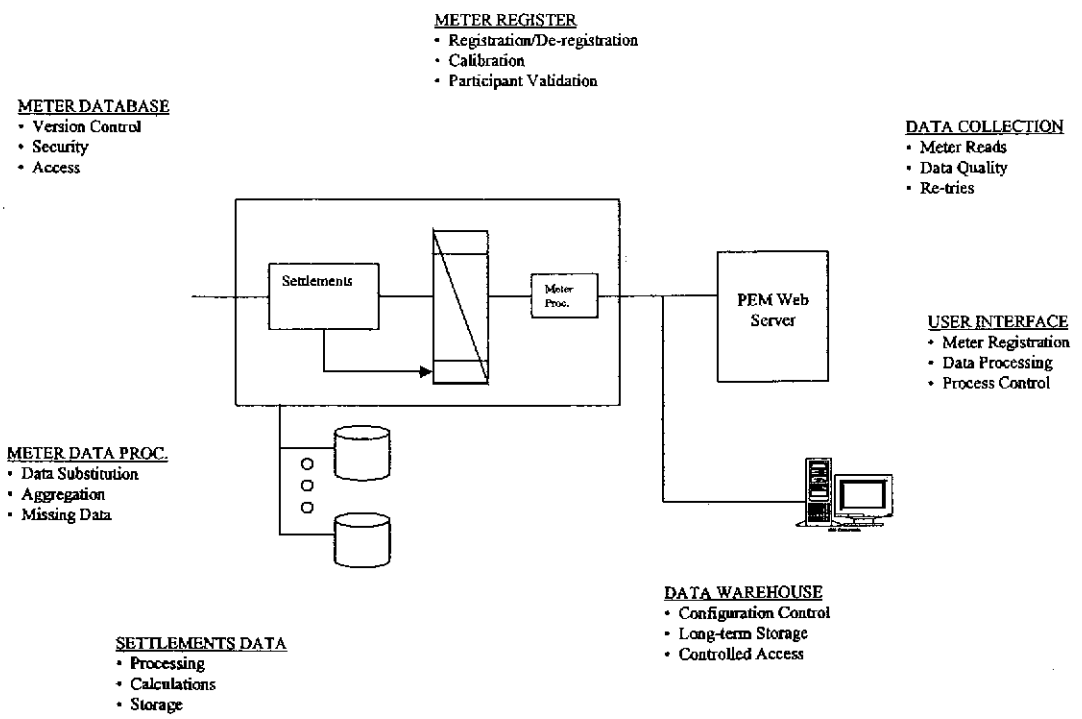
UCI proposes the use of standard data formats and standard communications protocols for these data transfer both to provide an even playing field during the bid/procurement process and to facilitate system maintenance and expansion. EPRI's Common Information Model (CIM) will be specified wherever feasible for interchange of electric utility network data. Computer industry standard file transfer protocols will be specified for use on the LAN between systems.

# 7. SETTLEMENTS

The calculation and processing of Settlements data is a major MMS function. Figure 7-1 (identical to Figure 5-2) shows the relationship of Settlements to Meter Data Management. The Meter Database will be made up of three sections:

- Meter Register – Data regarding Meter Locations
- Meter Data - Actual and Calculated Values
- Settlements Data – Calculated Values and Statements

**Figure 7-1 – Meter Data Management System**

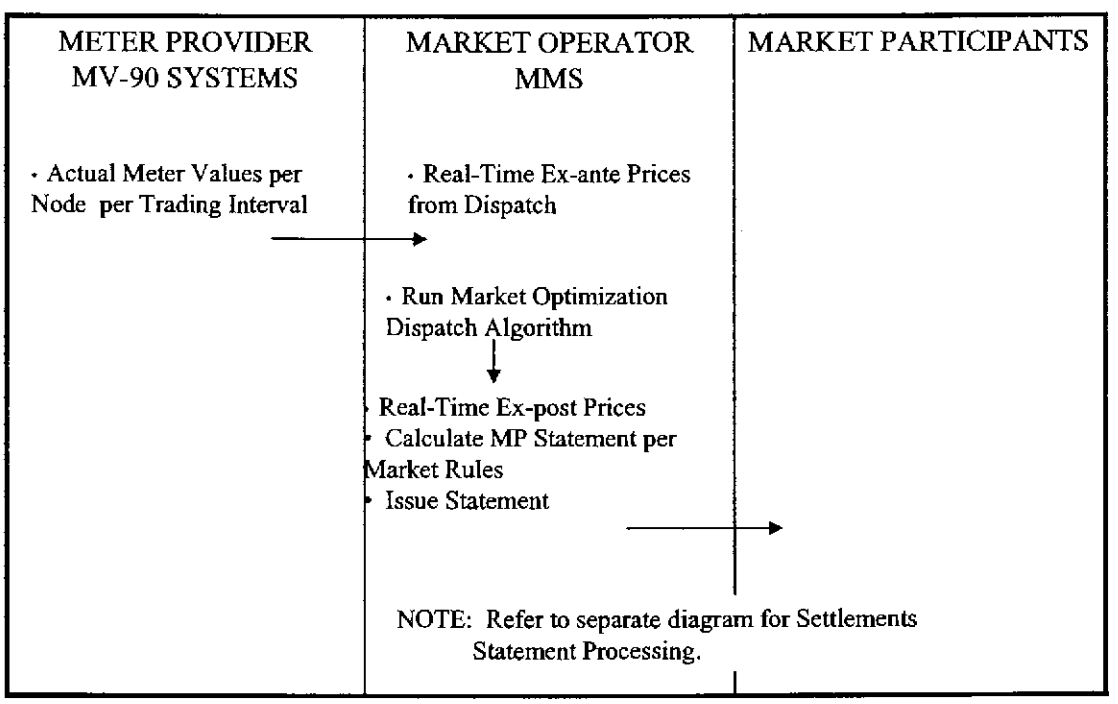


All archiving and data warehousing activities regarding meter data will apply to Settlements data as well.

## 7.1 Processing

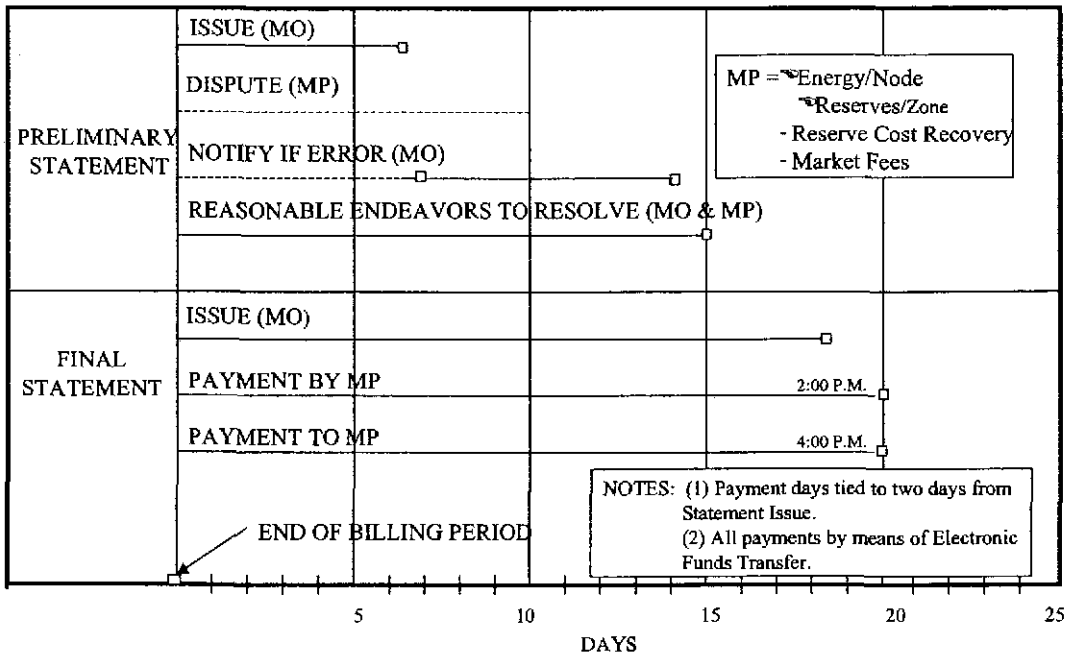
Settlements data will be prepared based on the results of the Market Optimization Dispatch Algorithm runs for Real-Time Ex Ante and Real Time Ex Post Dispatch runs. The exact algorithm to be used is as defined in the Market Rules. Figure 7-2 provides a process diagram for Settlements data to the preparation of the statements for all Market Participants for each Trading Interval.

**Figure 7-2**




Processing of the Preliminary and Final statements and payments by the Market Operator and Market Participants will be as shown in Figure 7-3.

**Figure 7-3 – Settlements Payment Process**




The payments must be made based on the Final Statements, independent of pending or potential disputes. The dispute process outlined in the Market Rules will accommodate adjustments and interest payments as appropriate should a dispute be allowed.

## 7.2 Prudential Requirements

Prudential requirements will be as defined in the Market Rules. The Market Operator will maintain a register of all Market Participants, providing detailed information on the status of security provisions, statements, payments and other data relevant to financial viability.

## 7.3 Electronic Funds Transfer

The vehicle to be used for Electronic Funds Transfer will be established by the Market Operator and information provided to all Market Participants.

# ATTACHMENT C

# Interface Requirements

## Deliverable #3

## Part 1 of 2

# MMS Interface Requirements

# for the

# Philippines Wholesale Electricity Spot Market

By Utility Consulting International

April 2002

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# 1. Introduction

Operation of the Wholesale Electricity Spot Market (WESM) for the Philippines will require communications capabilities both as part of and in addition to that supplied by the Market Management System (MMS). The requirements for the facilities have been developed in concert with responsible Napocor personnel as part of the study defining the Information Technology infrastructure required for WESM operations.

The decision to implement an Interim MMS has had an impact on communications as well as on system delivery. The IMMS has significantly less requirements for communications than the final system. This is shown in the following table excerpted from the IMMS specification.

| Function | IMMS | MMS |
|---|---|---|
| • MMS-EMS Interface | Manual | Automated |
| • Participant Interface | | |
| - Registration | Manual | Electronic |
| - Offers/Bids | Electronic | Electronic |
| - Market Notices | Not Available | Available |
| • Metering Systems | | |
| - Data Collection | Manual | Automated |
| - Re-tries | Not Applicable | Automated |
| • Settlements | | |
| - Statements | Manual | Automated |
| - Funds Transfer | Electronic | Electronic |

This document provides a summary of the elements of the WESM communications system for both the IMMS and MMS, including:

- Requirements
- Recommendations for implementation.

The timing for completion is as required to support IMMS and MMS commissioning. It may, however, be efficient and cost-effective to complete some MMS implementation concurrent with IMMS effort.

## 2. MMS-EMS Interface

**Requirements**

The GE-Harris EMS is an integral component of the Information Technology (IT) equipment and software required to support WESM operations. The SO has full responsibility for monitoring and ensuring electric network system security and will use and retain the energy management system (EMS) to execute generation dispatch in accordance with requirements developed by the MMS. The EMS will also provide information to the MMS for the Market Dispatch Optimization Algorithm, including the network model, system status and analog data, planned outages, security constraints, load forecast data and ancillary services requirements.

The MMS will provide the EMS with generation dispatch schedules and other data required for system control. These data will be provided as required by the WESM Timetable in a format compatible with the GE-Harris system and with all necessary security.

Input data required from the SO are:

- Network Status (transmitted only on change)
- Outages Schedule
- Transmission Constraints
- Generator Preferred Operating Points by Unit
- Load Forecast by Trading Node
- Ancillary Services, non-unit specific Requirements

The results of the Dispatch run will be transmitted to the EMS for use during the next Trading Interval unless updated by the IMMS or an Emergency condition has been declared.

The MMS-EMS Interface will provide the bandwidth and security required to support these data exchanges. The Interface will include hardware for interconnection of the MMS and EMS local area networks and the driver software to be run in both systems. Detailed requirements for peak data transfer as well as the protocol to be used will be defined by the MMS Supplier (Supplier).

**Recommendations**

The recommendation for the MMS-IMMS Interface as reflected in the specifications is that the existing physical EMS LAN be expanded and enhanced to provide the necessary MMS-EMS Interface. Specifically, this requires that:

- The successful supplier provide detailed recommendations for hardware and software to augment the existing network;
- Napocor Communications Department procure the necessary networking equipment, materials and software, consistent with the present implementation;
- GE-Harris connect to the expanded network and install driver software as required.

The specification provides additional specific requirements:

1. Physical

   The interface shall be a dual high-speed LAN, with one LAN acting as the primary and the other provided as backup. The backup path shall be tested once per day on a schedule agreed to between the MO and SO.

   Each LAN shall be routed via a separate path inasmuch as possible, to provide protection against physical damage.

   Routers and firewalls shall be provided in accordance with overall system design requirements. All hardware shall be compatible with present and planned network infrastructure.

2. Logical

   The modified LAN may have multiple logical segments and the components on the extended LAN shall have distinct IP addresses and subnet addresses

3. Data Exchange Protocol

   The data to be exchanged between the MMS and EMS will be both scheduled and on demand. All data shall be transferred utilizing standard data transfer protocols. Network Model data shall be in CIM-compatible format. Specific protocol(s) to be used shall meet open-system standards requirements.

4. Security

   Security of the Link between the MMS and EMS is essential to market operations. Security provisions shall be defined in detail in the MMS specification and the EMS Requirements document and shall include:

   a. Physical security as described above;

   b. Logical separation as described above;

   c. Software firewalls;

d. Protocols with security provisions; and
e. Data validation at both MMS and EMS.

Discussions with Napocor personnel revealed that the Local Area Network (LAN) on the Napocor campus is planned to be upgraded from the existing 10 mbps system to a gigabit Ethernet backbone with Edge switches in the four buildings and that the LAN within the buildings will be upgraded to 10/100 megabit Ethernet. The implementation for the MMS-EMS Interface should be combined with this work.

Since the extended LAN will span separate buildings on the NPC campus it is recommended that the dual LANs take alternative routes if possible but as a minimum should run on separate cables.

The MMS-EMS link is not strictly required as part of the IMMS implementation. It was felt that the GE-Harris system would not be ready for full electronic data exchange to support the desired schedule and that the alternate of batch and manual transfer of data would suffice. Nonetheless, the implementation of this link should be expedited as much as possible to support more efficient and error-free operations.

# 3. Participant Interface

**Requirements**

Participants in the WESM will access and provide data to the MMS using the WESM e-commerce capability. This capability is included in both the IMMS and MMS specifications for delivery by the successful Supplier. The web site will ultimately (with the MMS) provide support for the following functions:

- Registration – All Participants in the WESM need to be registered with and approved by the Market Operator. The Market Rules provide the qualifying criteria for each Participant type and the information required for submittal. The site shall provide the required forms for registration and maintain a register of Participants. The MO shall have control over the criteria and the forms used for registration, and the capability of manually de-registering Participants.

- Offers and Bids – The main on-going use of the WESM site will be the submittal of Offers, including reserves, by Generators, and Bids and Offers by Customers, for each trading interval in accordance with the requirements of the Market Rules. The web site shall be designed to handle the maximum number of offers and bids and re-submissions as defined in the Performance portion of the specification.
- Acceptances and Rejections – The means for the MO to signal acceptance or rejection of the submitted offers and bids shall be provided. Re-submittals shall be accommodated.
- Week-ahead and Day-ahead Projections – The projections of week-ahead and day-ahead projections for each trading interval shall be published in accordance with the Timetable.
- Market Information – The MO shall use the site to publish all required information regarding the market, including previous day details of dispatched generation or dispatched load, and dispatched reserves for each scheduled generating unit and scheduled load in each trading interval.
- General Information – The WESM web site shall have the capability of publishing general information as required by the MO or under the direction of the Government.
- Meter Data Collection – The MMS will periodically and on demand request data from the three regional meter data collection systems. These data will provide the information used to establish final prices for each trading interval for each Market Participant (MP).
- Settlements Data – The preliminary and final individual financial statements associated with market operations will be forwarded and responded to via the site. Provision for questioning the statements shall be provided.
- Electronic Funds Transfer – Actual payments of all statements will be authorized via the function and funds dispersed using the Electronic Funds Transfer capability.

The WESM Site will be used for the competitive buying and selling of power on a real-time basis. As such a great deal of the information on the site is both sensitive and proprietary. Access to specific portions of the site shall be controlled and subject to the security provisions detailed below. The site shall have at least fifteen levels of access, including the following:

- Market Administrator – Highest level of access. No limitations. Control of passwords and security controls.
- Market Auditor – Unlimited access to all data on the site including archives and current data.
- Market Operator – Unlimited access to all information submitted and published, currently available on the site. Used by the MO to operate the market.
- Network Service Provider – Access only to the details of their network; no market information.

- Meter Service Providers – Access to Participants Register, the Metering information database and general market information.
- Generators – Access to those data directly effecting them such as day-ahead and week-ahead projections and Market Information.
- Customers – As above for Generators.
- General Public – Will be restricted to specific information designated by the Market Rules for general publication.

**Recommendations**

The specifications require that the MMS (IMMS) supplier provide all functions and capabilities required for WESM e-commerce, including meeting availability and reliability requirements and supporting market surveillance and audit.

Specific requirements were also included for security and site monitor:

The security of the WESM web site is of foremost importance. With the sole exception of the web pages designed for use by the general public, security shall be assured by at least the following:

1. A Public Key Infrastructure (PKI) using standard 1024 bit digital certificates capable of signing shall be used to verify the identity of participants. The WESM web site shall ensure that:
   a. The certificates used are registered in the Certificate Registry;
   b. Certificates are current and valid, by verifying the Certificate Authorities signature and checking the validity period;
   c. The participant has initiated communications from the specified IP address or host; and
   d. The certificate has not been revoked.
2. Secure Sockets Layer version 3 (SSLv3) and/or Transport Layer Security (TLS) Version 1 or above, IP Security or equivalent shall be used for authentication. The following SSL selections or alternatives with equivalent performance characteristics shall be provided:
   a. Asymmetric Algorithm: RSA
   b. Symmetric Algorithm: RC4 (128-bit)
   c. Digest Algorithm: SHA-1
   d. Record Size: Largest size feasible.
3. Strong encryption with a minimum 128-bit key shall be required.

4. The web site shall provide for lockout of individual participants in the event of authentication failures, automatic logout on loss of connection, and automatic closing of all files and applications in the event of logout.

The Site Monitor function shall process all requests to access the WESM system from all users ensuring that requests are routed correctly, security rules are applied, and access constraints are handled correctly.

All activity occurring on the WESM web site shall be monitored and the following events recorded for review by authorized access levels:

1. Logons to the site;
2. Unsuccessful logon attempts;
3. Logoff and loss of connection;
4. Updates of information shown on the web pages;
5. Downloads of files or results of queries;
6. Upload of files;
7. Submitted forms;
8. Acceptance and Rejection Notices;
9. Attempts by individuals to access restricted data;
10. Web site application failures;
11. Web site communications failures;
12. Failed attempts for access from unauthorized ports; and
13. Any other security breaches.

Access to the security log shall be limited to authorized security engineers, the Market Auditor and the WESM Web Site administrator.

It was recognized that the Supplier will most probably subcontract the WESM e-commerce capability to a local supplier, but must retain responsibility for overall operation.

The performance of the Web servers and Internet connections shall be a contentious issue as will be the availability. Consideration shall be given to the fact that while the Market Operator is not responsible for the individual Participant connections it should be mindful of the fact that its end

of the internet connection shall not be a bottleneck and shall service all requests in a timely fashion. It is therefore recommended that the Supplier shall provide a high bandwith "pipe" to the ISP provider and the ISP provider can give suitable guarantees with respect to availability and performance.

Furthermore consideration should be given to the provision of direct communication facilities via modem as a backup facility. As an example a device such as the Lucent Livingston Portmaster will provide the desired capability suggested.

Provision must be made in the Napocor facility for the required hardware, including space, power and air conditioning, and for connection to the internal LAN. The equipment must be physically secure from tampering, collocated with the MMS and connected to an ISP via dual WANs. Dual servers are required as well as a backup power system. It is recommended that the selected Supplier meet with Napocor Communications Department personnel to work out the details of implementation and timing.

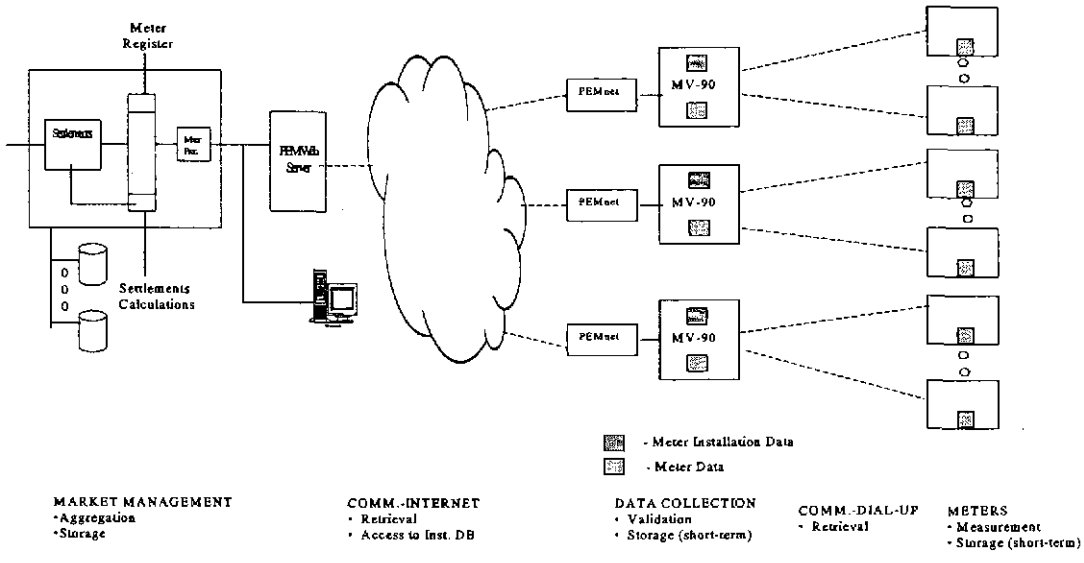
The Supplier is also required to provide software recommended for use by Participants to interconnect to WESM e-commerce. This must be a readily available, easily installed solution to encourage WESM e-commerce use. This too should be discussed with the Supplier.

The IMMS specification defines a subset of functions and capabilities required for that early system. This should be treated as a minimum requirement with full recognition that earlier delivery of MMS capabilities is to everyone's benefit.

# 4. Metering Systems

**Requirements**

Retrieval of metering data from trading points requires two levels of communications as depicted below:




1. Collection of data by MV-90 data collection system(s);

   The MV-90 data collection systems utilize dial-up communications to revenue meters equipped with remote access capability. Requirements are dictated by the capabilities and protocols of the Itron-supplied systems and the installed meters.

2. Return of data from the meter data.

   The return of data from the MV-90s to the MMS requires that the MO meet Itron protocol requirements for data retrieval, retries and data security. The specification recommends the use of WESM e-commerce for data exchange between the MMS and MV-90, but imposes the requirement for the Supplier to meet availability and reliability requirements.

**Recommendations**

1. Napocor has instituted a project to upgrade revenue metering throughout the electric system. This includes providing remote reading capability at all exchange and potential trading points. The project also provides for the necessary upgrades of meter data acquisition systems and assurance of the necessary communications channels. This project will provide the basis for the transition of manual collection of meter data for the IMMS to automatic collection of meter data as with the MMS. The project is not part of the MMS but complements it.

2. The communications medium to be used to retrieve all meter data as well as the meter installation database from the data collection systems to the MMS will be either:

   - E-commerce capability – The main function of the e-commerce function will be for communications between Market Participants and the Market Operator. However, consideration is being given to recommending this capability for meter data retrieval as well. Additional investigation in the areas of data security, and

costs for both MMS and data collection systems will be needed to make this decision.

- Dial-up Communications – The default choice for MMS-data collection systems communications will be dial-up or leased telephone lines. Should this option be selected in order to meet system requirements, the following will apply:

  Each MV-90 should be dual-homed to the Market Operator. This is to preclude the failure of one circuit from disrupting the flow of metering data. In the Visayas, one communications circuit from the MV90 should be routed via satellite and the other circuit should be routed via fiber optic cable connectivity. If a fiber optic link is not available, then a microwave link can be used as a less desirable alternative. In Mindanao the same type of scheme should be used, that is, using two circuits from the MV90 dual homed to the Market Operator. Again, one circuit should be via satellite and the other via a fiber optic link. If fiber is not available, then microwave connectivity can be used as a less desirable alternative. Because of the distance involved it is certain that frequent outages will be experienced on a microwave route.

All metering data will be stored in the MV-90 systems in native Itron data formats and shall be retrieved from the systems using standard Itron protocol(s). The MMS Contractor shall have responsibility for all data conversion and ensuring that data is settlement-ready.

As noted, there is no immediate need for the communications channel to the meter data acquisition system(s) for the IMMS. Nonetheless, the final implementation option and specific configuration need to be established with the Supplier. At that time also, the plans for upgrading the MV-90 system(s) should be established.

# 5. Settlements

**Requirements and Recommendations**

The Settlements system requires two communications channels:

- Interface for Statements
- Interface for Electronic Funds Transfer (EFT)

The requirements for statements will be established by the Napocor MO Accounting department and implemented over the in-house LAN. The requirements for interfacing to the EFT have been provided in a separate specification.

# 6. Summary

The need for communications for WESM operation will not be met by a single communications type or by a single company. Rather it will involve working with the MMS Supplier to ensure that the interfaces to be provided meet specification requirements, that the necessary information is provided to the Napocor communications department, and that testing of the various data links is comprehensive and thorough.

It should also be noted that the above is based on the assumption that the supplier will provide a dedicated LAN for the Market Operations computers (both servers and workstations) and that Market Operations staff will primarily use this network. At this time no consideration has been given to remote access of the systems such as staff working outside the office or access from the disaster recovery site.

# Attachment D

# EFT-RFP April 11-2002

## Deliverable #3

## Part 2 of 2

# REQUEST FOR PROPOSAL

# Electronic Funds Transfer Facility for the Philippines Wholesale Electricity Spot Market

By Utility Consulting International

April 2002

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# 1. Introduction

The Philippines government is establishing the Wholesale Electricity Spot Market (WESM) for the exchange of energy among generators and customers throughout the country. The WESM is being established in accordance with market rules developed for and approved by the government. The market rules mandate that an Electronic Funds Transfer (EFT) facility shall be made available for all market participants for the purpose of facilitating payments for the exchange of energy and collection of appropriate market fees. The rules also require all market participants to utilize this facility unless otherwise authorized by the government's representative, the Market Operator.

This specification provides the requirements for the Electronic Funds Transfer facility.

The EFT provider shall have the following minimum qualifications and capabilities. The provider MUST:

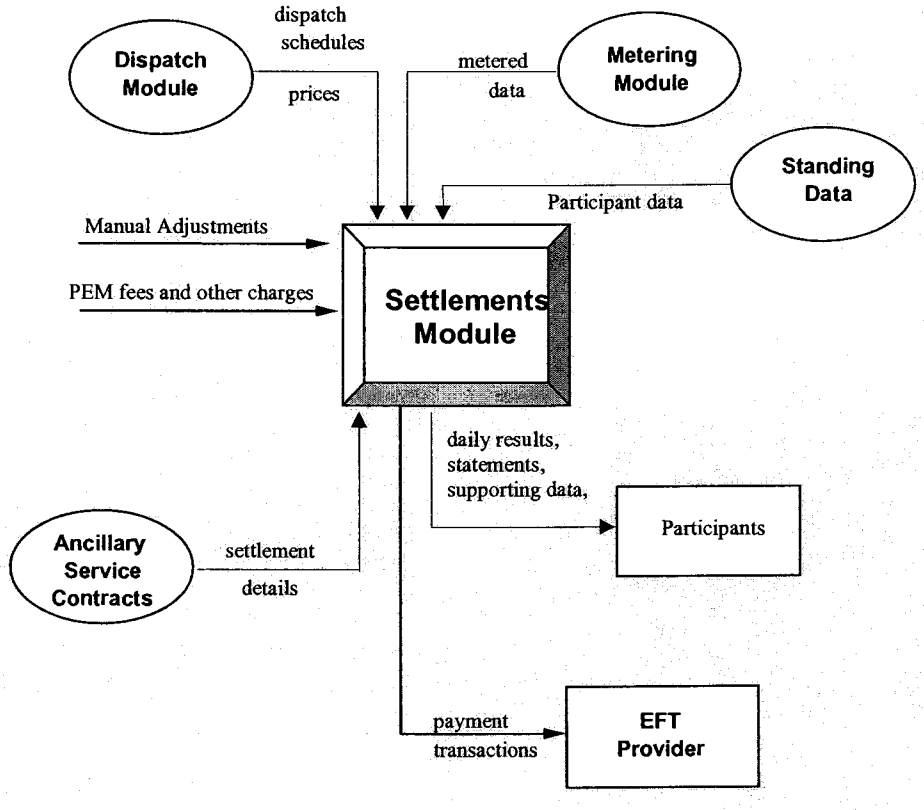
- be a reputable banking institution;
- have experience with electronic banking;
- have no association with any trading participants;
- have a proven track record on confidentiality;
- have the ability to accept EFT statements in the specified format;
- have electronic links to other banks for inter-bank transfers; and
- be capable of transferring funds within minutes..

# 2. Background

The settlement functions will be hosted in the Market Management System (MMS) operated by the Market Operator. The following information on settlements is provided as background information only so that the EFT provider can understand the basic processes and where the ETF fits into the overall system.

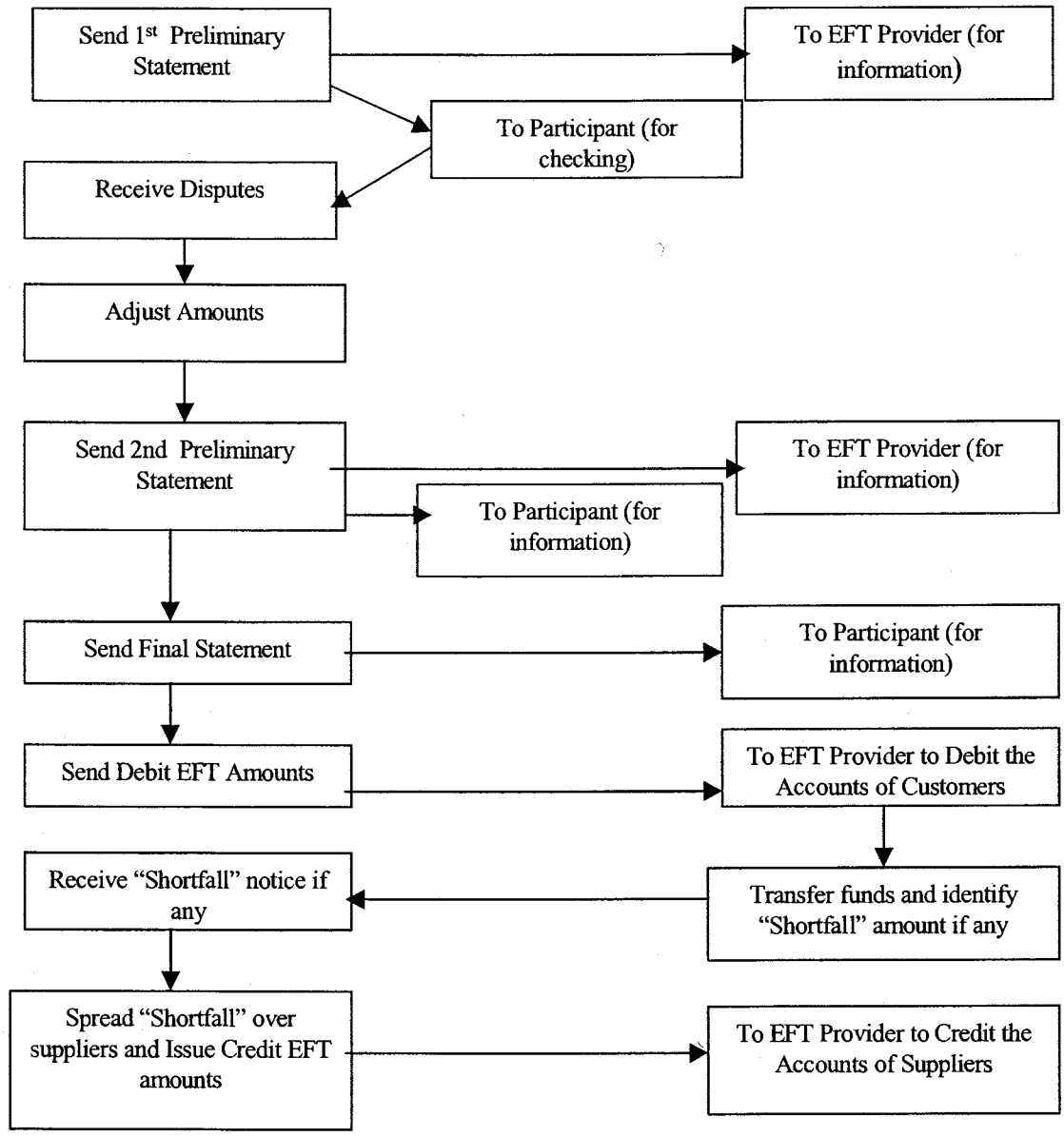
The WESM will settle participant accounts based mainly on energy supplied and purchased during a settlement period. Measurements will be obtained by the MMS for the volume of energy generated or distributed by a Market Participant in each trading period within the specified settlement period for each metered point. Measured amounts for each trading period shall be priced using the Spot Market Price in effect at the time for the pricing zone or node. Participants are paid for generation and pay for usage based on metered energy volumes. Adjustments and spot market trading charges will be added to determine the final amount due from or to each participant. The net values will be sent to the EFT provider in accordance with the Market Timetable. The overall process is shown pictorially below:

**Settlements**



The MMS will run preliminary and final settlements on predefined dates. The preliminary settlement runs allow Participants to make checks of figures against their own numbers, before a final settlement run is done. Payment will not be required against preliminary statements. They can, however, be sent to the EFT provider, if desired, for information only. Payment is required however against final statements regardless of whether a dispute is still outstanding. Payments shall be sent to and received from Participants using the EFT facility. This process is depicted in the following simplified diagram:

**Electronic Funds Transfer Process**



# 3. General Requirements

The electronic transfer of funds shall be managed by a highly reliable and efficient nationwide batch-oriented system providing interbank clearing of electronic payments for participating financial institutions. The system shall have current approval to operate throughout the Philippines, meeting all government regulations and requirements of Philippines banking authorities. The entities responding to this request shall also be currently approved by both government and banking authorities. Further, the proposing entity shall have no corporate ties to any Market Participant.

The Facility Supplier shall document its commitment to meeting the following principles and provide a summary of how this commitment is assured. They shall:

- recognize and respect customers' expectation of privacy;
- collect and use only the information needed for legitimate business purposes solely related to the operation of the Market;
- employ security measures that guard access to and disclosure of information;
- not disclose personally identifiable information to third parties unless instructed to do so by the Participant itself, by a senior member of the MO staff or by appropriate legal or other authorized governmental office;
- require any subcontracting company to maintain the same standards of confidentiality of customer information; and
- continuously monitor and assess their business practices to ensure that customer privacy is not compromised.

The security and integrity of the WESM, including the electronic funds transfer facility, is of paramount importance.

# 4. Specific Requirements

The Market Management System (MMS) will be used by the Market Operator (MO) to manage all aspects of the WESM including administration, operations and audit. The Electronic Funds Transfer facility will be an important element in overall market operations, interfacing to the MMS to provide all market collections and disbursals.

## 4.1 MMS-EFT Data Interface

The interface to the Market Operator shall be used for all data transferred between the MO and the EFT facility. Note that the MO will have the responsibility to calculate trading amounts, issue statements, perform billing runs, and issue invoices. The EFT facility shall only be responsible for the transfer of funds. Requests for electronic transfer will be prepared on a monthly basis for all participants and the list downloaded to the EFT at a specific date and time in accordance with the Market Timetable. All transfers resulting from these requests shall be executed at the specific date and time mandated in the Market Timetable.

The accounts department of the MO will have responsibility for interface to the EFT provider to process the financial transactions. The data supplied to the EFT provider represents the debit or credit amount payable to or receivable from an organization for a given version of data (settlement run). In the file supplied the Debit / Credit field will be negative if an organization is to receive a payment and positive if an organization is to make a payment.

Two separate files will be sent to the EFT provider for each set of data:

- **a receipts file; and**
- **a payments file.**

Each file has the following details:

**Interface Name:** EFT instructions to EFT Provider
**Source:** MO
**Destination:** EFT Provider
**Internal/External:** External
**Frequency:** Once per Billing Period

**Receipts File**

The receipts file will be forwarded to the EFT Provider in accordance with the settlements timetable. Receipt of this file will be taken by the EFT provider as full authorization to make the necessary transactions on behalf of the MO. The EFT Provider shall then await counter

authorization by the Participants, again within the settlements timetable, at which time the transactions shall be processed and the amounts cleared. The receipts file shall have the following format:

```
--------------------------------------------------------------------------------
MO EFT RECEIPTS - DD/MM/YYYY
--------------------------------------------------------------------------------
To              : EFT Provider

From            : MO

Issued          : DD/MM/YYYY

Authorized      : XXXXXXXXXXXXXXXXXXXX
--------------------------------------------------------------------------------
Participant Id : XXXXXXXXXXXXXXXXXXXX

Agent           : AAAAAA

Authorized Date : DD-MMM-YYYY

Settle Date     : DD-MMM-YYYY

Interest Rate   : XX.XXXXX

Amount          : PPPPPPPPP.PP

Settle Mode     : A

Bank Account    : NNNNNNNNNN

Comment         : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

****** Repeat for each Customer ******
--------------------------------------------------------------------------------
END OF FILE
--------------------------------------------------------------------------------
```

**Payments File**

The Accounts department will provide the Payments file to the EFT provider by the same means as for the Receipts file in accordance with the settlements timetable.

Before sending this file the MMS settlements application will look for a default by a Participant Any default will result in a re-run the Settlements routines within the Market Management System to "smear" the shortfall across the affected Participants. The file shall have the following format:

```
-----------------------------------------------------------------------------
MO EFT PAYMENTS - DD/MM/YYYY
-----------------------------------------------------------------------------
To              : EFT Provider

From            : MO

Issued          : DD/MM/YYYY

Authorized      : XXXXXXXXXXXXXXXXXXXX
-----------------------------------------------------------------------------
Participant Id : XXXXXXXXXXXXXXXXXXXX

Associate       : XXXXXXXXXXXXXXXXXXXX

Authorize Date : DD-MMM-YYYY

Settle Date     : DD-MMM-YYYY

Interest Rate   : XX.XXXX

Amount          : PPPPPPPPP.PP

Settle Mode     : A

Bank Account    : NNNNNNNNNN

Comment         : XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

****** Repeat for each Market Generator Id ******
-----------------------------------------------------------------------------
END OF FILE
-----------------------------------------------------------------------------
```

## Field Descriptions

| File Element | Compulsory | Comment | Validation |
|---|---|---|---|
| To | Y | EFT Provider is the compulsory destination | N/A |
| From | Y | Participant Id | Must be a currently "active Trading Participant" |
| Issued | Y | Date of Issue by MO | Must be: DD/MM/YYYY |
| Authorised | Y | Identity of Authorizing MO Representative | Must be: Alphanumeric |
| Participant Id | Y | Unique identifier of Participant | Must be: Alphanumeric |
| Associate | Y | Related Participant if payments go through an agent | Must be: Alphanumeric |
| Authorise Date | Y | Date of Submission of file | Must be: DD-MMM-YYYY |
| Settle Date | Y | Date of Funds Transfer | Must be: DD-MMM-YYYY |
| Interest Rate | Y | Interest Rate | Must be: Alphanumeric |
| Amount | Y | Peso value to be transferred | Must be: |

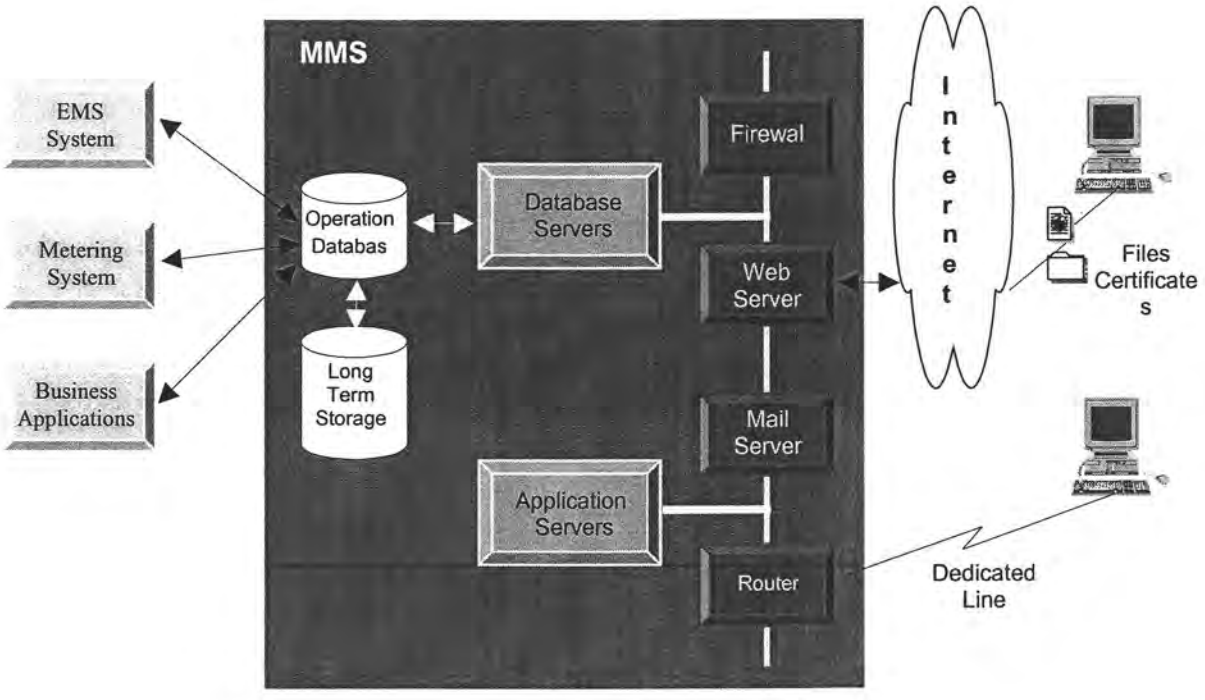
| File Element | Compulsory | Comment | Validation |
|---|---|---|---|
| | | | PPPPPPPPP.PP |
| Settle Mode | N | The ability to identify different types of settlement run (for future use). | Must be: Numeric |
| Bank Account | Y | Bank Account Number | Must be: Numeric |
| Comment | N | Any comments the MO wishes to append | Any Alphanumeric string |

## 4.2 MO Physical Interface

The MMS will be located at the present Napocor facility at:

Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

The MMS will have extensive communications capabilities including dedicated and leased telephone lines and Internet access. The communications of the data from the MO and to the MO for the EFT transfers will be conducted electronically, preferably via a secure socket technology web based interface (although a dedicated leased line may be acceptable providing security is not compromised). The overall structure of the communications system is given in the diagram below:




For a web based interface the following shall apply:

1. SSL based
2. Client and Server Side digital certificates for mutual authentication
3. Username/Password
4. 128 bit Encryption
5. All data, including data file upload and download, are transferred using the SSL technology – (no un-secure FTP / http transfers).

The ETF supplier shall provide data describing and justifying the recommended interface.

The Supplier may wish to provide its own driver software in the MMS to facilitate data exchange and provide needed communications security. Should that be the case, the driver must operate co-resident with the MMS software under the Unix operating system.

## 4.3 MO-EFT Data Exchanges

The EFT facility shall be capable of handling 500 transfers each month, all at the specific time established by the Market Timetable as part of the trading interval settlement process. These

requests will be transferred to the EFT in a batch file at the time specified by the Market Timetable.

The EFT shall provide confirmation of the execution of all transfers and/or reasons that transfers were not executed to the MO in a batch file immediately following the execution events. All relevant error information shall be provided.

## 4.4 EFT – Financial Institutions Interface

The EFT supplier shall provide a detailed list of in-country financial institutions with which electronic funds transfer capability is in operation. The MO intends to specify to all market participants an approved list of institutions for their use but must ensure that this is not an impediment to market participation.

## 4.5 Access to EFT Information

The Market Rules require open and transparent market operations to ensure the integrity of the market. At the same time, information proprietary to individual market participants must be respected to protect their trading practices. The Market Management System will ensure that both requirements are met by organization and storage of all EFT data and strict adherence to the access provisions of the e-commerce facility.

The guiding principle shall be that only a designated select group of individuals will have access to the details of EFT accounts. This group will be limited to:

- Generators and Customers – access to their own account information
- Market Operator – specific designated individuals will have access to account information
- Market Auditor – access to all account information for specific purposes
- Authorized Government or Legal personnel

The EFT facility shall provide complementary restrictions against authorized access and maintain a list of requests made for data.

### 4.6 Surveillance and Audits

The WESM will be subject to surveillance and periodic audits by the Market Auditor. The EFT supplier shall support all requested audits to ensure the integrity of the system. These activities will be coordinated with and in accordance with all existing government and banking institution audit requirements.

## 5. Proposal Requirements – Summary

EFT suppliers shall submit a proposal for meeting these requirements, including:

- Proposing company, and experience with electronic funds transfer in the Philippines;
- Proof of authorization from government and banking institutions to operate in the Philippines;
- Commitment to privacy principles and measures taken;
- Details of data exchange format and protocol;
- Recommended physical connection with the MMS;
- List of financial institutions with which the Supplier has electronic funds transfer capability;
- Cost proposal and cost basis; and
- Any other information deemed relevant to this request for proposal.

# Attachment E

# DRAFT Technical Specification

# Deliverable #4

# Market Management System (MMS)

# for the

# *Philippines Electricity Market (PEM)*

## Specification for System and Services

## August 2001

Utility Consulting International

Prepared by
Utility Consulting International
Cupertino, California, USA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## GLOSSARY

| TERM | DEFINITION |
|---|---|
| **AGC** | Automatic Generation Control (function) |
| **ANSI** | American National Standards Institute, Inc. |
| **API** | Application Program Interface |
| **A/S** | Ancillary Services |
| **ASCII** | American Standard Code for Information Interchange |
| **active energy** | A measure of electrical *energy* flow, being the time integral of the product of *voltage* and the in-phase component of current flow across a *connection point*, expressed in kilowatt-hours (kWh) and multiples thereof. |
| **administered price cap** | A price cap determined in accordance with the PEM which will apply during an *administered price period*. |
| **ancillary service** | A service of the kind necessary to support the transmission of capacity and *energy* from the sources to *loads* while maintaining reliable operation of the *transmission system* in accordance with good utility practice and the *Grid Code*, and including a reserve commodities. |
| **ancillary services charges** | Fees to be collected to pay for ancillary services in accordance with Market Rules. |
| **ancillary services agreement** | An agreement in accordance with Market Rules under which a *Participant*, registered as an *Ancillary Service Participant*, agrees to provide *ancillary services*. |
| **audit trail** | Information by which the specifics of an event or transaction can be reconstructed. |
| **Availability Test** | Operational testing of the MMS after site acceptance and for a defined period of time to confirm that the system is available for MMS users as defined in this Specification. |
| **Bid** | An offer to buy electricity submitted by a *Customer* in accordance with Market Rules. |
| **billing period** | The period of one calendar month commencing on 9.00 AM on the first day of each calendar month. |
| **Black Start** | The process of initializing power supply when it has been reduced to zero. |
| **black start capability** | In relation to a *generating unit*, the ability to start and *synchronise* without using *supply* from the *power system*. |


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| TERM | DEFINITION |
|---|---|
| **CCITT** | International Consultative Committee for Telephone and Telegraph |
| **CD-R** | Compact Disc – Recordable |
| **CD-ROM** | Compact Disc – Read-Only Memory |
| **CIM** | Common Information Model |
| **CSV** | Comma Separated Values |
| **Central dispatch** | The process, to be determined in accordance with Market Rules, of scheduling and issuing direct instructions by the *System Operator* to achieve the economic operation and maintenance of quality, stability, *reliability* and security of the *transmission system*. |
| **Communications Network** | The infrastructure by which data is exchanged between two entities or among a group. |
| **confidential information** | Information which is or has been provided to, or by, a *Participant* or the *Market Operator* under, or in connection with, these Rules and is stated under these Rules to be, or is classified by the *Market Operator* as, confidential information or is otherwise confidential or commercially sensitive information or is information which is derived from any such information. |
| **Connection point** | The agreed point of *supply* established between a *Network Service Provider* and a *Market Participant*. |
| **constrain-off** | In respect of a *generating unit* the output of that *generating unit* is limited below the level to which it would otherwise have been *dispatched* by the *Market Operator* on the basis of its *dispatch offer*. |
| **constrain-on** | In respect of a *generating unit*, the output of that *generating unit* is limited above the level to which it would otherwise have been *dispatched* by the *Market Operator* on the basis of its *dispatch offer*. |
| **Constraint** | A limitation on the capability of a *network*, *load*, *generating unit* or *ancillary service* such that it is, or is deemed by the *System Operator* to be, unacceptable to either transfer, consume, generate or produce the level of electrical power or other service that would occur if the limitation were removed. |
| **constraint violation penalties** | The penalties set by the *Market Operator* in accordance with Market Rules |


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| TERM | DEFINITION |
|---|---|
| **contingency reserve** | The ability to respond to a significant drop in system frequency such as would arise as a result of a credible contingency affecting one (or more) *Generators* within a region, or transmission flows into a region |
| **Contingency Reserve Offer** | An offer made by a Generator to provide the required contingency reserve. |
| **Contractor** | The successful bidder for the Market Management System defined by this Specification. |
| **Control Center** | The physical area used by system operators to monitor and control electric network activities. |
| **credit support** | An obligation owed to the *Market Operator* by a third party supporting the obligations of a *Market Participant*. |
| **Customer** | A person who:<br>(1) engages in the activity of purchasing electricity *supplied* through a *transmission* or *distribution system* other than where all that person's electricity requirements are purchased from a *Supplier*; and<br>(2) registers with the *Market Operator* in that capacity. |
| **Customer Bid** | An offer to buy electricity in accordance with the market rules. |
| **Customer Pricing Zone** | A *Customer pricing zone* determined by the *Market Operator* in accordance with Market Rules. |
| **cut-off time** | Time interval prior to the commencement of the *trading interval*, according to the *timetable*, where re-bidding is invalid except for authorized reasons. |
| **DC** | Direct Current |
| **DOE** | Department of Energy |
| **DPF** | Dispatcher Power Flow (function) |
| **DVD** | Digital Video Disc |
| **Data Sink** | System or software function that receives data transmitted |
| **Data Source** | System or software function that transmits data |
| **day ahead projections** | The day ahead projections *published* by the *Market Operator* in accordance. |
| **Dispatch** | The act of initiating all or part of the response offered or bid by a *scheduled generating unit* or *scheduled load* in accordance with Market Rules. |


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| TERM | DEFINITION |
|---|---|
| **dispatch procedures** | The procedures of selecting and ordering resource changes as described in Market Rules |
| **Dispatch Schedule** | The order in which energy and reserve resources will be dispatched during a specific trading interval. |
| **Dispatchable load** | A *load* which is able to respond to *dispatch* instructions and so may be "scheduled" via the *dispatch* process. |
| **distribution line** | A power line, including underground cables, that this part of a *distribution network, that is a lower voltage and/or radial configuration than a transmission line.* |
| **distribution network** | An *electrical network* which is a lower voltage and/or radial configuration, rather than a *transmission network.* |
| **Distribution Utility** | An entity that engages in the activity of owning, controlling or operating a *distribution system*, including an *Electric Co-operative.* |
| **EBS** | Emergency Backup System |
| **EFT** | Electronic Funds Transfer |
| **EIA** | Electrical Industry Association |
| **EIRA** | Electricity Industry Reform Act |
| **EMS** | Energy Management System |
| **ERC** | Energy Regulatory Commission |
| **economic rental** | Means, for a constraint in the *market dispatch optimization model* where the constraint is in linear programming canonical form (that is, for a maximising optimization model: the sum of the variable terms less than or equal to the constant term), the shadow price of the constraint multiplied by the constant term of the constraint. |
| **Emergency** | An event or situation described as an Emergency in accordance with Market Rules. |
| **Emergency directions** | Directions issued by the *Market Operator* in an *emergency.* |
| **Emergency procedures** | The procedures described for he procedures to be followed in a declared emergency in accordance with Market Rules. |
| **Energy** | *Active energy* and/or *reactive energy, most commonly referring to active (real) energy MWh.* |
| **energy balance equation** | An equation determined by the *Market Operator* in accordance with Market Rules, representing the balance between *generation, load* and transmission flows at a particular node of the *market network model.* |


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| TERM | DEFINITION |
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| **energy data** | The data that results from the measurement of the flow of electricity in a power conductor. The measurement is carried out at a *metering point*. |
| **Energy Management System (EMS)** | System responsible for real-time monitoring and control of the electric network, including dispatch of generation and network security. Specifically, the GE-Harris system supplied to National Power Corporation. |
| **Energy Regulatory Commission (ERC)** | Refers to the regulatory agency created by R.A. No. 9136. |
| **Ethernet** | The physical cable used for data exchange on a local area network. |
| **ex-ante dispatch** | The *dispatch* targets set for the end of a *trading interval*, immediately preceding the beginning of that *trading interval*. |
| **Ex-Ante Real-Time Dispatch** | The dispatch targets set for a future trading interval for each trading node. |
| **ex-post energy settlement price** | The *ex-post nodal energy price* of the zonal *price* determined in accordance with Market Rules as determined after the close of the trading period. |
| **Ex-Post Real-Time Dispatch** | The dispatch for each trading node for the just-completed trading interval. |
| **FAT** | Factory Acceptance Test |
| **Final statement** | A settlement statement issued by the *Market Operator* under Market Rules. |
| **Financial year** | A period commencing on 1 July in a calendar year and terminating on 30 June in the following calendar year. |
| **force majeure event** | An event which satisfies the requirements of Market Rules for establishing a force majeure event when the event is neither anticipated, nor controllable by Participants affected by the event and the event is caused by forces of nature, governmental intervention or acts of war. |
| **Frequency** | For alternating current electricity, the number of cycles occurring in each second. The term Hertz (Hz) corresponds to cycles per second. |
| **generating system** | A system comprising one or more *generating units*. |
| **Generating units** | The actual generators of electricity and all the related equipment essential to its functioning as a single entity. |
| **Generation** | The production of electrical power by converting one form of *energy* to another in a *generating unit*. |


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| **Generation Output** | The amount of electrical power available from a generating unit. |
| **Generator** | A person who engages in the activity of owning, controlling, or operating a *generating system* that *supplies* electricity to, or who otherwise *supplies* electricity to a *transmission system* or *distribution system* and who is registered with the *Market Operator* in that capacity in accordance with Market Rules. |
| **Generator Pricing Zone** | A zone established by the market rules in which all Generation is of equal price. |
| **Government** | The Government of the Philippines. |
| **Grid Code** | The code of that name which regulates the *supply* of electricity, and use of, and *connection* to, a *transmission* or *distribution system* and which is certified by the *Government*. |
| **historical database** | MMS-resident data collected by system and application programs. |
| **HTML** | Hypertext Markup Language |
| **HVDC** | High-Voltage Direct Current |
| **ICCP** | Inter-Control Center Communication Protocol (IEC 60870-6 TASE.2 protocol) |
| **ICD** | Interface Control Document |
| **IEC** | International Electrotechnical Council |
| **IED** | Intelligent Electronic Device |
| **ISO** | International Standards Organization |
| **IT** | Information Technology |
| **Interest rate** | The ninety day bank bill swap reference rate as published in the Philippines from time to time. |
| **interruptible load** | Means *load* a *Customer* is able to interrupt at very short notice in response to:<br>(a) a frequency deviation; or<br>(b) a request of the *System Operator*,<br>in order to meet *reserve* requirements, subject to the requirements of the Grid *Code*. |
| **intervene/intervention** | Measures taken by the *Market Operator* where there is a threat to *system security* |
| **KV** | Kilovolt |
| **LAN** | Local Area Network |


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| **License** | A license issued by the *Government* in respect of a particular activity(ies). |
| **line accounts** | Accounts established under Market Rules to be in receipt of *transmission line rentals* arising on a specific transmission lines. |
| **Load** | The amount of *active (real) energy* delivered at a defined instant to a *connection point*. |
| **Load Forecast** | An application program which predicts system load based on historical data, weather and system conditions. |
| **load shedding** | Reducing or *disconnecting load* from the *power system*. |
| **MDCS** | Meter Data Collection System |
| **MDOA** | Merit Dispatch Optimization Algorithm |
| **MMS** | Market Management System |
| **MO** | Market Operator |
| **MOD** | Merit Order Dispatch (function) |
| **MP** | Market Participant |
| **MVAR** | Megavolt Ampere Reactive |
| **MW** | Megawatt (1,000,000 watts, 1,000 kilowatts) |
| **Margin call** | An amount which the *Market Operator* calls to be made by a *Market Participant* in accordance with Market Rules to make up any anticipated shortfall between that *Market Participant's trading limit* and the *Market Operator's* exposure in respect of that *Market Participant*. |
| **Market** | The wholesale electricity market or *spot market* conducted and administered by the *Market Operator* in accordance with these Rules. |
| **Market Administrator** | The function set up by the Market Operator to provide technical services and support for the MMS. |
| **Market Auditor** | The function established by the market rules to oversee the operation of the market. |
| **Market Fees** | The fees payable by a *Market Participant* determined in accordance with Market Rules in respect of participating in the *market*. |


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| TERM | DEFINITION |
|---|---|
| **Market information bulletin board** | A facility to be established by the *Market Operator* on the *electronic communication system* on which it may *publish* information which is then available to and may be accessed by *Participants*. |
| **Market load** | The electricity delivered to a *connection point* and purchased by a *Customer* from the *spot market*. |
| **Market network model** | A mathematical representation of the *power system* submitted by the *System Operator* to the MO for the purpose of MO system analysis, optimization, and dispatch of resources |
| **Market Operator** | The entity responsible for the operation of the *spot market* governed by the *PEM Board* in accordance with Market Rules. |
| **Market Dispatch Optimization Algorithm** | The algorithm to be used for the purpose of *central dispatch* and developed by the *Market Operator* and *System Operator* pursuant to Market Rules. |
| **Market Management System (MMS)** | System responsible for all market functions as defined by the market rules. Specifically, the system defined by this Specification. |
| **Market Participant** | A *Customer, Generator, or other authorized entity participating in any aspect of the PEM.* |
| **Market price** | The nodal *price, zonal energy price,* or *zonal reserve price.* |
| **Market price cap** | Means the maximum allowable *market price* at any *node*. |
| **Market price floor** | Means the minimum allowable *market price* at any *node*. |
| **Market Rules** | The Philippines Spot Market Rules which established the market and the Market Operator function. |
| **Market Suspension** | The process of ceasing trading in the market for a specific period of time. |
| **Market trading nodes** | Those *market network nodes* determined by the *System Operator* in accordance with Market Rules. |
| **Meter** | A device which measures and records the consumption or production of electricity. |
| **Meter Data Collection System** | A system located within one of the three defined regions, Luzon, Visayas and Mindanao with the specific functions of collecting data from meters in those regions and returning data to the MMS. |
| **metering data** | The data obtained or derived from a *metering installation*. |
| **metering database** | The database kept by the *Market Operator* pursuant MO metered entities. |
| **Meter Data Processing** | The process within the MMS by which data received is validated, aggregated and stored. |


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| TERM | DEFINITION |
|---|---|
| **metering installation** | The *meter* and associated equipment and installations installed or to be installed for the collection of *metering data* required for *settlement* purposes. |
| **metering point** | The point of physical *connection* of the device measuring the current in the power conductor. |
| **Metering Provider** | A person registered with the *Market Operator* in that capacity in accordance with Market Rules. |
| **metering register** | A register of information relating to *metering installations* kept by the *Market Operator* and forming part of the *metering database*. |
| **MMS Errors file** | The system file that collects all information regarding errors detected in operations. |
| **NA** | Network Analysis (function) |
| **NEMA** | National Electrical Manufacturers Association |
| **NPC** | National Power Corporation |
| **Network** | The apparatus, equipment, *plant* and used to convey, and control the conveyance of, electricity to *customers* (whether wholesale or retail) excluding any *connection equipment*. In relation to a *Network Service Provider*, a *network* owned, operated or controlled by the *Network Service Provider*. |
| **network lines** | Means the:<br>(a) *transmission lines*;<br>(b) *distribution lines*;<br>(c) transformer elements; and<br>(d) other *plant* associated with *transmission lines* and *distribution lines*. |
| **Nodal price** | The price at a *node* determined in accordance with Market Rules. |
| **Node** | A *connection point* on a *network*, or junction point within a *network* model, whether physical, or notional. |
| **nodal value of lost load (nodal VoLL)** | Means the *constraint violation penalty* of the *energy balance equations* for each *node* set by the *Market Operator* in accordance with Market Rules. |
| **OEM** | Original Equipment Manufacturer |
| **OJT** | On-the-Job Training |
| **Offer** | An offer to supply electricity submitted by a *Generator* in accordance with Market Rules. |
| **Orphan data** | Data that has been rejected or otherwise fails to be matched or associated with validated and accepted data |
| **Outage** | Any full or partial unavailability of equipment or *facility*. |


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| TERM | DEFINITION |
|---|---|
| **PCL** | Program Control Language |
| **PDF** | Portable Document Format |
| **P/E** | Programmer/Engineer |
| **PEM** | The Philippines wholesale electricity spot market established and governed by these Rules. |
| **PPT** | PEM Project Team |
| **PKI** | Public Key Infrastructure |
| **POSIX** | Portable Operating System Interface for Computing Environment |
| **PreFAT** | Preliminary Factory Acceptance Test |
| **PSM** | Power System Model |
| **Participant** | A person who is registered with the *Market Operator* in accordance with Market Rules. |
| **Payment date** | The relevant date on which a *Market Participant* must pay to the *Market Operator* the *settlement amount* in accordance with Market Rules. |
| **PEM Auditor** | The auditor appointed by the *MO Board* per Market Rules. |
| **power system** | The integrated system of *transmission* and *distribution networks* for the supply of electricity *networks* in the *Philippines*. |
| **Preferred Operating Point (POP)** | Refers to individual generating unit output goal, based on dispatch optimization. |
| **pricing zone** | A *generator pricing zone*, *customer pricing zone* or *reserve pricing zone*. |
| **Problems Log** | A running list of problems uncovered with the MMS during the project. |
| **Project Plan** | Contractor's plan for completion of the MMS in accordance with specification requirements. |
| **Project Quality Plan** | Contractor's plan to demonstrate system quality throughout the project. |
| **Prudential Assessments** | Evaluations of Market Participants' ability to meet requirements for sound financial security. |
| **Prudential requirements** | The requirements imposed on a *Market Participant* to provide and maintain sound financial security in accordance with Market Rules. |


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| TERM | DEFINITION |
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| **R&D** | Research and Development |
| **RCS** | Revision Control System |
| **RTU** | Remote Terminal Unit |
| **ramp rate** | The maximum rate of change in electricity production from a *generating unit* or *scheduled load*. |
| **reactive energy** | A measure in megavar-hours (MVARh) of the (reactive energy) alternating exchange relating to inductance and capacitance, which is the time integral product of non-unity power factor with its impact upon *voltage*. |
| **reactive power** | The rate at which *reactive energy(MVAR)* is transferred, produced or purchased by a *Customer*. |
| **re-dispatch** | The act by the *System Operator* of providing a new dispatch schedule in the of a contingency occurrence |
| **re-schedule** | The act of re-dispatching using the market optimization algorithm subsequent to the regularly scheduled dispatch |
| **Region** | Refers to Luzon, Visayas and Mindanao, the three regions of the market. |
| **Regulating reserve** | A market ancillary service reserve commodity that provides generator movement in response to an automatic generation control signal (AGC) originating at the SO for the purpose of continuously adjusting generation to match load in order to maintain system frequency |
| **Reliability** | The probability of a system, device, *plant* or equipment performing its function adequately for the period of time intended, under the operating conditions encountered. |
| **Reserve** | *Contingency reserve* or *regulating reserve*. |
| **reserve cost recovery charges** | Means the amount determined in accordance with a formula approved in accordance with Market Rules |
| **reserve prices** | The *ex-ante reserve prices* for a particular *market reserve zone*. |
| **reserve pricing zone** | A zone determined by the *Market Operator* to designate an area for common prices for use of reserves. |
| **reserve offer** | An offer to supply *reserves*. |
| **revised statement** | A revised settlement statement issued by the *Market Operator* in accordance with Market Rules |
| **SAT** | Site Acceptance Test (of an installed system) |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SSL** | Secure Sockets Layer |


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| **SO** | System Operator |
| **SQL** | Structured Query Language |
| **scheduled load** | A *load* which has been bid into the *market* using a *customer bid*. |
| **Settlement** | The MO activity of producing bills and credit notes for *Participants* in accordance with Market Rules. |
| **settlement amount** | The amount payable by or to a *Market Participant* in respect of a *billing period* as determined by the *Market Operator*. |
| **settlement system** | The system, including the computerized system, for conducting *settlements*. |
| **Settlement Fees** | Fees, to be determined by the MO, to be assessed as part of the Settlement. |
| **shadow price** | Means the marginal net benefit from a unit relaxation of the capacity limitation of a *constraint* in the *market optimization algorithm*. |
| **Spot market** | The electricity *market* established and operated by the *Market Operator*. |
| **Spot market commencement date** | The date on which the *spot market* commences operation as notified by *Government*. |
| **Standing Data** | Data required for market functions which could be termed reference as opposed to transaction data. |
| **Submittal** | The official transmittal of contract documents for review and approval. |
| **suspension notice** | A notice issued by the *Market Operator* with notification of suspension in accordance with Market Rules. |
| **system blackout** | The absence of *voltage* on all or a significant part of the *transmission system* or within a *region* following a major *supply* disruption, after one or more *generating systems* and a significant number of *customers*. |
| **System Operator** | An entity that is registered as a System Operator. |
| **System Performance Test** | The series of tests that occur during the life of the project that verify that the system meets specification performance criteria. |
| **system security** | The safe scheduling, operation and control of the *power system* on a continuous basis in accordance with the *system security and reliability guidelines*. |


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| TERM | DEFINITION |
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| **system security and reliability guidelines** | The standards governing *system security* and *reliability* of the *power system*, which may include but are not limited to standards for the *frequency* of the *power system* in operation and *ancillary services* (including guidelines for assessing requirements and utilisation), developed by the *Market Operator* and *System Operator* in accordance with Market Rules. |
| **TLS** | Transport Layer Security |
| **time stamp** | The means of identifying the time and date at which data is transmitted or received. |
| **Timetable** | The timetable prepared by the *Market Operator* for operation of the *market*. |
| **Total Operating Time** | Continuous time that the system is on-line and available as defined in the specification. |
| **trading amount** | The sum calculated in accordance with Market Rules. |
| **trading day** | The 24-hour period commencing according to the Timetable. |
| **trading interval** | A 1-hour period ending on the hour. |
| **trading limit** | In respect of a *Market Participant* at any time means the last *trading limit* set by the *Market Operator* for the *Market Participant*. |
| **Transmission Line Flows** | Amount of energy being conducted on individual transmissioin lines. |
| **Trading Node** | A metered connection point for Generators and/or Customers. |
| **Transmission Company** | An entity that engages in the activity of owning or operating the electrical *transmission system*. |
| **transmission rights** | The right to financial compensation based on differences between *nodal* prices at different *nodes* in the *market network model*. |
| **transmission system** | The *transmission network* together with the *connection assets* associated with the *transmission network*, which is *connected* to another *transmission* or *distribution system*. |
| **UFE** | Unaccounted for Energy |
| **VAR** | Volt Ampere Reactive |
| **VAT** | Value Added Tax |
| **Variance List** | The running list of faults/problems detected during testing of the MMS. |


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|---|---|
| **Value of Lost Load (VoLL)** | A price cap, being the maximum, on the *market price*, as determined by the *Market Operator and Government*. |
| **WAN** | Wide Area Network |
| **WORM** | Write Once Read Many |
| **week ahead projections** | The projections (forecasts) performed by the *Market Operator* in accordance with Market Rules. |
| **Work Statement** | The document which shall define the contract requirements to be met by the successful bidder. |
| **zonal energy price** | The *Market Price* in a particular *generator pricing zone* and/or *customer pricing zone*., determined in accordance with Market Rules. |
| **zonal reserve price** | The *Market Price* in a particular *reserve pricing zone* determined in accordance with Market Rules |


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# 1.0 INTRODUCTION

The Philippines Government has passed a bill directing the restructuring of the electricity industry and the creation of a Philippines Electricity Market (PEM). In preparation for this eventuality a team composed of key individuals from the

- Department of Energy (DOE);
- Energy Regulatory Commission (ERC); and
- National Power Corporation (NPC)

has been working to plan all necessary activities.

This work includes the preparation of the Market Rules that will specify the market infrastructure and govern market operations. The Market Rules will mandate that a Market Operator (MO) be responsible for running the PEM and that the necessary Information Technology (IT) infrastructure be put in place to facilitate market activities.

The configuration for the infrastructure needed to support PEM Operations includes both new system components and existing system components distributed throughout the Philippines.

The diagram below provides an overview of the PEM IT components by major functional areas:

- Market Management System (MMS)– A new system to be specified as part of this project;
- Energy Management System (EMS)– The existing system, to be upgraded as necessary to meet market requirements;
- Meter Data Collection – Comprising ongoing meter and metering system upgrades and new functions required for market operations; and
- Communications Network Infrastructure – The existing network infrastructure, to be extended to meet market communications requirements.


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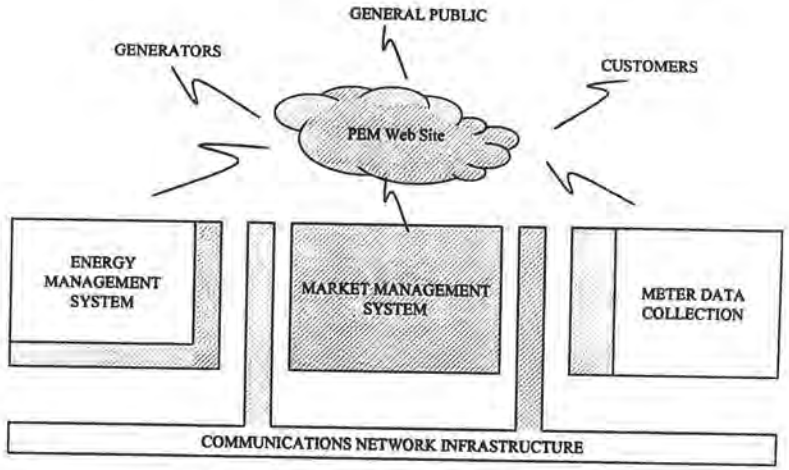


NOTE: Shaded area indicates additions and extensions for market operations

This specification defines the requirements for the MMS, including the necessary interfaces to Market Participants (MP), i.e., Generators and Customers, the existing NPC EMS and the Meter Data Collection System.

The MMS shall include all functions and capabilities required by the MO to meet obligations directed by the Market Rules. These include:

- Processing of Offers and Bids for supplying and purchasing electricity throughout the Philippines;
- Directing the dispatch of power based on the Security Constrained Dispatch Algorithm;
- Collecting and processing all meter data from market trading nodes;
- Calculation of final prices for all power generated and sold in the PEM;
- Providing oversight on market activities to ensure fair and ethical operation of the PEM.


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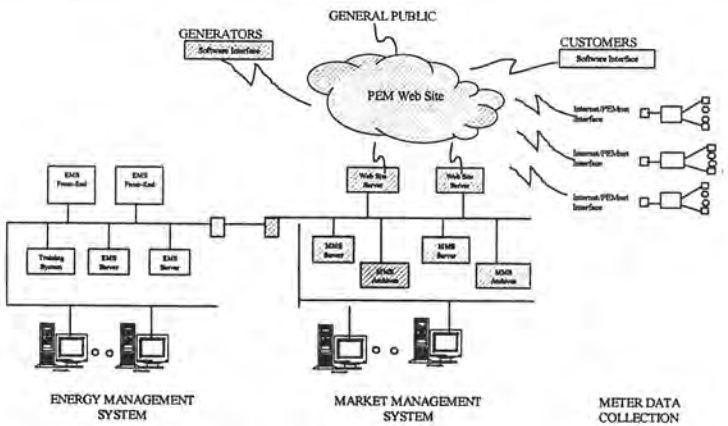
This specification is for the development, delivery and commissioning of the IT hardware, software and support services to put the MMS into successful operation and to ensure its continued support.

The complementary efforts necessary to upgrade the existing EMS, to complete the Meter Data Collection System and to provide the required Communications infrastructure throughout the Philippines will be completed concurrently with the MMS, based on separate specifications.

The system architecture of the MMS shall mesh within the overall IT system environment. Emphasis is on processing nodes distributed in an open wide area network based on industry standards, and secure use of Internet technology and capabilities.

Shown below is a representative block diagram of the MMS within the overall market operations system.




NOTE: Shaded area indicates additions and extensions for market operations

The total equipment complement required for the PEM operation as well as the Market Participant users of the system will be distributed throughout the Philippines. The major portion of the system are expected be located on the National Power Corporation (NPC) campus in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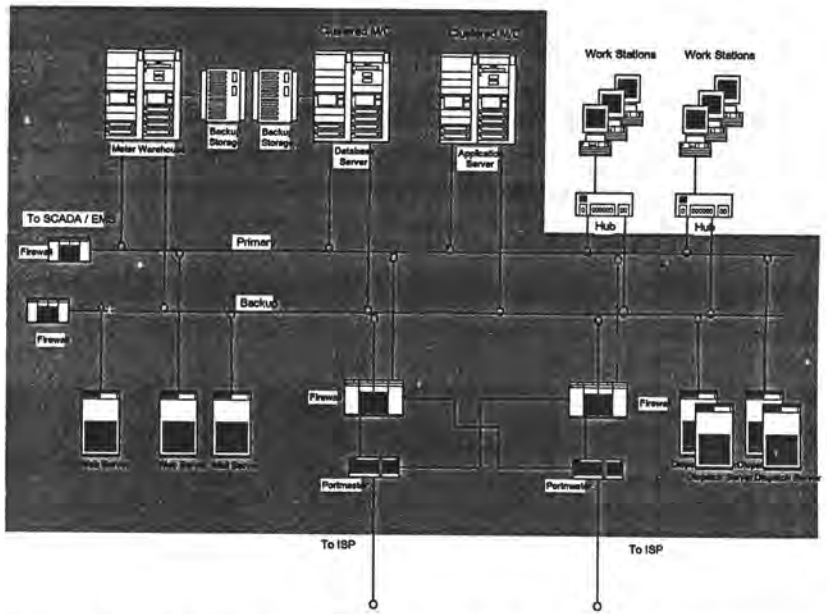
Quezon City. The existing Energy Management System (EMS), the new MMS, and the servers used to interface to the Internet e-commerce site will all be located on this campus. The MMS and EMS will be in separate buildings, each with its own entrance, infrastructure, and security facilities. The MMS shall be under complete control of the MO and in no way dependent upon the System Operator (SO) for facilities, security, or personnel. The independence of market operations shall be assured.

A conceptual block diagram showing the major components of the MMS is shown below.




Details of the actual system configuration proposed may vary, as long as the intent and the functional performance, availability and all other requirements are met. An open architecture that facilitates the maintenance, expansion and upgrading of the MMS is mandatory.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Project management of the overall infrastructure required for the MO in accordance with the Market Rules will require the close cooperation of all functions and contractors involved. This specification provides the plans for this process and describes the responsibilities of the MMS Contractor.


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# 2.0 MARKET ADMINISTRATION FUNCTIONS

The Philippines Electricity Market (PEM) will be under the direction of the Market Operator (MO). The MO will be responsible for Market Administration as defined by the Market Rules. The Market Management System (MMS) shall be the Information Technology platform required to facilitate administration of the market.

## 2.1 PEM E-Commerce

An important element of the PEM will be the communication system to be used by all Participants in the market. The MMS vendor shall provide all functions and capabilities required for PEM E-Commerce with the exception of Local Area Network cabling and equipment which is to be provided by the MO. It is possible that major portions of the PEM E-Commerce capability will be subcontracted; however, the MMS Contractor shall retain full responsibility for the functionality, including meeting availability and performance requirements.

The PEM E-Commerce capability will support multiple functions:

- Communications between the Market Operator and the Market Participants throughout the Philippines, specifically the Generators, Customers, Network Service Providers, and the Meter Service Providers in Luzon, Visayas and Mindanao. The Market Participants will be located throughout the regions, but all must have local and immediate access.
- Meter data collection that provides the interface between the MO and the Meter Data Collection Systems located in the three regions. Collection of data will be automatic (at predetermined periods) and on demand.
- Distribution of settlement and billing information required for the payment for energy and services in the market. This will include electronic funds transfer. Security provisions are of prime concern in this function.
- Publication of general information by the MO. Information will include the status of the market as well as energy prices. The data shall be available to a wide range of users throughout the Philippines.


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- Oversight of the PEM by the Market Surveillance Committee and by Government agencies. The integrity of the PEM must be ensured. This will be accomplished by having the appropriate functions to monitor the market activities in accordance with the Market Rules.

Specific requirements for PEM E-commerce capability are included in Section 5.

## 2.2 *Participant Registration*

All Participants in the PEM must be officially registered with the MO. The specific Participants defined by the Market Rules are:

- Market Operator;
- System Operator;
- Network Service Providers;
- Ancillary Service Providers;
- Metering Providers;
- Generators; and
- Customers.

Individual companies can qualify as Participants in more than one category as defined by the Rules. Note that while all of the above are Participants, only Generators and Customers are designated as Market Participants.

The MMS shall manage a set of basic information concerning all Participants, including the categories for which companies and individuals have registered, the registration of users and their roles and access levels, together with company aliases, associations and agents.

The MMS shall provide a registry of Participants, which shall include:

- Participant Category;
- Company Name;
- Address;
- Contact Information – Mail; Telephone; Fax; Internet;
- Registration Status – Applied; Registered; Suspended; Withdrawn;


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- Credit Details;
- Market Trading Node; and
- Emergency Contact.

Certain data from this file will be made generally available including name, address, participant category, etc. Other information shall be considered confidential and restricted to the authorized users, based on security access levels.

### 2.2.1 ***Qualifications***

The individual Participants must provide qualification information and data specific to the categories for which they are applying to register. These data will be reviewed by the MO and if approved shall be in the Participant registry. These data will be dependent upon the category for which application is being made.

(1) Generator – Participants wishing to be classified as Generators must provide detailed information about the units available for dispatch and for ancillary services as well as proof of eligibility in accordance with Market Rules. These data will be reviewed by the MO and stored in the MMS with proper links to the MP.

The MMS shall also provide facilities that allow an MP to aggregate physical units (scheduled generation or load) into single "dispatchable" units upon satisfaction of the MO that the following conditions are met:

1. The units are located at a single site;
2. The units are owned and operated by a single MP;
3. Power System security will not be compromised in any way by aggregation;
4. Combined control systems satisfy the Grid Code;
5. Communication protocols between the MO, its agents and the units satisfies the Market Rules; and
6. Metering systems satisfy the Market Rules.

The contractor shall provide functions for the registration and the storage of standing data for all dispatchable units. This includes all the physical units and all aggregated units. There shall be a


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unique Dispatchable Unit identification (ID) for each approved dispatchable unit. The registration process shall ensure that there is no duplication of physical units registered as aggregate units.

MPs must submit and maintain the unit standing data for all dispatchable generation and load within their control. Unit standing data is data that is not anticipated to require frequent modification. The following information shall be maintained by the system for each generating unit:

1. Identity of the organization responsible for the unit;
2. Unit type, e.g., generator or dispatchable load;
3. Unit registered rating registered capacity of each physical unit;
4. Unique identity of each physical unit;
5. Registered capacity of dispatchable unit (MW);
6. Unique identifier of Dispatchable Unit - determined after approval of aggregation by the MO;
7. Zone unit is located in;
8. Start type flag, e.g., fast or slow start unit;
9. Connection point details;
10. Date and time of submission; and
11. Unique file number for version control.

(2) Customer – Participants applying to be classified as Customers must provide detailed information about the load(s) they represent as well as proof of eligibility in accordance with the Market Rules. This includes load size, availability for load shed and/or ancillary services, and market trading node. These data shall be stored in the MMS with appropriate links to the Customer file.

(3) Metering Services Provider – Participants applying to be classified as Metering Services Providers must provide proof of qualification as shown by holding a current license from the Government, proof of responsibility for each metering point for which it is applying, and proof that metering installations meet Grid Code requirements. These data shall be stored in the MMS with appropriate links to the Metering Services Provider file.


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(4) Other Participants – All other Participants will have supporting information that must be recorded in their own registration file. The MMS shall accommodate storage of all data in the MMS database in accordance with the sizing parameters given in Section 6.

### 2.2.2 Registration Process

The MMS shall provide the capability to receive and process Participant Registration applications. Participants will submit registration requests to the MO in electronic format utilizing forms specifically prepared for this purpose. The Contractor shall have the responsibility for creating the forms for Participant registration as defined under PEM E-Commerce.

Once submitted, the MMS shall automatically review the forms for completeness (all required entries filled in) and prepare the Participant registry entry and all links to subsidiary information. The default registration status will be "Applied".

The MO will be responsible for verifying all information submitted, including prudential information, and determining that the submittal is in accordance with the Market Rules. Based on this review, the MO will decide to change the status of the submittal from "applied" to "active".

### 2.2.3 Participation Data Table

Table 2.2-1 provides additional detail on the requirements for Participant Data.


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**Table 2.2-1: Participant Data**
**High Level Data Requirement**

| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall accommodate alternative names for a Participant, which the Participant can maintain itself. The data is initially created by the Market Operator (MO) and maintained by the Participant or Market Operator as required. The Contractor shall assume an average of two entries per Participant. The data shall include: Unique Identifier of a Participant, Identifier used to differentiate between multiple aliases for the same Participant, Alternate name for the Participant. | All | MMS | MMS |
| | The system shall maintain details about a Participant (Company or Individual) that the MMS uses. The Participant may also be known by an alias. The data is initially created by the Market Operator and maintained by the Participant or MO as required. There shall be 450 entries initially. The data shall include: Unique Identifier of a Participant, Type of Participant, Participant's legal name, Participant 's legal address, Primary Contacts home phone numbers, Participants work phone numbers (including extension if applicable), Participant fax numbers, Participant e-mail addresses, Participant mobile phone numbers, Participant preferred method for delivery of messages (e-mail or fax), Participant web site address. | All | MMS | MMS |
| | The system shall maintain details about a unit that generates energy within the PEM. The data is created and maintained by the market operator. There shall be 450 units initially. The data shall include: Unique identifier of a Unit, Unique Identifier of a fuel type, Unique identifier of a dispatch unit type (generator or load). | All | MMS | MMS |
| | The system shall record readings taken by the Energy Management System (EMS) that relate to a generating unit. The data shall be maintained by the MO. Assume 10 readings per dispatchable unit per dispatch interval. The types of data shall include: Unique identifier of a Unit, Type of reading received from EMS, Date and time this reading was taken in EMS, Value of reading. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall maintain information on an individual contact (user) that the MO deals with or wishes to keep track of. The data is initially created by the MO and maintained by the Participant or MO as required. Assume 20 entries per participant organization. The data shall include: Unique Identifier of a Contact, Identification of certificate granted to an individual to gain access to the PEM system, Name that individual uses to log in to the PEM system, Flag indicating if this individual is been suspended from using the system, Notes about the individual. | All | MMS | MMS |
| | The system shall facilitate the entry of notes about the status of a Participant. The data is created and maintained by the MO. Assume 10 entries per Participant per year. The data shall include: Date and time the note was originally made, Unique Identifier of a Market Participant. Note about the status of a Participant. | All | MMS | MMS |
| | The system shall maintain a description of a Participant's role in the PEM. These are used to allocate Participants into groups to allow application of market Rules specific to that Participant Type. The data is created and maintained by the market operator. It is assumed there shall be a maximum of 20 roles. The data shall include: Unique Identifier and description for a particular group. | All | MMS | MMS |
| | The system shall record information relating to the position held by an individual in a company. The data is initially created by the MO and maintained by the Participant or MO as required. There shall be one per contact. The data shall include: Unique Identifier of a business relationship / contact, Unique Identifier of a Market Participant. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall record information on an individual identified by a Participant as the person to contact with respect to Prudential Security. The data is created by the MO and maintained by the Participant or MO as required. There shall be one per Participant. The data shall include: Unique Identifier of a business relationship / contact, Unique Identifier of a Market Participant. | All | MMS | MMS |
| | The system shall record a physical or logical point (Connection Point or "CP") where electrical energy is supplied to or purchased within the PEM, and, where the MO can obtain or derive a measurement for the energy supplied or purchased. The data is created and maintained by the MO as required. CP's may only be 'owned' by a single participant. In cases where a site may both produce and consume electrical energy, the MO shall set up two "logical" CP's, one supply and one purchase. The Contractor shall therefore allow for two per participant. The data shall include: Unique identifier of a Unit, Unique Identifier of a Market Participant, Unique Identifier of a participant type, Flag indicating if Unit normally supplies or purchases energy, Unique Identifier of a business relationship / contact, Date this unit became effective at the Pool, Maximum Nameplate Capacity Rating (MNCR) of unit (MW), Date this unit was retired from the Pool. | All | MMS | MMS |
| | The system shall maintain registered users of the PEM MMS system. Note that a user is a specific individual, but an individual may be more than one user as they can act on behalf of many Participants and Participant Types. Assume there shall be five per Participant The data is created by the MO and maintained by the Participant or MO as required. The data shall include: Unique identifier of a PEM system user, Unique Identifier of a Participant Type, Unique identifier of a Security Class, Unique Identifier of a Participant. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall record all valid connection points and their type. Data are updated for new connection points as required. The initial data is created by the MO. Assume there shall be an average of two per participant. The data shall include: Connection Point Identifier, Connection point full description, Connection point type (Transmission, distribution, station, generating unit, or inter-connector), Connection point location, Last date and time record changed. | All | MMS | MMS |
| | The system shall record relevant details for each connection point including the responsible party, any fixed loss factors and relevant Meter Connection Point. Data shall be updated as required by the Meter Warehouse application. The initial data are created by the MO. Assume there shall be two points per Participant. The data shall include: Effective date of record, Version number of record for given effective date, Connection point identifier, Region Identifier, Associated transmission connection point ID for a distribution connection point, the Meter Connection Point providing meter data for this connection point, the transmission level loss factor for this connection point, the distribution level loss factor for a distribution connection point, the Network Service Provider, Financially responsible organization, Unique National Meter Id., User authorizing record, Date record authorized, Last date and time record changed, Meter data Agent, Retailer of last resort, Responsible Person, Specified if data is aggregated at this point, Expiry date if applicable, the Local Retailer. | All | Meter Wareho use | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall record whether a connection point is active or not. Data is updated only with changes in connection point status. The data is created by the MO and maintained by the Participant or MO as required. Assume there shall be one record per Participant. The data shall include: Effective date of record, Version no of record for given effective date, Connection point identifier, "Active" or "Inactive" indicator, Date record authorized, User authorizing record, Last date and time record changed. | All | MMS | MMS |
| | The system shall record specific details for each unit including start type and whether normally on or off load. Much of this data is information only and is not used in dispatch or settlements. The data is created by the MO and maintained by the Participant or MO as required (authorization is required before aggregations become effective). There shall be one entry Per Participant. The data shall include: Effective calendar date of record, Dispatchable Unit Identifier, Version of Dispatchable Unit details for this effective date, Country wide - Unique id of a connection point, Voltage Level genset / load is connected at, Registered capacity for normal operations, AGC Capability flag, Identifies LOAD or GENERATOR, Maximum Capacity as used for bid validation, Identify unit as Fast (can synchronize and increase generation/load within XX minutes of dispatch) or Slow, For a dispatchable load indicates that the load is normally on or off, Spinning reserve capability, User authorizing record, Date record authorized, Last date and time record changed, | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall record Genset details for each physical unit within the relevant power station. Data is updated whenever plant details change. The data is created by the MO and maintained by the Participant or MO as required. There shall be one record per Participant. The data shall include: Physical Unit identifier, Station Identifier, Centrally dispatched Indicator, AGC Available flag, Voltage level, Registered capacity, Scheduled indicator, Fast / Slow, Scheduled generator flag, On / Off for load, Maximum capacity, Genset fuel type, Genset name, Last date and time record changed. | All | MMS | MMS |
| | The system shall record Participant ID, name and class for all participants. The data is created by the MO and maintained by the Participant or MO as required. There shall be one record per Participant created or maintained as new participants are registered or details change. The data shall include: Unique participant identifier, Class of participant, Full name of participant, Philippines Company Registration Number, Identifies primary business activity of participant, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain financial details on participants. Data will be updated as new participants are registered or details change. The data is created by the MO and maintained by the Participant or MO as required. There shall be one entry per Participant. The data shall include: Name of the account, Unique participant identifier, Account number, Bank name, Branch name, Bank Sort Code, PEM credit account number, PEM debit account number, User authorizing record, Authorized date, Date record authorized, Last date and time record changed. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall maintain valid participant categories. Data will be updated as categories change, this table would therefore change infrequently. The data is created by the MO and maintained by MO as required. There shall be two per Participant. The data shall include: Category unique identifier (applied retrospectively), Category description, and the last date and time record changed. | All | MMS | MMS |
| | The system shall record the assignment of Participants to particular categories. Information will be updated for new participants or when categories change. This table will change infrequently. The data is created by the MO and maintained by the Participant or MO as required. There shall be two per Participant. The data shall include: Category unique identifier, Unique participant identifier, and the last date and time record changed. | All | MMS | MMS |
| | The system shall maintain valid participant classes. This table will be updated only if classifications change. This table would change infrequently. The data is created by the MO and maintained by the Participant or MO as required. There shall be two per participant. The data shall include: Class of participant, Description of participant class, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain cross-references between participant notices and participants. Data will be updated immediately, whenever a participant notice is issued. The data is created by and maintained by the MO as required. Assume there shall be 10 notices per participant per week. The data shall include: Unique participant identifier, Market notice identifier, and the last date and time record changed. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall record details on the allocation of dispatchable units to particular sites or stations. Data will be updated whenever there is a station configuration change or new unit registration. The data is created by the MO and maintained by the Participant or MO as required. Assume the may be multiple entries per Power Station. The data shall include: Dispatchable Unit Identifier, Effective date of this record, Station Identifier, Version no of this record for the effective date, Last date and time record changed. | All | MMS | MMS |
| | The system shall record valid station IDs. This table is updated whenever there is a station configuration change or new unit registration. The data is created by the MO and maintained by the Participant or MO as required. There shall be one entry per Participant. The data shall include: Unique Station identifier, Full name of station, Last date and time record changed, Connection Point Identifier for station load. | All | MMS | MMS |
| | The system shall record the owner details of each station. The data is created by the MO and maintained by the Participant or MO as required. This table will be updated whenever there is a change in the station owner or new units are registered. The data shall include: Effective date of this record, Unique participant identifier, Station Identifier, Version no of record within the effective date, Last date and time record changed. | All | MMS | MMS |

### 2.2.4 *Prudential Assessment Table*

The requirements for Prudential Assessment of Market Participants are in addition to those of other Participants. Table 2.2-2 provides details of those requirements.


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**Table 2.2-2: Prudential Assessment Data**
**High Level Data Requirement**

| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall maintain records of financial security placed by a Participant with the PEM, or assigned to a Participant by the Market Operator (MO) through an assessment of their financial position. Note that multiple prudential instruments with the same effective date and participant can exist at the same time. The data is created by the MO and maintained by the Participant or MO as required. Assume there shall be 10 instrument changes per Participant per year. The data shall include: Unique identifier of a Prudential Instrument. (Allows more than one prudential instrument to be defined for a Participant with the same effective date), Date that Prudential Instrument becomes effective, Unique Identifier of a Business Associate, Type of Prudential Instrument, Description of the Prudential Instrument, for reference purposes, Value of Prudential Instrument, Expiry date of this Prudential Instrument, Date on which the next review of this Prudential Instrument is due, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain the rules defining the actions when a Participant's prudential data is processed. The data is created and maintained by the MO. Assume there shall be 100 different rules. The data shall include: Unique Identifier of a rule, Processing algorithm for this prudential rule, Last date and time record changed. | All | MMS | MMS |
| | The system shall handle processes defining the test procedure required for checking a participant prudential data. The data is created and maintained by the MO. Assume there shall be 20 test types. The data shall include: Date this processing definition comes into effect, Unique Identifier of a Test Type, Date this prudential test process definition expires, Last date and time record changed. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall support the definition of specific steps in a prudential test process. The data is created and maintained by the MO. Assume there shall be a maximum of 100 steps per Prudential Test. The data shall include: Unique Identifier of a rule, Date this processing definition comes into effect, Unique Identifier of a Test Type, Order in which the prudential rule is applied within this prudential test process, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain types of prudential test. The data is created and maintained by the MO. Assume there shall be 10. The data shall include: Unique Identifier of a Type of test, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain a type of prudential instrument allowed by the Pool to perform prudential monitoring. Examples include Letters of Credit, Cash instruments and Pool Financial Ratings (bond ratings of A, A+ and A++, but may be expanded in the future). The data is created and maintained by the MO. Assume there shall be ten types initially. The data shall include: Type of Prudential Instrument, General description of this prudential type, Flag indicating if this type of prudential has a predefined Peso value, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain a Prudential Type that has a preset Peso value. The data is created and maintained by the MO. Initially only 3 types (A, A+ and A++) of Instrument Rating shall exist. This may be expanded in the future, but is unlikely to ever exceed 20. The data shall include: Type of Prudential Instrument, Last date and time record changed. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall maintain the Peso value of a Prudential Instrument in effect from a particular date. The data is created and maintained by the MO. Assume there shall be 10 instruments per Participant. The data shall include: Type of Prudential Instrument, Date that this rating comes into effect, Preset monetary value of a prudential limit, Date that this type expires, Last date and time record changed. | All | MMS | MMS |

### 2.2.5 *Updating Registration Information*

The MMS shall enable authorized users to update components of the Participant register. Authorized users associated with an organization shall only be permitted to update contact details for their own organization.

All details of the update action shall be tracked for audit purposes, with at least the system User ID of the person modifying the record, date/time stamp, and location, etc. being recorded. The MMS Contractor shall provide facilities to update the following data:

1. Updated organization (company) details;
2. Updated Electronic Funds Transfer (EFT) details;
3. Updated credit limit details;
4. Updated organization type details;
5. Updated organization status details;
6. Updated control details;
7. Updated contact type details;
8. Updated contact address details; and
9. Updated contact number details.

EFT details shall be mandatory for organizations that receive a statement from the MO.

The updated organization register records shall be entered into the MMS database and tracked for audit purposes. Archived records for audit purposes shall record details of the user updating the entry along with a date/time stamp.


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#### 2.2.5.1 *Maintaining Participant Data*

The Contractor shall provide functions to maintain Participant information, which will include, but not be limited to:

1. Registration of Participants;
2. Setting Participant status (active/inactive);
3. Maintaining account details (for trading Participants);
4. Maintaining credit details (for trading Participants);
5. Maintaining contact details;
6. Maintaining Participant confidential report details;
7. Produce Participant registration report;
8. Maintaining Participant standing data;
9. Recording Participant types;
10. Maintaining contact types;
11. Allocating reports to dispatch types (generator/load); and
12. Allocating reports to Participant types.

#### 2.2.5.2 *Participant Data Maintenance Process*

The maintenance of registration and associated data regarding Participants shall be maintained via Web pages accessible only by authorized users. The MMS shall provide the capabilities to update individual files and make global changes, where required. Representative tasks which must be accommodated are:

1. Change of Participant status from inactive to active*;
2. Entry of notes regarding individual Participants*;
3. Update of contact information for individual Participant;
4. Update of information regarding a specific company, a global change; and
5. Change of generating capability or load.

*Usually restricted to the MO

In all cases, the MMS shall process the change requests in the same manner as that of the initial registration submittals, flagging any errors or emissions detected. In this instance, however, the


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MO shall have the ability to correct the detected errors or in fact reject the changes if made by the Participant. An audit trail of all activities shall be created and maintained.

#### 2.2.5.3 *Read Participant Data*

The data maintained in the Register shall be readable by authorized Participants through their Web-browser based interface. The Participants shall be able to view details of their own organization and also certain details regarding other registered organizations.

The authorized persons shall be able to view data through their on-line interface; information will include, but not be limited to:

1. Company details (name, address, registration information, etc.);
2. EFT details*;
3. Credit limit details*;
4. Trading limit details*;
5. Organization class details;
6. Organization type details;
7. Organization status details;
8. Contact details;
9. Contact type details;
10. Contact address details; and
11. Contact number details.

* Confidential to a Participant viewing their own records.

A subset of this information shall also be available on the general Web site.

### 2.2.6 *Suspension/Withdrawal of Participation*

Provision shall be made to change the status of a MP from "active" to either "suspended" or "inactive". The MO will manually change MP status based on:


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- Suspended – Failure to maintain a viable economic status or a breech of the Market Rules;
- Inactive – Written notification request made by the Participant to the MO to temporarily or permanently withdraw from participation in the PEM.

#### 2.2.6.1 *Further Activity*

Offers and/or Bids received from MPs in the "Suspended" or "Inactive" category shall be processed in the normal manner, but will fail the test for eligibility. Rejection notices shall be forwarded in response to the submittals and tracked in the MMS.

#### 2.2.6.2 *Reinstatement*

Reinstatement of the MP to the "active" state shall only be done manually by the MO.

## 2.3 *Standing Data and General System Functions*

In providing the functions relating to standing data the Contractor shall provide facilities for:

1. Maintaining data that is used by more than one application area; and
2. Maintaining data that very rarely changes.

The Contractor is therefore responsible for providing functions to maintain these reference data as well as transaction based data.

Functions shall be provided for managing all of the basic parameters required to operate the spot market. Physical market parameters shall be managed as data sets each with an effective date, time and number. Any changes to a market parameter shall be recorded in the audit log.

The MO shall be able to create and maintain MMS-specific standing data which is not anticipated to change frequently, e.g., Value of Lost Load, the Settlements Timetable and details specific to Regions. The system shall provide for the maintenance of these parameters including (as examples):


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1. Settlements start time;
2. Settlements start time effective from;
3. Markets start time;
4. Markets start time effective from;
5. Prudential factor percent (when multiplied by MP's maximum credit limit, results in a trading limit, i.e., the maximum level of exposure before a call notice is issued such that if a default were to occur, suspension procedures could be performed before exposure rose above the maximum credit limit);
6. Prudential factor percent effective from;
7. Region identifiers (IDs);
8. Region names;
9. Region effective from – date;
10. Region effective to;
11. Regional Reference Node ID – the Connection Point at a nominated major transmission substation closest to the largest load center in the Region or, if no major load center exists (the load center could be a city), then the nominated major transmission substation nearest the largest generation center in the Region;
12. Regional Reference Node effective from;
13. Regional Reference Node effective to;
14. Dispatch period; and
15. Duration of trading interval.

Examples of these data types and content follow.

### 2.3.1 Regions

In facilitating the spot market management function, the MMS must allow for the establishment and definition of Network Nodes and Regions for spot price determination.

The Contractor shall make provision to:

1. Record Regional identities;
2. Update a Region's operational status (active/inactive/connected/disconnected);
3. Record Regional administered price cap value (may be different to national value); and
4. Record all Nodes within a Region.


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### 2.3.2 Connection Points

The Contractor shall provide functions to allow the MP to register all the Connection Points for which they will be financially responsible. These will include both, Generators and Customers. The commissioning, decommissioning or transfer of a Connection Point between MP needs to be catered to. The Contractor shall provide a workflow process to ensure that no Connection Points are registered simultaneously with two MPs or, equally importantly, with none, and that there is no risk of data duplication or incomplete records for Connection Points.

An existing registered MP may also wish to submit a notice to withdraw from the market at any time. However, a withdrawal application should not be validated or processed by the software until a request to transfer the Connection Point is also received. Only when a transfer application and a withdrawal application are received by the MO for the same Connection Point with the same transfer date, can the Connection Point be registered as transferred and the said Participant be allowed to withdraw from the market (notwithstanding any other conditions that may be specified with respect to withdrawal).

The following information is necessary for Connection Points:

1. Version number;
2. Participant unique identifier;
3. Unique Connection Point identifier;
4. Metering Agent nominated to the MO as responsible for collection of Meter Data for the Connection Point; and
5. Registration date of Connection Point to MP.

There may be instances when a Participant objects to the registration of a particular connection point; facilities shall be provided for Participants to register such an objection. In this instance the following information will be supplied from the respective MP to the MO:

1. Unique identifier of MP;
2. Unique Connection Point identifier;
3. A description of the objection; and
4. Objection status, e.g., Registered, Pending, Withdrawn.


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### 2.3.3 Metering Agents

The Contractor shall provide for the possibility that meter data will be collected by various companies and agents registered with the MO as Meter Service Providers. In the paragraphs below, the term "meter agent" may apply initially only to the meter data collection sites established within the region, but provision shall be made to have multiple meter providers in the future.

Upon the successful registration as the Responsible MP for a Connection Point, the Market Operator shall notify the existing and new Responsible MP nominated Metering Agent of the change. Facilities shall be required to record the following information:

1. Unique version number for the record;
2. Market Participant's ID;
3. Connection Point ID;
4. Date and time Market Participant becomes responsible for the Connection Point; and
5. Identity of the Metering Agent.

The MMS shall provide functions to support the MPs who wish to change their Metering Agent at any time by submitting a notice to the MO informing it of the identity of the new Metering Agent and the date and time from which the appointment will be effective. In such a case the MO will notify both of the affected Metering Agents of the change request. The system shall record the following:

1. Unique version number for this transaction;
2. Market Participant's ID;
3. Both Metering Agents' IDs; and
4. Effective date and time of new Metering Agent's appointment.

The whole change process shall be handled by a workflow process similar to that provided for the registration of a Connection Point.


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### 2.3.4 Market Fees

The imposition of Market Fees will be necessary so that the MO can recoup its expenses for facilitating the market. Market Fees can take various forms and the rates that are applied to organizations will be based on their market activity.

Market fees will only change after consultation with the necessary authorities and as such will not be revised very often. Based on this, it is planned that the MO will manually enter and maintain the Market Fee rates as necessary. The MMS shall facilitate this manual entry and maintenance of the fees.

The Ancillary Services Charges, and Settlements Fees that are payable by the affected MP will be included in the invoices issued at the end of each billing period as part of the Settlements process. It is expected that an annual registration and administration fee will be separately invoiced to all MP and will not be amortized over the calendar year. To support the application of different types of market fees, the following functions shall be provided by the Contractor:

1. Record and maintain Market Fee definitions;
2. Record Market Fee values (scales);
3. Print Market Fees; and
4. Record and print Market Fees histories.

Maintenance of Market Fees shall be facilitated via a Web page the purpose of which will be to maintain the types of charges that are applied to Participant accounts

### 2.3.5 Value of Lost Load

If total supply is still inadequate in a region even after all available reserves are exhausted and load management has been applied to the maximum extent possible, involuntary load shedding and a special pricing regime will be enforced. In general, prices are set at a predetermined Value of Lost Load ("VoLL") to the customer, e.g., Peso 200,000.00 per MW.


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The Contractor shall provide functions for the application of the concept of VoLL. VoLL is effectively a price cap on the regional reference prices as determined by the Market Rules and which can vary from time to time. VoLL is a constant that will be entered by an authorized Market Operator and maintained in the system with an effective date and version number. All maintenance operations related to VoLL shall be recorded in the audit log.

The Contractor shall provide a method for the MO to create and maintain a record of the Value of Lost Load for each Region. The system shall record the following data:

1. Region identifier
2. VoLL value – e.g., Peso 200,000
3. Date and time VoLL was effective

### 2.3.6 *System Standing Data*

Table 2.3-1 provides additional requirements for System Standing Data.

**Table 2.3-1: System Standing Data**
**High Level Data Requirement**

| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | Type of reading from EMS. Data shall be created and maintained by the Market Operator (MO). Assume there shall be a maximum of 50 types. Code for a type of reading received from EMS, Type Unique Identifier of a Measurement Unit, Description of the reading received from EMS. | All | MMS | MMS |
| | The system shall maintain the definitions of a charge that is applied by the PEM. Data shall be created and maintained by the MO. Assume there shall be 20 definitions. The data shall include: a Unique code for type of charge, a Description of the charge, Units in which charge is measured, for example Peso/MWh, percentage charge (for VAT) or one time Peso charge (for participation fee), GL account in which charges are recorded, Flag indicating if charge is required. | All | MMS | MMS |
| | The system shall maintain information relating to participant fees that may be in effect on a particular date. Data shall be created and maintained by the MO. There shall be a maximum of 100 fee (charge) types. The data shall include: Unique code for type of fee, Date Participant Fee becomes effective, Peso amount of fee, Date fee expires, Frequency of fee application. E.g. per Settlement Period, Hour, Daily, Monthly or Yearly. | All | MMS | MMS |
| | The system shall maintain information relating to charges for trading though the PEM that are in effect from time to time. Data shall be created and maintained by the MO. Assume there shall be a maximum of 100 charge rates. The data shall include: Unique code for type of charge, Date charge becomes effective, Trading Charge Rate in Pesos/MWh, Date trading charge expires. | All | | |
| | The system shall record of a set of data that has been removed from the MMS database and stored offline. Data shall be created automatically or by a manual trigger. The Contractor shall allow for a maximum of 100 entries per year. The data shall include: Unique Identifier of a archive type, Date and time that the dataset was last archived, Parameters that define the data that was archived, Unique Identifier of a code in a code table. | All | MMS | MMS |
| | The system shall maintain information relating to rates of Value Added Tax in effect from a particular date in the future. Data shall be created and maintained by the MO. There shall be one change per year. The data shall include: Unique code for the tax charge, Date rate becomes effective. Must fall on the first day of a month, Rate of VAT, Date rate expires. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall allow for maintenance of the periods of time for which participant accounts are settled. Data shall be created and maintained by the MO. Assume there shall be one per day (for prudential settlement) + one per week (for draft, final and adjustment settlement). The data shall include: Unique identifier of a settlement period, Time and date the period starts, Time and date it ends. | All | MMS | MMS |
| | The system shall maintain information on start and end dates / periods of any force majeure event. Data shall be created and maintained by the MO. Data shall be updated only if a force majeure event is recorded. The data shall include: Force Majeure Identifier, Start Date for this event, Start Trading Interval for event, End Date for this event, End Trading Interval for this event, APC Start Date, User authorizing start, User authorizing end of event, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain information on regions impacted by a force majeure event. Data shall be created and maintained by the MO. Data shall be updated only if a force majeure event is recorded. The data shall include: Force Majeure Id, Differentiates this region from all other regions, Last date and time record changed. | All | MMS | MMS |
| | The system shall facilitate Market notices to participants. Data shall be created and maintained by the MO. Data shall be updated as required. Assume there shall be a maximum of five notices per week. The data shall include: Notice Identifier, Effective Date of Market notice, Market Notice Type Identifier, Market Notice Type, Last date and time record changed, Reason for market notice. | All | MMS | MMS |
| | The system shall maintain information on the different types of market notices. Data shall be created and maintained by the MO. Data shall be updated whenever market notice types change. The data shall include: Identifier for market notice, Type description, Last date and time record changed. | All | MMS | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | The system shall maintain information on start and end periods of any market suspension and the reason affected. Data shall be created and maintained by the MO. Data shall be updated only if market is suspended. Assume there shall be one per year. The data shall include: Unique identifier for suspension, Start date of suspension, Start trading interval of suspension, End Date of suspension, End trading interval of suspension, Reason for suspension, User authorizing start, User authorizing end, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain information on regions affected by a market suspension. Data shall be created and maintained by the MO. Updated only if market is suspended. The data shall include: Unique identifier of suspension, Differentiates this region from all other regions, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain information on standing region data. Data shall be created and maintained by the MO. This table will only change when a change is made to a region. This table will change infrequently. The data shall include: Effective date of this record, Version No, Differentiates this region from all other regions, Date record authorized, User authorizing record, Last date and time record changed. | All | MMS | MMS |
| | The system shall maintain the billing calendar for the year, with week number 1 being the first for the MO financial year. Data shall be created and maintained by the MO. As standing data this will be updated infrequently. Future periods only can be adjusted. The data shall include: Financial Year number, Week no within the contract year, Start Date of week, End Date of week, Preliminary Statement Date, Final Statement Date, Payment Date, Last date and time record changed. | All | MMS | MMS |


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## 2.4 PEM Timetable

Administration of the PEM will be in accordance with the Timetable established by the Market Rules. The Timetable will be reviewed periodically by the Market Rules Change Committee, a Market Surveillance Committee, and a Technical Committee as well as by the MO.

These reviews will focus on the efficiency of market operations and may well result in changes to the PEM Timetable. The MMS shall provide efficient update of all functions within the system under such circumstances.

The MMS shall include the PEM Timetable as defined by the Market Rules within the system and available to all functions and applications, including third-party applications. This PEM Timetable shall be the one and only source of absolute and relative times effecting functions and applications.

### 2.4.1 Timetable Functions

The Timetable shall include all time-dependent definitions for all MMS functions:

- Registration*;
- Offers/Bid Processing;
- Information Submitted;
- Dispatch Interval;
- Metering (data transfer); and
- Settlement.

*Registration is included since there will be times stipulated that will bind the applying Participant and the MO with respect to provision of information and approval respectively.


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### 2.4.2 Timetable Variables

The Timetable shall contain the following item types. Note that this list is representative and will need to be augmented by a thorough review of the latest release of the Market Rules Timetable.

- Approval and re-approval of Participant Registration applications;
- Time for receiving Offers and Bids for Energy and Reserves;
- Time for publication of information concerning the market;
- Day-ahead and week-ahead projections;
- Pre-dispatch and dispatch runs of the Security Constrained Dispatch Algorithm;
- Trading Intervals;
- Meter data collection intervals;
- Preparation of Settlements; and
- Payments.

## 2.5. PEM Audit

Audit of the PEM has been mandated by the Market Rules and shall be accommodated in the MMS by the provision of tracking (audit) tables.

### 2.5.1 Market Auditor

Access shall be at the appropriate level depending on the functions being performed. For example the Market Auditor shall be able to log in to the MMS as a MP, to enable test of new software.

### 2.5.2 Audit Capabilities

The Market Auditor shall be able to access all data collected in the MMS for this purpose. The Contractor shall provide a listing of all audit information including system administration,


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registration, market operations, metering and settlement that will be available in the MMS as part of its response to this specification.

### 2.5.3 Audit Reports

The MMS shall include default audit reports with delivery of the system. The format and content of the reports shall be reviewed and approved by the MO. The capability to prepare additional reports and to modify the default reports based on Market Audit requirements shall be provided with the MMS.

## 2.6 PEM Security

Security of the PEM is an overriding concern of the MO and the Government. This is reflected in the Market Rules by the establishment of the Market Auditor and Market Surveillance functions as well as by the emphasis on security in all functions. The concern for security is both in protection from outside intervention and assurance of data integrity throughout the PEM.

### 2.6.1 PEM E-Commerce

The specification section for PEM E-Commerce includes specific requirements for ensuring security of data exchanged via that medium.

### 2.6.2 Data Links

All data links between and among systems shall utilize full security provisions of the selected protocols. These provisions shall be specifically tested during system integration and again during factory acceptance test.


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### 2.6.3 MMS Internal

The full security provisions of all hardware and software utilized in the MMS shall be used in system implementation, thoroughly tested and demonstrated during factory acceptance test. Emphasis will be on integrity of the databases, from data collection to archives.

### 2.6.4 Contractor Recommendations

The MO is interested in any specific recommendations regarding additional security provisions available, based on prior Contractor experience. This is especially pertinent to the E-Commerce function.


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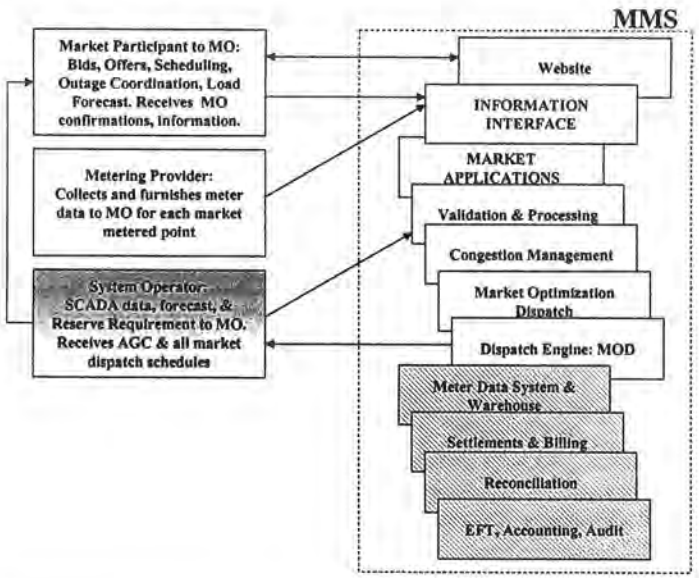
# 3.0 MARKET OPERATIONS FUNCTIONS

Operation of the Philippines Electricity Market (PEM) in real-time involves close collaboration between the Market Operator (MO) and the System Operator (SO). The MO will administer the spot market in accordance with Market Rules. The SO will dispatch energy according to schedules provided by the MO and maintain the security and reliability of the electric network. The Market Management System (MMS) shall provide all functions and capabilities required by the MO to carry out these operations. The broad scope of MMS functionality includes but is not limited to:

a. Providing a secure information interface with external users;
b. Validating and processing bids, offers, load schedules, and congestion data;
c. Executing market optimization analysis and congestion analysis; and
d. Providing dispatch schedules to the SO for each trading interval.





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## 3.1 Offers/Bids Processing

The processing of Offers and Bids from Generators and Customers for both delivered energy and reserves will be handled entirely within the MMS.

### 3.1.1 Offers/Bids Submittal

The MPs (Generators and Customers) will prepare Offers and Bids for energy and reserves utilizing forms designed for those purposes by the Contractor and will submit these offers via the Web based interface. Information to be included with each submittal includes:

1. Generator Offer
   a. Must include the plant name, unit ID(s), location of the connection point and relevant market network node;
   b. Must include the Generator Pricing Zone of the connection point;
   c. May include up to 10 energy offer blocks per (aggregate) unit;
   d. Must be for a minimum block size;
   e. Must have monotonically increasing prices, starting from zero generation;
   f. May include negative prices but these are limited by the market price floor and market price cap;
   g. Must include maximum up and down governor ramp rates;
   h. Must include a validity period of offers (e.g., valid for specified period or valid until offer is revised);
   i. May include a "forbidden operating zone" if applicable; and
   j. Must include an operating range (upper and lower limit).
2. Regulation Reserve Offers (Ancillary Services)
   a. Must include the plant name, unit ID(s), location of the connection point and relevant market network node;
   b. Must include the Generator Pricing Zone of the connection point;
   c. May include up to 10 energy offer blocks per (aggregate) unit;
   d. Up to 3 reserve offer blocks per aggregate unit (MW/block);
   e. Must have monotonically increasing prices from zero to the first offer block, which shall correspond to the mandatory reserve capability required from that Generator under its connection agreement;
   f. Must include up and down governor ramp rates;


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g. An AGC ramp rate up and down (if offering regulation);

h. Must include a validity period of offers (e.g., valid for specified period or valid until offer is revised);

i. May include a "forbidden operating zone" if applicable;

j. Must include an operating range (upper and lower limit);

k. A maximum response level up and down for the relevant reserve category (MW); and

l. A minimum and maximum energy dispatch level (MW) at which any regulation reserve response will be available (MW above and below preferred operating point);

3. Contingency Reserve Offers (Ancillary Services)

a. Must include the plant name, unit ID(s), location of the connection point and relevant market network node;

b. Must include the Generator Pricing Zone of the connection point;

c. Up to 3 reserve offer blocks per aggregate unit (MW/block);

d. A minimum block size;

e. Must have monotonically increasing prices from zero to the first offer block, which shall correspond to the mandatory reserve capability required from that Generator under its connection agreement.;

f. Must include up and down governor ramp rates;

g. Must include a validity period of reserve offers (e.g., valid for specified period or valid until offer is revised);

h. May include a "forbidden operating zone" if applicable;

i. Must include an operating range (upper and lower limit);

j. A maximum response level up and down for the relevant reserve category (MW); and

k. A minimum and maximum energy dispatch level (MW) at which any reserve response will be available (MW above and below preferred operating point).

4. Customer Reserve Offers (Ancillary Services)

a. Load ID and Customer Pricing Zone

b. A maximum response level for the relevant reserve category (MW);

c. A maximum proportion of the forecast/scheduled load which may be interrupted;

d. Up to 3 reserve offer blocks (MW/block);

e. A minimum block size;

f. Monotonically increasing prices;

g. Must include validity period of reserve offers; and

h. Must represent a certified dispatchable load.


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5. Customer Bids (Certified Demand Bids)

a. Must have up to 10 bid blocks per takeoff point;

b. Must have a minimum block size;

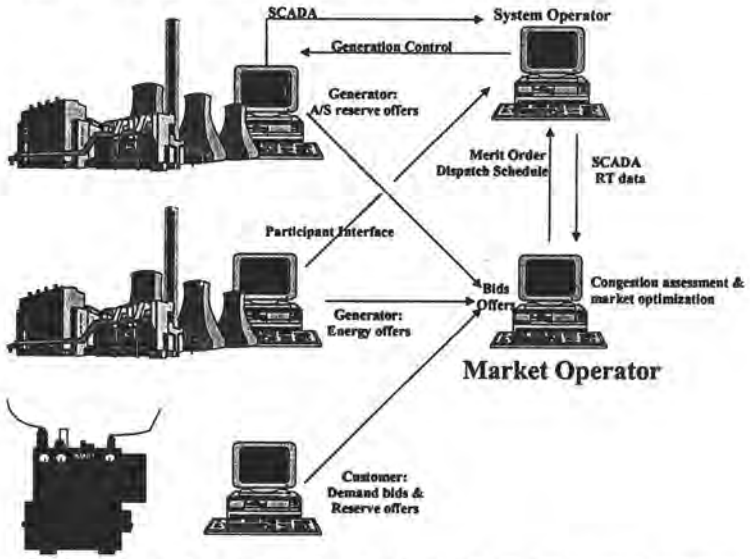
c. Must have monotonically decreasing prices;

d. Must start from a zero offtake;

e. May have bid prices that are negative but they will be limited to the market price floor and market price cap;

f. Must include a validity period of bids; and

g. Must represent a certified dispatchable load.




SO relates MO preferred operating points (target levels) and AGC (regulation) signals to the generators

**MMS Receives Bids And Offers From Market Participants**

### 3.1.2 *Review Process*

The MMS shall provide for the validation of the submitted materials automatically and in accordance with the Market Rules. It is important to understand that the dynamics of the PEM do not allow the time for manual intervention in the validation process. This puts great emphasis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on the thoroughness and accuracy of the validation provided in the MMS. Included in the validation shall be:

1. Validity of registration/certification of commodity bid or offered;
2. Submittal in accordance with Timetable;
3. Completeness of Submittal (all required fields completed);
4. Reasonability of Submittal, where data falls within parameters of Standing Data (Examples include but are not limited to: Maximum capacity, governor ramp rates, maximum dispatchable load values, physical location by pricing zone and node, status of unit or load dispatch availability from outage scheduling data, cold start-up times, total bids/offers in all commodity categories does not exceed total available capability, and ability of authorized MO personnel to adjust the "bandwidth" or trigger points for each data type);

| Item | Examples For Reasonability Checks | User-enterable Trigger Points |
|---|---|---|
| 1 | Value offered/bid is greater than maximum capacity of unit or load | >1MW Δ |
| 2 | AGC or governor ramp rate offered is greater than AGC ramp rate certified | >0.1-0.5 MW/min Δ |
| 3 | AGC ramp rate offered is greater than the certified AGC ramp rate | >0.05-0.5 MW/min Δ |
| 4 | Total of commodities offered/bid is all market categories (incl. reserve) exceeds the total available capacities of cited resources | >0.5-2MW Δ |
| 5 | Units, physical location, pricing zone are correct | No tolerance |
| 6 | Fields required for all submittals are completed | No tolerance |
| 7 | Fields required for commodity offered/bid are completed | No tolerance |
| 8 | Resource offered is not available per outage scheduling data [override by MO provided] | No tolerance: |
| 9 | Generation availability for units off line are sooner than cold-start data timing | >5-50 minutes Δ |
| 10 | Dates and times and cited market periods submitted are within PEM Rules regarding submittal | No tolerance |

- Consistency of Submittal (Submittal in full compliance with MO Rules); and
- Consistency with Published Market Information (MO and SO procedures and orders).


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### 3.1.3 Approval/Re-submittal

The MMS shall process all submittals as received and provide the results to the MP in a timely manner. Approval shall mean passing all tests described above; rejection shall include the indication of which test was failed. MMS shall provide an automated response to the submitting MP at the time of processing, indicating acceptance or rejection. Rejection notification to MPs shall include the reason for rejection. The MMS shall provide for acceptance of re-submittals in accordance with the Timetable.

## 3.2 Information Submittal

The MO requires additional information beyond that contained in the Offers and Bids. In order to calculate the optimal dispatch schedule for each trading interval, information shall be forwarded by the SO via the EMS-MMS LAN connection in accordance with the market Timetable.

The types of information required include the following.

### 3.2.1 Network Status

The network model for the electrical system will be created and maintained in the EMS. The EMS shall transmit the network model in EPRI Common Information Model (CIM) compatible format on initial system interconnection, and thereafter on each major change or as required to assure compatibility between systems.

Network model updates shall be provided for each dispatch in CIM-compatible format in accordance with the Timetable.

### 3.2.2 Outage Schedules

The SO will have responsibility for the maintenance coordination function and maintaining all system outage schedules in the EMS, and submitting them to the MO. MO may have some


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future level of authority over outage requests submitted by the SO. Approved outage schedules shall be electronically submitted to the MMS. Outage schedules requested but rejected by the SO shall be submitted to the MO daily for review. Decisions regarding outage scheduling made by the SO must be equitable and independent with respect to Market Rules. The schedules shall be forwarded to the MMS in accordance with the Timetable.

### 3.2.3 Transmission Constraints

The SO has responsibility for monitoring and ensuring the security of the electric system through compliance with Market Rules. The EMS will run network security programs both periodically and on request of the SO, but these will not replace the MMS congestion analysis and market optimization process. The Merit Order Dispatch stack (schedule) shall originate from the MMS. For each trading interval the EMS shall forward a list of all transmission constraints to the MMS.

### 3.2.4 Preferred Operating (Targets) Points

The SO will have responsibility for executing automatic generation control according to the MO Security Constrained Dispatch (SCD) schedule. As input to the market optimization dispatch algorithm, the EMS will determine and forward actual operating points for each generation unit.

### 3.2.5 Load Forecast (Option)

The EMS includes a Load Forecast program which will furnish data to market operations. The function provides forecasts for all three regions and for each market trading node in each of the regions. The data, on an hourly basis for a rolling window of 168 hours and on a 10-minute basis for the nearest four hours, will be sent to the MMS per the Timetable.

If the output from this Load Forecast program is unacceptable, the MO must consider an alternative LF program that more closely aligns with the MMS applications. Load forecast shall be offered as an option to the MO by the vendor.


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### 3.2.6 Ancillary Services

The SO has the responsibility to ensure that there are sufficient ancillary services available for each trading interval as provided for by the PEM.

Ancillary services requirements shall be forwarded to the MMS from the EMS per the Timetable.

### 3.2.7 Initial Conditions

In solving the dispatch schedule, the dispatch algorithm will normally make use of the dispatch results from the previous dispatch interval as its initial parameters. In the event that this is not possible due to system startup or major system interruptions, the SO and the MO will collaborate on setting initial conditions with information exchanged via the EMS-MMS LAN.

## 3.3 The Dispatch Process

The market scheduling and pricing software shall provide for a Week Ahead Projection, Day Ahead Projection for the Pre-Dispatch Schedule, and a Real-Time Dispatch market price and schedule. While different numerical values may be used in each mode, the mathematical formulation is the same in these modes except that:

- The two-fold pre-dispatch process has a Week Ahead Projection which represents 168 individual periods each of a duration of 1 hour, and a Day Ahead Projection which represents 144 individual periods (138 or 150 for daylight savings changes as applicable), each of a duration of 10 minutes and provided in six 10-minute periods per each hour, thus defining each 1-hour period therewith. A short-term projection update shall provide for an adjustable rolling window of from six to 216 10-minute periods beginning at the selected start time, but no earlier than the time of execution. The Week Ahead schedule produced represents the state of the system at the end of each 1-hour period; the Day Ahead and short-term schedules will represent each of the six 10-minute periods within each hour, with the final 10- minute period being used per PEM Rules for targeting;
- The pre-dispatch projections have starting conditions given by the current state of the plant with the ending state for each subsequent hour representing the starting state for the following hour;


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- The Week Ahead Projection process is repeated daily with daily updated data. The Day Ahead Projection process is repeated regularly throughout the day with all the data updates since the previous run;
- The Real-Time Ex Ante Dispatch represents an individual period of 1 hour. The schedule produced represents the projected state of the system at the end of the 1-hour period; and
- The Real-Time Ex Post Dispatch represents an individual period of 1 hour. The schedule produced represents the state of the system at the last system dispatch during the 1-hour period and with metered load at the end of the hour for that period.

In all modes, the schedule process will take into account the actual generation and demand applied to the initial conditions in the previous trading interval as well as the forecast, or target, for the end of that trading interval and for the market trading node as assumed in or estimated by the dispatch optimization performed prior to the beginning of that trading interval.

### 3.3.1 *Inputs*

The required inputs are:

- Generator offers for energy;
- Generator offers for each generation class and generation reserve class, including tradeoff functions between generation and each class of reserve;
- Scheduled load bids for energy;
- Scheduled load bids for each reserve class, including proportionality relationships between load and each class of reserve;
- Nonscheduled demand for each node;
- Constraint violation penalties as allowed by PEM Rules;
- Actual generation and demand levels (or projected demand);
- Actual and scheduled (target) generation and forecast demand for the previous period;
- Generator and scheduled load characteristics (e.g., ramp-rate limits, operating reserve response characteristics);
- Transmission system configuration, including transmission facilities in service, their physical flow and loss characteristics and flow limits from network model data update;
- A forecast of generator and transmission facilities scheduled to be changed, impacting reserve requirements;
- Reserve requirements (non-unit specific) by Region, from SO;
- Linkages between primary and contingent risks (if any);


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- MO specified risk-scaling factors. These allow the size of the risk to be covered by operating reserves to be scaled by a factor reflecting recent MO performance in handling contingencies;
- SO security constraints which may, for example, define constraints on real power generation/flow which may be implied by the requirements of reactive power and voltage control; and
- Any ancillary services or local generation "must-run" capacity previously committed for use outside of the market clearing mechanism.

Table 3.3-1 provides additional information on Input Data.

**Table 3.3-1: High Level Data Input Requirement For MMS**

*MMS= market management system; MP= Market Participant; SO= System Operator; EMS= energy management system (operated by SO)*

| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | **Offers & Bids, Required Data** | | | |
| 1 | The Contractor shall provide for Market Participant registration and meter certification requests with associated information in text and table format (see MP registration and metering portions of this Specification) | Various | MP | MMS |
| 2 | MP data submittal prerequisite to submitting Offers/Bids: Market Participant Name (each MP shall have submitted and have MO approval of "standing data" to include but not be limited to contract tables (if applicable), unit or equipment maximum rating, operating limits, unit governor ramp rate, unit forbidden operating zones, unit AGC ramp rate (if offering regulation), cold start-up (time from start to synchronize), physical location (connection point) for each physical unit or load with an associated MO assigned generator pricing zone or customer pricing zone respectively, certified Metering Provider, financial and business information required by PEM (such as EFT information, account ID, routing numbers, bank, corporate data, addresses, contacts, MO authorized prudential limits, etc. (refer to Section 5). that it applies only to generators] | Text | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 3 | Validated offers, bids, schedules from each valid Market Participant for each trading period submitted: Each offer, bid or schedule shall be submitted using an approved MO template; Each template shall provide for the data field identified by this Data Input Table as defined by the following data field descriptions | All | MP | MMS |
| 4 | Offers & bids shall be date and time stamped received by MO: This will be the time used to determine validity with respect to allowed period for submittal | Date | MP | MMS |
| 5 | Each Offer/Bid shall designate: Commodity type Identifier to include initial provision for: (1) energy, generation offer; (2) energy, customer demand bid (corresponding with dispatchable load); (3) Ancillary Service, Customer contingency reserve offer regarding dispatchable load; (4) Ancillary Service, regulating reserve offer; (5) Ancillary Service, contingency, spinning reserve offer; (6) Ancillary Service, contingency, non-spinning reserve offer; (7) Ancillary Service, contingency, replacement reserve (future) offer; (8) Ancillary Service, Black-start service offer; (9) Ancillary Service, generation reduction offer to provide reactive support; (10) Ancillary service, Other (future); and ten additional initial categories, with ultimate accommodation of fifty commodity types; Each commodity type shall be capable of accommodating eight subsets thereof | Codes TBD | MP | MMS |
| 6 | Commodity type offered/bid: Each template shall allow initially for up to twenty different commodity types, with provision to accommodate 24 trading periods in each 24-hour calendar day; ultimately sized to accommodate expanded template to accept thirty different commodity types in any or all of 288 trading periods in each 24-hour calendar day | Text & times | MP | MMS |
| 7 | Commodity trading period to which submittal applies: Beginning and ending times for each commodity type in the specified trading period(s); default will use first entered submittal date for each time segment, unless flagged as standing bid | Times | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 8 | Contractor shall provide for commodity trading period "standing bid" flag as allowed by PEM, with beginning date and time and ending date and time for each commodity type | Code TBD | MP | MMS |
| 9 | Non-Participant Participation ID: Market Participant Registration Number (ID) shall also apply for non-participant identification *if applicable in the future* | TBD | MP | MMS |
| 10 | **Fixed Contracts** Fixed Contract Data submitted as contract table in MO defined format including but not limited to: MP name, registration number, contract type (code to be determined by MO), contract number or identifier, commodity type, contract effective date, contract expiration date, values and prices table, physical location each of plant/unit/load, connection point and associated node and pricing zone, limits/conditions/restrictions; this input will be received and flagged; MO authorization and approval is required for implementation | Various | MP SO (if applicable) | MMS |
| 11 | NOTE REGARDING CORRECTED MP MARKET OFFER/BID SUBMITTALS: Flags for corrected submittals are not included herein: The most recent of any valid offer, bid, or schedule for any valid specified trading period or subset thereof, submitted to and processed by MO shall prevail with regard to any earlier submittal: In the event multiple transactions were offered/bid in an earlier submittal and the most recent submittal includes only a subset thereof, only the transactions resubmitted shall constitute change(s) | Various | MP | MMS |
| | **Market Commodity Submittals** | | | |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 12 | Back-start, Contingency, Ancillary Service, generation offer, unit specific data: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block, Start-up time (Minutes from request to synchronizing my not be less than cold start time in standing data), sustained response rate offered (MW/minute may not exceed governor ramp rate), response to begin immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-600 minute range with 60 minute default setting, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," status flag to indicate fixed contract or market offer (Contractor shall provide for fixed term contract and possible future offer pricing) must include operating range equal or less than that in the standing data, must include governor ramp rate (up) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data | Various | MP | MMS |
| 13 | Black start unit specific data and unit cold-start data (values, time to synchronize, loading ramps, forbidden zones) if reported via SO | All | MP SO If applicable | MMS |
| 14 | Constrained re-dispatch Δ input or request (as applicable) | MW | EMS | MMS |
| 15 | Constraint definitions and associated data (limits) by location/equipment, limit, allowed deviation per duration, trigger points, deadbands | All | MP SO If applicable | MMS |
| 16 | Date and time submitted | Date | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 17 | Energy reduction, Ancillary Service, action required to provide reactive support: Flag as generation offer or requested response, unit specific, reduction shall be specified in MW per each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable: this may not apply, so zero entry may be selected), must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation reduction, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," operating range equal or less than that in the standing data, offered rate of reduction (MW/minute not to exceed governor ramp rate down), governor ramp rate down (MW/minute) not to exceed those in standing data, and maximum MW will not exceed maximum rating in standing data | Various | MP | MMS |
| 18 | Energy, Customer demand bid, load specific: Must correspond with certified dispatchable load, MW per each of 1-10 blocks per take-off point, must equal or exceed minimum block size (user enterable), must include monotonically decreasing prices (Pesos), must begin from a zero off-take, may have negative prices, all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 19 | Energy, generation offer, unit specific: MW specified in each of 1-10 blocks, each block size must equal or exceed specified MW minimum value (user enterable), must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation, may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down (each in MW/minute) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data | Various | MP | MMS |
| 20 | MP notification messages regarding availability or other market communications (in MO specified template), receipt to be automatically logged, flagged, and displayed as received MP communication | Text | MP | MMS |
| 21 | Other submitted, if authorized agent of MP | TBD | MP | MMS |
| 22 | Outage schedule requests by location/plant, equipment ID, time scheduled out/in, dates, related de-ratings or other impacts, with trailer information [process to be determined] | Text | MP/SO | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 23 | Reserve, Ancillary Service, Customer replacement reserve offer (FUTURE), load specific: Must correspond with certified dispatchable load, MW per each of 1-3 blocks per connection point, must equal or exceed minimum block size (user enterable), maximum response level representing maximum MW decrease attributable to this control action from load MW immediately prior to this control action (with change caused directly by this control action), Maximum proportion of the forecast/scheduled load that may be interrupted (user enterable as either percentage of total before control action or MW value), time required to execute reduction (1-10 minutes), must include monotonically increasing prices (Pesos), all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 24 | Reserve, Ancillary Service, Customer reserve offer, load specific: Must correspond with certified dispatchable load, MW per each of 1-3 blocks per connection point, must equal or exceed minimum block size (user enterable), maximum response level representing maximum MW decrease attributable to this control action from load MW immediately prior to this control action (with change caused directly by this control action), Maximum proportion of the forecast/scheduled load that may be interrupted (user enterable as either percentage of total before control action or MW value), time required to execute reduction (1-10 minutes), must include monotonically increasing prices (Pesos), all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 25 | Reserve, Contingency, Non-Spinning, Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Start-up time (Minutes from request to synchronizing may not be less than cold start time in standing data), Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-60 minute range with 20 minute default setting), sustained response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 26 | Reserve, Contingency, Replacement (FUTURE), unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Start-up time (Minutes from request to synchronizing my not be less than cold start time in standing data), Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-600 minute range with 60 minute default setting), sustained response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 27 | Reserve, Contingency, Spinning, Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon request and provide full capacity within a specified period (user enterable 1-10 minute range with 10 minute default setting), Response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 28 | Reserve, Regulating (AGC), Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response (Raise and Lower) for this commodity from the operating point, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum and maximum dispatch level (MW) at which maximum raise and lower reserve response will be respectively available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, AGC response rate (MW/minute raise and MW/minute lower)) for providing regulation (must begin automatic response immediately upon control command), AGC response rate offered (MW/minute may not exceed governor ramp rate), prices must fall between the market price floor (user enterable) and the market price cap (user enterable) if specified by PEM (future), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, maximum MW may not exceed maximum rating in standing data, and response up or down may not exceed real capacity available, status flag to indicate fixed contract or market offer | Various | MP | MMS |
| 29 | Schedules, load forecasts, and other (FUTURE) capabilities shall be accommodated by the Contractor (100 additional future inputs with associated tables) | Various | MP | MMS |
| 30 | Security local must-run generation requirements, by Region and unit specific (if allowed by PEM) | MW | SO | MMS |
| 31 | SO changes or updates for Nonscheduled demand, pricing node specific (if applicable, time, MW values, all data per PEM ) | MW | SO | MMS |
| 32 | SO will submit data through the MP Web based interface for data transfers that are incremental to MP market offer/bid information | Note | Note | Note |
| | **Note On Future Potential Market Changes** | | | |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 33 * Note | At the time of Specification preparation, the extent of non-participant role in the grid and market is unknown. The specification is based upon the Market Rules published in January 2001. | Note | Note | Note |
| 34 | IF APPLICABLE, Non-participant customer schedules, energy (load specific, MW blocks, beginning and ending scheduling times HHMM in 24-hour military time format, values, limits, parameters) in lieu of offers/bids* | Various | SO | MMS |
| 35 | IF APPLICABLE, Non-participant generator and customer offers/bids, reserve class (unit/load specific, MW blocks, beginning and ending trading times HHMM in 24-hour military time format, values, limits, parameters)* | MW | MP/GEN | MMS |
| | **MMS Data From The Metering Provider** | | | |
| 36 | Market interval meter data for each trading period, each resource, each commodity type (includes trailer data). Refer to Metering specifications for detail. This data shall be deposited in the meter data acquisition and processing application of MMS where it shall be made settlement-ready and stored in the meter data warehouse | Meter data (all) | Metering Provider | MMS |
| | **MMS Data From The SO**<br>The following data transfer is included as EMS-MMS Data Exchange Data and is also referenced herein | | | |
| 37 | Actual calculated system load from EMS-SDLF (if applicable) | MW | EMS | MMS |
| 38 | Actual MW per each congestion point | MW | EMS | MMS |
| 39 | Actual unit MVAR 4 digit field + 2 decimal places all | MW | EMS | MMS |
| 40 | Actual unit Status (on-off) & flag change | Status | EMS | MMS |
| 41 | All grid related data that may be updated by MPs (see first part of this table) and provided by defined process to the SO, for SO to report to MO | Various | SO | MMS |
| 42 | Interchange MW total by each Region tie + sum including any dynamic scheduling across ties | MW | EMS | MMS |
| 43 | Message Exchange information | Various | SO | MMS |
| 44 | MW rate of change monitor: MW/min change 5 sec interval each for A/S providing units (if applicable & origin is EMS) | MW | EMS | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 45 | Network model, electronic transfer, including all parameters, constraints, logical definitions [transfer link type to be determined] | All | EMS | MMS |
| 46 | Nonscheduled generation projection (time, MW, values, all data per PEM) | MW | SO | MMS |
| 47 | Outage schedules, approved and rejected by location/plant, equipment ID, time scheduled out/in, dates, related de-ratings or other impacts, with trailer information [process to be determined] | Text | MP/SO | MMS |
| 48 | Requests for re-dispatch based upon grid security reasons | Various | SO | MMS |
| 49 | Reserve minimum and target requirements, non-unit specific by trading period, (input source to Market Optimizer output by Region) | MW | SO | MMS |
| 50 | SCADA data update: Raw data for monitoring unit market performance, particularly for units providing ancillary services. This data is a subset of the SCADA data category, such as for units providing selected ancillary services that shall be provided to the MMS at separate (from the greater set) user enterable intervals (5, 10, 15, 30, 60 minutes, default 60), or as triggered by a requested run of optimizer, or by a defined trigger event to be furnished by EMS (such as ACE value exceeded, minimum reserve value trigger, CB trips, etc.) | Various | EMS | MMS |
| 51 Note | SCADA data update near-real-time for use by Market Optimizer application: Most points are to be regularly provided in user enterable intervals (5, 10, 15, 30, 60 minutes, default 15) or as triggered by a requested run of optimizer, or by a defined trigger event to be furnished by EMS (such as ACE value exceeded, CB trips, etc.); A subset of points such as for units providing selected ancillary services, shall be provided to the MMS at separate (from the greater set) user enterable intervals (5, 10, 15, 30, 60 minutes, default 60), or as triggered by a requested run of optimizer, or by a defined trigger event to be furnished by EMS (such as ACE value exceeded, minimum reserve value trigger, CB trips, etc.) | Note | Note | Note |
| 52 | SCADA/EMS Limited remote visibility as authorized by SO [for consideration by SO] | SCADA | EMS | MMS |


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| Item | MMS Data Input Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 53 | Transmission path over operating limit (.9-1.1) x 100 by path name & MW Δ (User enterable) | MW | EMS | MMS |
| 54 | Unit specific, SO changes or updates for High/low MVAR limits (Q max-min) | MW | EMS | MMS |
| 55 | Unit specific, SO changes or updates for High/low operating limits | MW | EMS | MMS |
| 56 | Unit specific, SO changes or updates for High/low regulating limits | MW | EMS | MMS |
| 57 | Unit specific, SO changes or updates for Unit reserve monitor MVAR, unused – MVAR | MW | EMS | MMS |
| 58 | Unit specific, SO changes or updates for Unit reserve monitor MVAR, unused + MVAR | MW | EMS | MMS |
| 59 | Unit specific, SO changes or updates for Unit reserve monitor MW, unused capacity (if applicable) | MW | EMS | MMS |
| 60 | Violations and trigger events, data, and updates as may be required incremental to normally scheduled data output to MMS | Various | EMS | MMS |

**High Level MMS Input Information**

MP's offers and bids each include the data as required by PEM with all details. MW/Hr refers to MW value for an interval; by default the interval is an hour period. Supplier is responsible for design and PEM compliance. Supplier shall supplement this listing as required. . Content will as applicable include: Market Participant approved name or acronym, registration code, plant or location ID, unit or equipment ID, commodity type, contract ID when applicable, commodity type, trading interval to be applied including beginning and ending times HHMM (24-hour military time format), time submitted, value of commodity (includes ramps up/down for ancillary services) per block, operating limits, forbidden zones, loading ramps as applicable, prices (if SO EMS market functionality is to be used as a back-up to the MO MMS) dead-bands/bandwidths/deviation as applicable, flags/identifiers and trailer information required by PEM.

### 3.3.2 *Outputs*

The dispatch process will produce the following outputs, for each dispatch period:

- The cost of the solution;
- Generation output levels (MW) for each generator offer band;
- Operating reserve for each operating reserve class and offer band;
- Scheduled load for each demand bid band;
- Transmission line flows;
- System losses by transmission line and in aggregate;
- Nodal energy prices at each node;
- The regional operating reserve price for each class of operating reserve;


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- The largest contingency for each region; and
- Non-zero violation variable values.

These data will be transmitted to three separate functions and shall be formatted specifically for each. Table 3.3-2 provides additional information regarding Output Data.

**Table 3.3-2: High Level Data Output Requirement For MMS**

*MMS= market management system; MP= Market Participant; SO= System Operator; EMS= energy management system (operated by SO)*

| Item | MMS Output Information, Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 1 | Actual calculated system load from MMS-SDLF (if applicable) | MW | MMS | EMS |
| 2 | Actual reserve capacity available per Region (area if applicable) as feed-back, originates with SO) | MW | MMS | EMS |
| 3 | Area load scheduled MW per Region | MW | MMS | EMS |
| 4 | Black start resource stack with values, limits, ramps and pricing thereof | All | MMS | EMS |
| 5 | Congestion data parameters: bandwidths, triggers, limit and duration of allowed violation (data originates in SO and is fed-back) | All | MMS | EMS |
| 6 | Constrained re-dispatch Δ (if applicable & MMS origin), includes details of re-dispatch blocks/values, Plant/location ID, Equipment ID, commodity, trading period start/end, and associated data | MW | MMS | EMS |
| 7 | Energy & reserve pricing data for resources selected in the stack in Pesos per MWh and Pesos per MW, respectively as required by PEM | Pesos | MMS | Market |
| 8 | For Settlement related output, refer to Settlements specifications | Various | MMS | Settlement |
| 9 | Load, non-spinning reserve contribution [include for future- no current provision in PEM] | MW | MMS | EMS |
| 10 | Load, non-spinning reserve max interruptible MW (dispatchable load) | MW | MMS | EMS |
| 11 | Load, replacement reserve non-spin contribution [include for future- no current provision in PEM] | MW | MMS | EMS |
| 12 | Market interval meter data (includes trailer data) as accessed by authorized Metering Providers | kWh | MMS | Metering Provider |
| 13 | MOD (resource stacks: energy gen/load, reserve capacity) schedules, MW by HE, each trading interval, prices*, multiple trading intervals as required by PEM | MW | MMS | EMS |


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| Item | MMS Output Information, Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 14 | MW rate of change monitor MW/min change 5 sec interval each for A/S providing units | MW | MMS | Audit |
| 15 | MW scheduled per each congestion point | MW | MMS | EMS |
| 16 | Net area scheduled MW interchange [check sign convention] between Regions as applicable | MW | MMS | EMS |
| 17 | Offers/Bids/Schedules: Confirmation and rejection notification with associated data including MP/GEN ID, trading commodity, blocks/values, trading period start/end, offer/bid price*, acceptance or rejection (reason if rejected) | Various | MMS | Market Participant |
| 18 | Projected load flow summaries, including key lines and all congestion paths, grid losses, etc. | MW | MMS | EMS |
| 19 | Projected market cost of each dispatch solution | All | MMS | Audit & MO |
| 20 | Public Market information, MO Website, per PEM | Various | MMS | Website |
| 21 | Reactive and voltage schedules, unit and device specific: Any associated prices* if allowed per PEM for MW change to provide MVAR (seven digit field, provided to three decimal places). This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MVAR | MMS | EMS |
| 22 | Region (and area if applicable) non-unit specific: Minimum scheduled reserve and available reserve totals (as well as unit specific reserve data listed herein) | MW | MMS | EMS |
| 23 | Region interchange schedule ramp time begin/end time & min: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 24 | Restricted Market Information, MO Website, per PEM | Various | MMS | Website |
| 25 | Scheduled total MW for each Regional tie point | MW | MMS | EMS |
| 26 | Unit high regulating limit MW limit schedule Δ MW; this shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |


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| Item | MMS Output Information, Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 27 | Unit high/low non-spin limit schedules Δ MW [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 28 | Unit high/low replacement reserve limits scheduled [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 29 | Unit low regulating limit MW limit schedule Δ MW: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 30 | Unit MW non-spinning reserve contribution [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 31 | Unit non-spin reserve sustained ramp rate MW/min [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 32 | Unit non-spin time to synchronize in minutes [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | Min. | MMS | EMS |
| 33 | Unit offer price* curves: regulation, spin, non-spin (if required to EMS as form of MOD) | MW | MMS | EMS |
| 34 | Unit preferred (target) operating point: POP in MW includes provision for A/S AGC signal as applicable and AGC equipped units not selected for regulation, but moving POP automatically. Ancillary service data shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 35 | Unit regulation sustained ramp rate in MW/min steps (to be enterable by user from range 1-10 steps) for units selected for regulation: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |


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| Item | MMS Output Information, Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 36 | Unit replacement reserve contribution MW [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 37 | Unit replacement reserve time to synchronize in min [include for future- no current provision in PEM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | Min | MMS | EMS |
| 38 | Unit scheduled MW, unit specific, blocks, each 4 digit field+2 decimal places with commodity type selection | MW | MMS | EMS |
| 39 | Unit specific cold-start characteristics, time to synchronize, loading ramps, and any forbidden zones | All | MMS | EMS |
| 40 | Unit specific MW spinning reserve MW contribution: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 41 | Unit specific, dispatch table summaries for ancillary services, by each separate category | MW | MMS | EMS |
| 42 | Unit specific, dispatch table summaries for energy | MW | MMS | EMS |
| 43 | Unit spinning reserve hi & low limit schedules Δ MW: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 44 | Unit spinning reserve sustained MW ramp rate MW/min: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch and for ancillary service dispatch | MW | MMS | EMS |
| 45 | Note: Refer to MP interface data for MMS output to MPs via secure or public web-based mechanisms | Various | MMS | MPs |

* Prices will be provided to SO only if SO EMS will be used in a role as a MMS back-up function

## High Level MMS Output

MO's offer, bid, and schedule acceptance/rejection to MPs include the data as required by PEM with all details. MW/Hr refers to MW value for an interval; by default the interval is an hour period. Supplier is responsible for design and PEM compliance. Supplier shall supplement this listing as required. See Settlements for other. All data will as applicable include: Market Participant approved name or acronym, registration code, plant or location ID, unit or equipment ID, commodity type, contract ID when applicable, commodity type, trading interval to be applied including beginning and ending times HHMM on 24-hour military time format, time submitted, value of commodity (includes ramps up/down for ancillary services) per block, operating limits, forbidden zones, loading ramps as applicable, prices (if SO EMS market functionality is to be used as a back-up to the MO MMS), dead-bands/bandwidths/deviation as applicable, flags/identifiers and trailer information as may be required by PEM.


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Information to be posted will be in compliance with PEM including but not limited to prices, congestion data, loads (projected and actual), non-unit specific resources, losses, market summaries, and conditions. See Market Participant interface data for web data and other public information.

1. Market Operator (MO)

   The MMS will automatically check the results of each dispatch for errors, data inconsistencies and overall validity of the results. All data, including that prepared for transmittal elsewhere, shall be made available to the MO along with automated system error messages. The MO will provide a manual check of MMS Settlements output to determine if the data should be forwarded to others or if a rerun with revised input data is required. The Contractor shall provide user friendly tools to assist in a manual check and review of all MMS processes, including Settlements. The MMS shall provide the MO with (a) screen summaries, organized reports, and alarm flags for errors, rejections, missing data, process failure, time-out, non-convergence of network applications (if applicable), and other anomalies along with adequate descriptive text explanations for each, (b) user friendly tools for authorized access to data, (c) high speed archiving and retrieval processes, (d) Index pages including text and object format, and (e) full compliance with these specifications, including sizing and performance.

2. System Operator (SO)

   The SO will receive from the MO the dispatch schedule (stacks) required for system operation and dispatch for each trading interval. The data shall comprise:

   - Generation Output target Levels (preferred operating points) for each Generator;
   - Operating Reserves, unit and value specific;
   - Scheduled Loads per Trading Node; and
   - Transmission Line Flows.

   The data shall be forwarded via the MMS-EMS LAN as described in MMS-EMS Data Exchange and Interface Requirements.

3. Market Participants (MP)

   The MP will be provided the market cost data for each market trading node for each trading interval for which dispatch was run. These data shall be made available in accordance with the PEM Timetable and with access as described under PEM E-Commerce.

## 3.4 Dispatch Engine

The dispatch scheduling and pricing process will involve a mathematical optimization algorithm. It will determine the optimal schedules for each individual time period (dispatch interval) given the bids and offers and the constraints imposed on the dispatch, and corresponding prices. The functionality that shall be required for the "dispatch engine" includes the following:


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1. Processing validated bids, offers, and schedules accepted by MMS;
2. Process system model (SCADA) data and complete state estimation as required (this must run consistently in real-time with data supplied by SO);
3. Execute a system analysis process to evaluate grid congestion, system security, and provide a market optimization result;
4. Based upon the market optimization, prepare pricing for each pricing zone and node as required by PEM and prepare separate Merit Dispatch Order (MDO) stacks for energy and reserve resources, based upon least total cost considering all market commodities and system projected requirements; and
5. Upon occurrence of significant change in system conditions and if deemed necessary by SO or MO, a re-run of the optimization and MOD shall be executed with subsequent notifications and re-scheduling in accordance with PEM.

### 3.4.1 Dispatch Algorithm

The dispatch order for energy and reserve resources, as well as the pricing, shall be provided by the dispatch algorithm. The dispatch "stack" or Merit Order Dispatch (MOD) shall provide dispatch targets or Preferred Operating Points (POPs) for the end of the respective trading interval. This process will calculate prices in accordance with the Market Rules. The Contractor shall provide for separate "stacks" for energy and for reserve market commodities, based upon spot pricing at all trading nodes (zones as applicable) and reserve regions and calculated energy and reserve prices.

The optimization is intended to maximize the value of the dispatched load, by optimizing the energy and reserve selection (by cost analysis) and considering constraints and associated potential violation penalties.

The MDO or resource schedule shall be furnished to the SO/EMS for implementing energy schedules, reserve allocation, and AGC dispatch control in accordance with the PEM Rules.

The dispatch (allocation) of energy and reserve resources shall be based upon the following specific considerations deemed to be applicable to the respective trading interval(s), node, and zone:

1. Generation energy offer;
2. Generation reserve offer (regulation and contingency classes);
3. All limits, constraints, de-ratings, and projected values (unit, resource, and grid related);
4. All validated rates of change: governor ramps (up & down), AGC ramps (up & down);


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5. Start-up times;
6. Load interruption times;
7. Forecasted or calculated non-scheduled load;
8. Scheduled load;
9. Reserve requirement constraints (minimum requirements) for each reserve region;
10. Status of resources and facilities, availability, scheduled outages, commitment;
11. Grid constraints within or between Regions (by path and MW Δ);
12. Electric network (grid) configuration and status of lines, units, and equipment impacting kV, MVAR, Impedance/Admittance, stability, power transfer or ability to serve loads;
13. HVDC link constraints and capabilities;
14. Energy balance equations for each node in the market network model;
15. Power flow analysis completed by approved methodology (AC or DC model, if DC modeling, it shall include approximation of AC load flows within AC sub-systems);
16. Constraints applied by either the System Operator or Market Operator;
17. System security or reliability constraints in addition to those noted above;
18. Actual loads, flows, and voltages from real-time grid data supplied by SO;
19. Updates of load forecasts or condition change from resources and grid; and
20. Contingency occurrence for loss of SO or MO systems, or declared Emergency.

### 3.4.2 Security Constrained Dispatch Algorithm

The Security Constrained Dispatch Algorithm is central to the integrity and success of the PEM. The algorithm has been defined in the Market Rules and will be given to potential Contractors separately. Strict conformance to the algorithm is mandatory. The Market Rules, however, allow two potential implementations, a Basic and an Advanced algorithmic solution.

#### 3.4.2.1 Basic Algorithm

The basic algorithm described in the Market Rules utilizes a Linear Programming solver to produce a least cost schedule based on energy and reserve offers and bids from Market


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Participants. It produces energy and reserve schedules for Generators and Customers and nodal spot prices.

#### 3.4.2.2 Advanced Algorithm

The more advanced algorithm additionally handles voltage control within the optimal dispatch. It takes a more sophisticated approach which is of interest to the MO but introduces an element of risk which requires evaluation.

#### 3.4.2.3 Contractor Recommendation

The MO would like to have the Contractor's recommendation for the algorithm to be used, based on previous experience with the technique being promulgated, the potential benefits and the associated risk. The paramount concerns of the MO are:

- On-time MMS Operations;
- Stability of market operations; and
- Integrity and Acceptance of the PEM.

The MO will make the final decision as to algorithm to be used based on its evaluation of Contractors' proposals.

## 3.5 Energy And Reserve Dispatch Selection

The broad guidelines and detailed components described in this specification shall be used by the Contractor in preparing the market clearing processes. In addition, it has become apparent in other markets, that the methodology should include a resource selection process that includes simultaneous analysis of all market commodities, rather than a serial selection from single market commodities. CALISO terms their process "Rational Buyer." The PEM is not identical to the California market, but there is a necessity for a "simultaneous methodology" that results in the lowest total cost for the market commodities purchased.


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### 3.5.1 *"Total" Evaluation And Resource Selection*

The evaluation and selection of energy and reserve commodities shall conform to the PEM Rules.

Additionally, the evaluation shall take into consideration the price and availability of all commodities and the quantity of each commodity required by SO security constraints. Then, for example, if it is more cost effective to buy regulation reserve in lieu of a part of the contingency reserve, or to buy and call upon contingency reserve for energy at lower cost than a segment of energy, then the evaluation takes into consideration the "best overall" resource mix to acquire, rather than looking to fill only one commodity type with the offers made for that one commodity type. In every case, the MO shall meet the SO regulation and contingency requirements and the system energy requirements.

| Item | Market Commodity | Required | Evaluate by |
|---|---|---|---|
| 1 | Energy offered | MW | Price, include price and quantity of reserve classes |
| 2 | Reserve, regulating offered | MW | Price, include price and quantity of other reserve classes as allowed |
| 3 | Reserve, contingency offered | MW | Price, include price and quantity of other reserve classes as allowed |
| 4 | Reserve, contingency offered (future classes) | MW | Price, include price and quantity of other reserve classes as allowed |

**Total Resource Selection Consideration**

### 3.5.2 *Maximize the Gains from Trade*

The dispatch scheduling and pricing process is intended to minimize the overall cost of energy to the end user. It will match supply with demand and losses in each dispatch period, and in each location, so as to simultaneously minimize the cost of providing energy and operating reserve while obeying the constraints on the dispatch.


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### 3.5.3 *The Transmission Network*

- The dispatch process will represent power flow relationships between locations in the transmission network;
- The dispatch process will approximate an optimal power flow with explicit representation of electrical flows on each transmission element;
- Limits on transmission flows in either direction of flow will be explicitly represented; and
- Transmission losses will be represented as a function of transmission line flow.

### 3.5.4 *Operational Reserve Constraints*

The dispatch process will simultaneously optimize energy and operating reserve schedules, respecting the tradeoff between energy and operating reserve capabilities of each plant:

- Operating reserve shall be scheduled to meet regional requirements defined in accordance with specified standards;
- Immediately following an outage, the operating reserve requirements may be reduced while operating reserves are restored in line with specified standards;
- The SO may use the dispatch algorithm after the contingency to restore the system to a new optimal dispatch. Using as inputs the most recent plant availability and transmission capabilities;
- Each class of operating reserve offer in a region shall be used to meet the requirements for that class of operating reserve in that region alone;
- Initially, the HVDC links will not be deemed to be available to supply reserves in an adjacent region;
- The reserve requirements in each region shall be defined by a set of candidate transmission lines and generator contingencies, by minimum reserve requirements, and by any MO defined scaling factors;
- The amount of capacity a Participant is scheduled for one class of operating reserve will be independent of the amount it is scheduled for another class of operating reserve;
- Initially, there is only one class of operating reserve; spinning reserve with a 5 second response time sustainable for 30 minutes; and
- The penalty cost incurred due to a shortfall in any class of operating reserve may be allowed to impact the energy price.


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### 3.5.5 Constraint Violation Variables

The Contractor shall provide for a dispatch process that will include violation variables which will allow it to automatically violate transmission and MO/SO imposed operational constraints (but not bids or offers, or the physical limits on participant plant) in situations where no solution would otherwise exist:

- Violation variables will be subject to a (typically high cost) penalty to discourage their use;
- Different penalties may apply for each of the various transmission and operating constraints, reflecting the relative flexibility of these limits;
- The use of violation variables will indicate that a feasible schedule is possible as long as some constraints are relaxed. If it is not acceptable to relax these constraints in reality then the input data must be revised and the problem re-solved. If it is acceptable to relax these constraints then the solution should be accepted;
- The penalties used by the MO for an accepted schedule will be allowed to influence published prices; and
- Penalty values must be approved by the MO Board.

### 3.5.6 Load Curtailment

If nonscheduled load cannot be satisfied, the procedures for the dispatch scheduling and pricing process have yet to be determined. It is anticipated that when load has been shed the algorithm is run in two modes:

- With estimated load to determine the nodal prices; and
- With shed load, as determined by the SO, to determine the dispatch quantities.

### 3.5.7 Inter-Temporal Linkages

The dispatch process will solve one dispatch period at a time, but will respect generator and scheduled load ramp-rate limits between hours, going forward.


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## 3.6 Verification of Ancillary Service Providers

The MO intends, as part of its certification process, to verify the ability of Ancillary Services Providers to meet their Offers and Commitments. The MMS shall provide for supporting testing and retention of certification status in accordance with the following.

The current MO test approach is intended to initially test the performance of a resource wishing to provide Ancillary Services. The objective is to measure the response of these resources to a variety of dispatch instructions to determine the successful capabilities. The results of such tests are intended to reveal the resource is that capable of being certified for, the successful quantities tied to such certification, and the general limits of the resource including a unit's ability to meet the obligations of the power factor range under the PEM. The time period typically required to perform such testing will be 1 hour. The MO, however, may determine the need to test a unit for the entire 2-hour period.

- The objective of the test is to validate unit minimums, maximums, ramp rates, and if the system conditions support such, the VAR capabilities of the unit. The results of such testing may enable the MO to certify a unit for more than one reserve class. Should the MO certify a unit for multiple services using this "integrated testing" approach, such certification for a service resulting from the integrated approach, absent the specific test, will not relieve the unit from its obligations to provide such service. Further, failure to provide a certified service may result in the application of any appropriate penalties and sanctions as approved by PEM.
- If time permits, the MO intends to verify the various stated ramp rates, but at a minimum will verify the maximum stated ramp rate.
- The SO or generation owner for the unit will NOT manage the energy of the unit, rather the MO will dispatch the unit for the purposes of the test. This is to minimize the variables that the MO and SO have to manage during the test.
- The MO will use the observed EMS/MO data for verification of the stated values. The lower of either the stated or tested quantities may be used by the MO in determining the data contained in the MO Master File.
- Instrumentation error is acknowledged and values observed and noted during the test will consider this tolerance should a unit not achieve its stated value.
- Following the conclusion of the test, the MO will notify the tested resource of the successful quantities the resource is now certified to provide or not certified to provide.
- The MO, in conjunction with the SO, will perform unannounced tests of resources certified for Ancillary Services following the completion of all Ancillary Services testing.


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## 3.7 Market Clearing Details

*Sections 3.7, 3.8, and 3.9 are comprised primarily of data supplied by the final **Mathematical Formulation of Market Clearing Engine** dated 13 September, 2000, prepared for Philippines Government (DOE/NPC/ERB) by PHB Hagler Bailly Asia Pacific Limited. These parties are gratefully acknowledged for the PEM market clearing detail provided herein. This information is provided as a guide to details of definitions, parameters, terms, indices, and variables intended for inclusion in the market clearing process.*

All variables and parameters are non-negative except where stated.

The word "dispatched" is used when describing the meaning of some variables. For example, "Generation" is the MW generation dispatched corresponding to offer g∈ **OFFERS**". This means the generation the algorithm calculates, rather than the actual generation.

### 3.7.1 Time

The formulation presented represents a single dispatch period. For multiple period dispatch the single period model is run for each period with the ending conditions of one period forming the starting conditions of the next.

### 3.7.2 Fundamental Sets and Indices

#### 3.7.2.1 Areas

An area is represented by an element of the set **AREAS** and is indexed by $a$.

Areas are used in the operating reserve parts of the formulation. The formulation is predicated on the areas being defined as Luzon, Visayas and Mindanao. Since a generic formulation for any configuration of areas is difficult, the formulation of some of the constraints would need to be changed for a different set of areas.


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#### 3.7.2.2 Generation Offers

A generation offer is represented by an element of the set **OFFERS** and is indexed by $g$.

A generation offer has, associated with it, an area and a node. The spot energy offer is a gross offer. That is, it is not net of embedded wholesale market load.

For operating reserve purposes, a subset of **OFFERS** called $\mathbf{AREARISKGENERATORS}_a$ is defined. This subset is used to determine the potential risk due to generator outages in each area. A subset is used because not all offers represent a potential risk.

Each element $g \in$ **OFFERS** has a corresponding set of offer blocks, $\mathbf{GENERATIONOFFERBLOCKS}_g$.

**SECURITYGENERATIONGROUP**, is subset of generation offers $g \in$ **OFFERS** for which the dispatched generation is constrained by security constraint $v$.

#### 3.7.2.3 Purchase Bids

A purchase bid is represented by an element of the set **BIDS** and is indexed by $p$.

A purchase bid has, associated with it, an area and a node. The spot purchase bid is a gross bid. That is, it is not net of embedded wholesale market generation.

Each element $p \in$ **BIDS** has a set of load blocks, $\mathbf{PURCHASEBIDBLOCKS}_p$.

#### 3.7.2.4 Operating Reserve Offers

An operating reserve offer from either a generator or interruptible load provider is represented by an element of the set **RESERVEOFFERS** and is indexed by $r$. As with generation offers and purchase bids, an operating reserve offer has associated with it an area and a node. Each operating reserve offer is also associated with a reserve class and a reserve type.


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Each element $r \in$ **RESERVEOFFERS** has a corresponding set of offer blocks, **RESERVEOFFERBLOCKS**$_r$.

#### 3.7.2.5 Operating Reserve Classes

An operating reserve class is represented by an element of the set **RESERVECLASSES** and is indexed by *c*.

**RESERVECLASSES** = *{5 second}*

#### 3.7.2.6 Operating Reserve Types

An operating reserve type is represented by an element of the set **RESERVETYPES** and is indexed by element *s*.

**RESERVETYPES** = *{SYNCH,NONSYNCH,IL}*

SYNCH is synchronous spinning reserve which can be provided by any generator. *IL* is interruptible load which can only be provided by purchasers.

#### 3.7.2.7 Regulating Reserve Offers

A regulating reserve offer from a generator is represented by an element of the set **REGULATIONOFFERS** and is indexed by *f*. As with generation offers and purchase bids, a regulating reserve offer has associated with it an area and a node.

Each element $f \in$ **REGULATIONOFFERS** has a corresponding set of offer blocks, **REGULATIONOFFERBLOCKS**$_f$


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#### 3.7.2.8 AC Nodes

A node is represented by an element of the set **ACNODES** and is indexed by *n*. Associated with a node is an area.

**SECURITYACNODESGROUP**$_v$ is the subset of nodes $n \in$ **ACNODES** for which the net injection at *n* is constrained by security constraint *v*.

#### 3.7.2.9 AC Lines

An HVDC line is represented by an element of the set **HVDCLINES** and is indexed by *k*. There is a "conventional" direction for these lines but this does not imply a direction of flow.

An undirected AC line is represented by an element of the set **ACLINES** and is indexed by *k*. There is a "conventional" direction for these lines but this does not imply a direction of flow.

Each element $k \in$ **ACLINES** has a corresponding set of flow blocks, **ACLINEFLOWBLOCKS**$_k$

**SECURITYACLINESGROUP**$_v$ is subset of lines $k \in$ **ACLINES** for which the flow is constrained by security constraint *v*.

#### 3.7.2.10 Security Measures

A security measure is represented by an element of the set **SECURITY** and is indexed by *v*. The SO may set parameters in these security measures so as to maintain system security and adequacy.

Two complementary subsets of **SECURITY** are **SECURITYMIN** and **SECURITYMAX**, representing the constraints which impose a minimum level, and those which impose a maximum level, respectively.


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#### 3.7.2.11 Violation Variables

The formulation contains a number of violation variables which allow certain constraints to be violated to some extent but with a high penalty cost. These variables have a number of blocks, so that the per unit penalty can be increased for larger violations. The sets used are:

For each $n \in$ **ACNODES,**

**DEFICITGENERATIONBLOCKS**$_n$

**SURPLUSGENERATIONBLOCKS**$_n$

For each $a \in$ **AREAS,**

**DEFICIT5SECRESERVEBLOCKS**$_a$,

**DEFICITSYNCH5SECRESERVEBLOCKS**$_a$,

**DEFICITREGULATIONBLOCKS**$_a$

For each $v \in$ **SECURITYMIN,**

**DEFICITSECURITYBLOCKS**$_v$

For each $v \in$ **SECURITYMAX,**

**SURPLUSSECURITYBLOCKS**$_v$

For each $g \in$ **OFFERS**

**DEFICITRAMPRATEBLOCKS**$_g$, and

**SURPLUSRAMPRATEBLOCKS**$_g$

### 3.7.3 Derived Sets

There are numerous subsets of the fundamental sets that are of interest. A subscripted fundamental set represents all elements of the set that have the attribute represented by the subscript, where the subscript is either the unique index identifier or a set of specified elements of another fundamental set.

Examples of derived sets are:

1. **OFFERS**$_a$ is the set of all generation offers belonging to area $a$.
2. **BIDS**$_a$ is the set of all purchase bids belonging to area $a$.
3. **OFFERS**$_n$ is the set of all generation offers at node n.


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4. **BIDS**$_n$ is the set of all purchase bids at node $n$.
5. **ACLINES**$_n$ is the set of all AC lines connected to node $n$.
6. **RESERVEOFFERS**$_{SYNCH,5,a}$ is the set of all synchronous 5 second reserve offers in area $a$.

### 3.7.4 Functions Defined on Sets

For ease of description, a number of functions are defined that operate on elements of sets and return either another set or a single element. The following functions are defined:

**3.7.4.1 $k(v)$ where the argument is a security constraint $v$, returns the AC line $k$, associated with the argument.**

**3.7.4.2 $g(\cdot)$ where the argument could be an operating reserve offer $r$, or a security measure $v$, returns the generation offer $g$, associated with the argument.**

**3.7.4.3 $p(\cdot)$ where the argument could be an operating reserve offer $r$, or a security measure $v$, returns the purchase bid $p$, associated with the argument.**

**3.7.4.4 $r(g,c)$ where the arguments are a generation offer $g$ and reserve class $c$, returns the reserve offer $r$ for class $c$ reserve, corresponding to generation offer $g$.**

**3.7.4.5 *NodeAtStartOf*$(k)$ and *NodeAtEndOf*$(k)$ give the beginning and ending AC nodes respectively of an AC line k . The conventional direction of the line is used to determine the beginning and ending nodes.**


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### 3.7.5 Generation and Purchases

#### 3.7.5.1 Parameters

| | |
|---|---|
| $GenerationBlockMax_{g,j}$ | The MW element of the $j^{th}$ block of the offer. |
| $GenerationOfferPrice_{g,j}$ | The price element of the $j^{th}$ block of the offer. *The parameter is unbounded.* |
| $PurchaseBlockMax_{p,j}$ | The MW element of the $j^{th}$ block of the bid. |
| $PurchaseBidPrice_{p,j}$ | The price element of the $j^{th}$ block of the bid. *The parameter is unbounded.* |

#### 3.7.5.2 Variables

| | |
|---|---|
| $Generation_g$ | The total MW generation scheduled corresponding to offer $g \in$ **OFFERS**. |
| $GenerationBlock_{g,j}$ | The MW generation corresponding to the $j^{th}$ block of the offer. |
| $Purchase_p$ | The total MW purchase scheduled corresponding to bid $p \in$ **BIDS**. |
| $PurchaseBlock_{p,j}$ | The MW purchase corresponding to the $j^{th}$ block of the bid. |

### 3.7.6 AC Transmission System

#### 3.7.6.1 Parameters

| | |
|---|---|
| $ACLineMaxForward_k$ | The MW capacity of AC branch $k \in$ **ACLINES**, in the forward direction of conventional flow. |
| $ACLineMaxReverse_k$ | The MW capacity of AC branch $k \in$ **ACLINES**, in the reverse direction of conventional flow. |
| $ACLineAdmittance_k$ | The "admittance" of the branch. Technically, the susceptance "B" of the branch is used. However the loose use of "admittance" is widespread, and is maintained here. |
| $ACLineFlowBlockMax_{k,j}$ | The quantity of MW flowing in the $j^{th}$ block of the AC branch. |
| $ACLineLossBlockFactor_{k,j}$ | The loss factor of the $j^{th}$ block of the AC branch. |


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| | |
|---|---|
| $ACLineFixedLosses_k$ | The fixed losses of the transformer attached to AC branch $k$. |
| $HVDCLineMaxForward_k$ | The MW capacity of HVDC branch $k \in$ **HVDCLINES**, in the forward direction of conventional flow. |
| $HVDCLineMaxReverse_k$ | The MW capacity of **HVDC** branch $k \in$ **HVDCLINES**, in the reverse direction of conventional flow. |
| $HVDCLineFlowBlockMax_{k,j}$ | The quantity of MW flowing in the $j^{th}$ block of the HVDC branch. |
| $HVDCLineLossBlockFactor_{k,j}$ | The loss factor of the $j^{th}$ block of the HVDC branch. |
| $HVDCLineFixedLosses_k$ | The fixed losses of the transformer attached to HVDC branch $k$. |

#### 3.7.6.2 Variables

| | |
|---|---|
| $ACNodeNetInjection_n$ | The MW injection at node $n \in$ **ACNODES**. *The variable is unbounded.* |
| $ACNodeAngle_n$ | The voltage angle at the node. *The variable is unbounded* |
| $ACLineFlow_k$ | The MW flow scheduled for branch $k \in$ **ACLINES**. *The variable is unbounded* |
| $ACLineFlowBlock_{k,j}$ | The MW flow corresponding to the $j^{th}$ block of the loss curve for branch $k$. |
| $ACLineLoss_k$ | The MW variable losses for branch $k \in$ **ACLINES**. *The variable is unbounded* |
| $ACLineLossBlock_{k,j}$ | The MW variable losses corresponding to the $j^{th}$ block of the loss curve for branch $k$. |
| $HVDCLineFlow_k$ | The MW flow scheduled for branch $k \in$ **HVDCLINES**. *The variable is unbounded* |
| $HVDCLineFlowBlock_{k,j}$ | The MW flow corresponding to the $j^{th}$ block of the loss curve for branch $k$. |
| $HVDCLineLoss_k$ | The MW variable losses for branch $k \in$ **HVDCLINES**. *The variable is unbounded* |
| $HVDCLineLossBlock_{k,j}$ | The MW variable losses corresponding to the $j^{th}$ block of the loss curve for branch $k$. |


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### 3.7.7 Risk and Operating Reserve

A generic operating reserve offer structure is used. Differentiation between types and classes of operating reserve is achieved by using the fundamental sets **RESERVETYPES** and **RESERVECLASSES** to create subsets of **RESERVEOFFERS**.

#### 3.7.7.1 Parameters

| | |
|---|---|
| $ReserveBlockProportion_{r,j}$ | The incremental MW percentage of the $j^{th}$ block of offer $r \in$ **RESERVEOFFERS**$_{SYNCH}$. This is used to link the reserve capability to the generation level. |
| $ReserveOfferPrice_{r,j}$ | The price element of the $j^{th}$ block of the offer. *The parameter is unbounded* |
| $ReserveBlockMaximum_{r,j}$ | The maximum MW operating reserve available from the $j^{th}$ block of the offer. |
| $ReserveGenerationMaximum_{g}$ | The MW maximum generation and operating reserve of class $c \in$ **RESERVECLASSES** capability associated with generation offer $g \in$ **OFFERS**. |
| $ReserveMaximumFactor_{s,g,c}$ | The factor to adjust the proportion of operating reserve of type $s \in$ **RESERVETYPES** and class $c \in$ **RESERVECLASSES** associated with generation offer $g \in$ **OFFERS** that needs to be included in the unit's capacity. |
| $AreaRiskAdjustmentFactor_{a}$ | The risk adjustment factor for area $a \in$ **AREAS**. This may be used to scale the risk in an area if these risks can be partially met from reserve in other areas. |
| $AreaMinimumRisk_{a,c}$ | The minimum MW risk level for area $a \in$ **AREAS**, and operating reserve class $c$. |
| $SynchReserveProportion_{a}$ | The proportion of total reserve in area $a$ to be met by synchronous reserve. |
| $ReserveSynchFactor_{a,c}$ | The scaling factor used in area $a$ when meeting a risk using synchronous reserve of class $c$. Derived from the historical efficiency of using that category of reserve to meet contingencies. |
| $ReserveNonSynchFactor_{a,c}$ | The scaling factor used in area $a$ when meeting a risk using non-synchronous reserve of class $c$. Derived from the historical efficiency of using that category of reserve to meet contingencies. |


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| | |
|---|---|
| $ReserveIntLoadFactor_{a,c}$ | The scaling factor used in area $a$ when meeting a risk using interruptible load reserve of class $c$. Derived from the historical efficiency of using that category of reserve to meet contingencies. |
| $AreaRiskFactor_{a,c}$ | The scaling factor used to determine the proportion of the risk of class $c$ which must be met in area $a$. |

#### 3.7.7.2 Variables

| | |
|---|---|
| $Reserve_{r}$ | The scheduled operating reserve that corresponds to the operating reserve offer $r \in$ **RESERVEOFFERS**. |
| $ReserveBlock_{r,j}$ | The operating reserve scheduled corresponding to $j^{th}$ block of the offer. |
| $AreaRisk_{a,c}$ | The MW risk of area $a$, over the time frame corresponding to reserve class $c$. |
| $HVDCLinerisk_{k}$ | The MW risk associated with line $k$. |

### 3.7.8 Regulating Reserve

#### 3.7.8.1 Parameters

| | |
|---|---|
| $RegulationOfferPrice_{f,j}$ | The price element of the $j^{th}$ block of offer $f \in$ **REGULATIONOFFERS**. *The parameter is unbounded* |
| $RegulationBlockMax_{f,j}$ | The maximum MW regulating reserve available from the $j^{th}$ block of offer $f \in$ **REGULATIONOFFERS**. |
| $AGCHigh_{f}$ | The maximum MW output for which the generator associated with offer $f \in$ **REGULATIONOFFERS** is capable of providing regulating reserve. |
| $AGCLow_{f}$ | The minimum MW output for which the generator associated with offer $f \in$ **REGULATIONOFFERS** is capable of providing regulating reserve. |
| $RegulationMaximumFactor_{g}$ | The factor to adjust the proportion of regulating reserve associated with generation offer $g \in$ **OFFERS** that needs to be included in the unit's capacity. |


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#### 3.7.8.2 Variables

| | |
|---|---|
| $Regulation_f$ | The scheduled regulating reserve that corresponds to the regulating reserve offer $f \in$ **REGULATIONOFFERS**. |
| $RegulationBlock_{f,l}$ | The regulating reserve scheduled corresponding to $l^{th}$ block of the offer. |

### 3.7.9 Security

#### 3.7.9.1 Parameters

| | |
|---|---|
| $GenericSecurityLimit_v$ | The limit imposed on the combination of AC branch flows, nodal net injections, and generation offers in security constraint $v \in$ **SECURITY** *The parameter is unbounded.* |
| $SecurityGroupACLineWeight_{k,v}$ | The weight associated with AC branch $k \in$ **SECURITYACLINESGROUP**$_v$ in security constraint $v$. *The parameter is unbounded.* |
| $SecurityGroupACNodeWeight_{n,v}$ | The weight associated with AC node $n \in$ **SECURITYACNODESGROUP**$_v$ in security constraint $v$. *The parameter is unbounded.* |
| $SecurityGroupGenerationWeight_n$ | The weight associated with generation offer $g \in$ **SECURITYGENERATIONGROUP**$_n$ in security constraint $v$. *The parameter is unbounded.* |

### 3.7.10 Ramping

A generator has limits on its ability to move from one level of generation to another. Ramping constraints are enforced by constraining the generation level to be between an upper and a lower bound. These limits are determined by pre-processing, based on starting generation levels and maximum ramp rates.


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#### 3.7.10.1 Parameters for the Optimization Determined by the Pre-processing

| | |
|---|---|
| $GenerationEndMax_g$ | The maximum generation level associated with generation offer $g \in$ **OFFERS**, given the corresponding starting generation level. |
| $GenerationEndMin_g$ | The minimum generation level associated with generation offer $g \in$ **OFFERS**, given the corresponding starting generation level. |

#### 3.7.10.2 Parameters for Pre-processing

| | |
|---|---|
| $RampRate_g^{Up}$ | The ramping up rate in MW per minute associated with generation offer $g \in$ **OFFERS**. |
| $RampRate_g^{Down}$ | The ramping down rate in MW per minute associated with the offer. |

#### 3.7.10.3 Variables used in the pre-processing

| | |
|---|---|
| $GenerationMaximum_g$ | The maximum MW generation level associated with generation offer $g \in$ **OFFERS**. |
| $GenerationMinimum_g$ | The minimum MW generation level associated with generation offer $g \in$ **OFFERS**. |
| $Generation_g^{Start}$ | The MW generation level associated with the offer at the start of a trading period. This will be the corresponding $Generation_g$ variable from the previous period's dispatch. |
| $RampTime_g^{Up}$ | The time to ramp up to the maximum, or the length or the trading period length if this is less. |
| $RampTime_g^{Down}$ | The time to ramp down to the minimum, or the trading period length if this is less. |

### 3.7.11 Violation Variables

These have been added to all constraints which might potentially be violated. Most will have a very high cost indicating that the problem has no solution, but some may have lower costs indicating that the constraint can be relaxed to some degree. For example the operating reserve violation costs will rise in a number of steps, but will always be less than the generation violation cost steps. Hence the operating reserve requirements will be violated before the algorithm starts to shed load.


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#### 3.7.11.1 Parameters

| | |
|---|---|
| DeficitGenerationPenalty $_{j,n}$ | The penalty per unit of the *DeficitGenerationBlock* $_{j,n}$ variable. |
| SurplusGenerationPenalty $_{j,n}$ | The penalty per unit of the *SurplusGenerationBlock* $_{j,n}$ variable. |
| Deficit5SecReservePenalty $_{j,a}$ | The penalty per unit of the *Deficit5SecReserveBlock* $_{j,a}$ variable. |
| DeficitSynch5SecReservePenalty $_{j,a}$ | The penalty per unit of the *DeficitSynch5SecReserveBlock* $_{j,a}$ variable. |
| DeficitRegulationPenalty $_{j,a}$ | The penalty per unit of the *DeficitRegulationBlock* $_{j,a}$ variable. |
| DeficitRampRatePenalty $_{j,g}$ | The penalty per unit of the *DeficitRampRateBlock* $_{j,g}$ variable. |
| SurplusRampRatePenalty $_{j,g}$ | The penalty per unit of the *SurplusRampRateBlock* $_{j,g}$ variable. |

#### 3.7.11.2 Variables

| | |
|---|---|
| *DeficitGenerationBlock* $_{j,n}$ | The amount by which load at node *n* exceeds the generation and net inflow into the node, in violation block *j*. The blocks are cleared in order of increasing cost, so the further the node balance equation is violated, the more extreme the per unit penalty. |
| *SurplusGenerationBlock* $_{j,n}$ | The amount by which generation and net inflow into node *n* exceeds the load at the node, in violation block *j*. |
| *Deficit5SecReserveBlock* $_{j,a}$ | The amount by which the 5 second operating reserve requirement in area *a* exceeds the 5 second operating reserve scheduled in the area, in violation block *j*. |
| *DeficitSynch5SecReserveBlock* $_{j,a}$ | The amount by which the synchronous 5 second operating reserve requirement in area *a* exceeds the synchronous 5 second operating reserve scheduled in the area, in violation block *j*. |
| *DeficitRegulationBlock* $_{j,a}$ | The amount by which regulating reserve requirement in area *a* exceeds regulating reserve scheduled in the area, in violation block *j*. |


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| | |
|---|---|
| *DeficitSecurityBlock* $_{j,v}$ | The amount by which the generation, branch flows or net injection fall short of meeting security constraint *v*, in violation block *j*. |
| *DeficitRampRateBlock* $_{j,g}$ | The amount by which generation scheduled *g* is less than the lower limit set by the ramp rate down, in violation block *j*. |
| *SurplusRampRateBlock* $_{j,g}$ | The amount by which generation scheduled *g* is greater than the upper limit set by the ramp rate up, in violation block *j*. |

### 3.7.12 General Parameters

#### 3.7.12.1 Parameters

| | |
|---|---|
| TradingPeriodLength | The length of a trading period in minutes. Equal to either SchedPeriod or DispPeriod as appropriate. |
| SchedPeriod | The length of a Week Ahead Projection and Day Ahead Projection Pre-Dispatch Schedule trading period in minutes. This will be 60 minutes. |
| DispPeriod | The length of a Real-Time Dispatch Schedule trading period in minutes. This will be 60 minutes. |

## 3.8 Objective Function

As well as the market terms that are used in the objective function, violation penalties on the various constraints also appear in the objective function.

### 3.8.1 Net Benefit

The *NetBenefit* is maximised, where:


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$$NetBenefit = \sum_{\{j,p \mid j \in \mathbf{PURCHASEBIDBLOCKS}_p, \text{where } p \in \mathbf{BIDS}\}} \text{PurchaseBidPrice}_{p,j} \times PurchaseBlock_{p,j} - \sum_{\{j,g \mid j \in \mathbf{GENERATIONOFFERBLOCKS}_g, \text{where } g \in \mathbf{OFFERS}\}} \text{GenerationOfferPrice}_{g,j} \times GenerationBlock_{g,j} - \sum_{\{j,r \mid j \in \mathbf{RESERVEOFFERBLOCKS}_r, \text{where } r \in \mathbf{RESERVEOFFERS}\}} \text{ReserveOfferPrice}_{r,j} \times ReserveBlock_{r,j} - ViolationPenalties$$

Note: Block notation

Wherever the following notation is found:

$\{j, x \mid j \in \mathbf{XBLOCKS}_x, \text{where } x \in \mathbf{GROUP}\}$

It should be interpreted as, for each $x \in$ **GROUP**, take each of the corresponding blocks from **XBLOCKS**.


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### 3.8.2 Violation Penalties

$$ViolationPenalties = \sum_{\{j,a \mid j \in \text{DEFICITGENERATIONBLOCKS}_a, \text{where } a \in \text{ACNODES}\}} \text{DeficitGenerationPenalty}_{a,j} \times DeficitGenerationBlock_{a,j} + \sum_{\{j,a \mid j \in \text{SURPLUSGENERATIONBLOCKS}_a, \text{where } a \in \text{ACNODES}\}} \text{SurplusGenerationPenalty}_{a,j} \times SurplusGenerationBlock_{a,j} + \sum_{\{j,a \mid j \in \text{DEFICIT5SECRESERVEBLOCKS}_a, \text{where } a \in \text{AREAS}\}} \text{Deficit5SecReservePenalty}_{a,j} \times Deficit5SecReserveBlock_{a,j} + \sum_{\{j,a \mid j \in \text{DEFICITSYNCH5SECRESERVEBLOCKS}_a, \text{where } a \in \text{AREAS}\}} \text{Deficit5SecReservePenalty}_{a,j} \times DeficitSynch5SecReserveBlock_{a,j} + \sum_{\{j,g \mid j \in \text{DEFICITSECURITYLOCKS}_v, \text{where } v \in \text{SECURITYMIN}\}} \text{DeficitSecurityPenalty}_{v,j} \times DeficitSecurityBlock_{v,j} + \sum_{\{j,g \mid j \in \text{SURPLUSSECURITYLOCKS}_v, \text{where } v \in \text{SECURITYMAX}\}} \text{SurplusSecurityPenalty}_{v,j} \times SurplusSecurityBlock_{v,j} + \sum_{\{j,g \mid j \in \text{DEFICITRAMPRATEBLOCKS}_g, \text{where } g \in \text{OFFERS}\}} \text{DeficitRampRatePenalty}_{g,j} \times DeficitRampRateBlock_{g,j} + \sum_{\{j,g \mid j \in \text{SURPLUSRAMPRATEBLOCKS}_g, \text{where } g \in \text{OFFERS}\}} \text{SurplusRampRatePenalty}_{g,j} \times SurplusRampRateBlock_{g,j} + \sum_{\{j,p \mid j \in \text{DEFICITRAMPRATEBLOCKS}_p, \text{where } p \in \text{DISPBIDS}\}} \text{DeficitRampRatePenalty}_{p,j} \times DeficitRampRateBlock_{p,j} + \sum_{\{j,p \mid j \in \text{SURPLUSRAMPRATEBLOCKS}_p, \text{where } p \in \text{DISPBIDS}\}} \text{SurplusRampRatePenalty}_{p,j} \times SurplusRampRateBlock_{p,j}$$

## 3.9 Dispatch Constraints

### 3.9.1 Generation and Purchases

$$GenerationBlock_{g,j} \le \text{GenerationBlockMax}_{g,j} \qquad \{j,g \mid j \in \mathbf{GENERATIONOFFERBLOCKS}_g, \text{where } g \in \mathbf{OFFERS}\}$$

$$Generation_g = \sum_{j \in \mathbf{GENERATIONOFFERBLOCKS}_g} GenerationBlock_{g,j} \qquad \{g \in \mathbf{OFFERS}\}$$

$$PurchaseBlock_{p,j} \le \text{PurchaseBlockMax}_{p,j} \qquad \{j,p \mid j \in \mathbf{PURCHASEBIDBLOCKS}_p, \text{where } p \in \mathbf{PURCHASES}\}$$


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$$Purchase_p = \sum_{j \in PURCHASEBIDBLOCKS_p} PurchaseBlock_{p,j}$$

{p ∈ **PURCHASES**}

All generation offers are entered as offers to supply a block of energy at a minimum price. Similarly, purchase bids for scheduled load are entered as bids to buy a block of energy at a maximum price. Generation offers must have the price increasing with increasing quantity while bids to purchase must have the price decreasing with increasing quantity.

### 3.9.2 Transmission

There are three groups of transmission constraints:

- Those dealing with the balance of flows into and out of a node;
- Those governing the flow of power in a transmission line; and
- Those governing the losses in each transmission line.

#### 3.9.2.1 Node Balance

$$ACNodeNetInjection_n = \sum_{\{k \in ACLINES | NodeAtStartOf(k)=n\}} ACLineFlow_k - \sum_{\{k \in ACLINES | NodeAtEndOf(k)=n\}} ACLineFlow_k + \sum_{\{k \in HVDCLINES | NodeAtStartOf(k)=n\}} HVDCLineFlow_k - \sum_{\{k \in HVDCLINES | NodeAtEndOf(k)=n\}} HVDCLineFlow_k$$

{n ∈ **ACNODES**}

By Kirchoff's Second Law, the total line flows into and out of a node must equal the difference between the generation flowing into the node and the off-takes. The variable *AC Node Net Injection* represents the difference between the line flows into a node and the line flows out of a node.

Two summations are necessary, because the lines have a conventional direction associated with them. Hence positive *AC Line Flow* and *HVDC Line Flow* variables may represent power flowing into the node for some lines, and power flowing out for others.


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$$ACNodeNetInjection_n = \sum_{g \in OFFERS_n} Generation_g - \sum_{p \in BIDS_n} Purchase_p - \sum_{k \in ACLINES_n} \tfrac{1}{2} \times ACLineLoss_k - \sum_{k \in ACLINES_n} \tfrac{1}{2} \times ACLineFixedLoss_k - \sum_{k \in HVDCLINES_n} \tfrac{1}{2} \times HVDCLineLoss_k - \sum_{k \in HVDCLINES_n} \tfrac{1}{2} \times HVDCLineFixedLoss_k + \sum_{j \in DEFICITGENERATIONBLOCKS_n} DeficitGenerationBlock_{n,j} - \sum_{j \in SURPLUSGENERATIONBLOCKS_n} SurplusGenerationBlock_{n,j}$$

{*n* ∈ **ACNODES**}

The principal off-takes at the node are the purchases (loads) and the losses due to the power flow in the lines, with half of the losses attributed to each end of the line.

#### 3.9.2.2 Line Limits

$$ACLineMaxReverse_k \le ACLineFlow_k \le ACLineMaxForward_k$$

{k ∈ **ACLINES**}

$$HVDCLineMaxReverse_k \le HVDCLineFlow_k \le HVDCLineMaxForward_k$$

{k ∈ **HVDCLINES**}

#### 3.9.2.3 Line Flow

The AC flow equations are those of a DC power flow model, in which the flow of power (MW) between two nodes is given by the susceptance of the transmission line, denoted by *AC Line*


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*Admittance* and the difference in the voltage angles at the ends of the line, denoted by *AC Node Angle*. The variables *AC Node Angle* are internal variables only.

The flow in each line has a nominal positive direction and is constrained to lie within the flow limits of the line and its associated terminal equipment, which may be determined by "thermal" limits, or by contingency considerations, for example. One limit is positive, the other negative depending upon the conventional direction of flow.

$$ACLineFlow_k = \text{ACLineAdmittance}_k \times \left(ACNodeAngle_{\text{NodeAtStartOf(k)}} - ACNodeAngle_{\text{NodeAtEndOf(k)}}\right)$$
{k ∈ **ACLINES**}

1.
$$ACNodeAngle_{\text{REFERENCENODE}} = 0$$

$$ACLineFlowBlock_{k,j} \le \text{ACLineFlowBlockMax}_{k,j}$$
{j,k | j ∈ **ACLINEFLOWBLOCKS**$_k$, where k ∈ **ACLINES**}

2.
$$ACLineFlow_k = \sum_{j \in \text{ACLINEFLOWBLOCKS}_k} ACLineFlowBlock_{k,j} \qquad \{k \in \textbf{ACLINES}\}$$

$$HVDCLineFlowBlock_{k,j} \le \text{HVDCLineFlowBlockMax}_{k,j}$$
{j,k | j ∈ **HVDCLINEFLOWBLOCKS**$_k$, where k ∈ **HVDCLINES**}

3.
$$HVDCLineFlow_k = \sum_{j \in \text{HVDCLINEFLOWBLOCKS}_k} HVDCLineFlowBlock_{k,j} \qquad \{k \in \textbf{HVDCLINES}\}$$

#### 3.9.2.4 *Line Losses*

Two forms of line losses are allowed; variable lines losses, given by *AC Line Loss* and *HVDC Line Loss;* and fixed losses, including transformer iron losses and AC/DC converter losses, given by *AC Line Fixed Loss* and *HVDC Line Fixed Loss*. The AC fixed losses may often be ignored


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for practical purposes, except where the iron losses are a significant proportion of the transformer's full load losses. In that case, allocating all of the transformer's losses to the quadratic variable losses would significantly increase the transformer's marginal losses. Therefore, provision has been made for fixed losses in the Formulation.

The variable lines losses are calculated from a piece-wise linear approximation to the quadratic loss function.

1.
$$ACLineLossBlock_{k,j} = \text{ACLineLossBlockFactor}_{k,j} \times ACLineFlowBlock_{k,j}$$
{j,k | j ∈ **ACLINEFLOWBLOCKS**$_k$, where k ∈ **ACLINES**}

2.
$$ACLineLoss_k = \sum_{j \in \text{ACLINEFLOWBLOCKS}_k} ACLineLossBlock_{k,j} \qquad \{k \in \textbf{ACLINES}\}$$

$$HVDCLineLossBlock_{k,j} = \text{HVDCLineLossBlockFactor}_{k,j} \times HVDCLineFlowBlock_{k,j}$$
{j,k | j ∈ **HVDCLINEFLOWBLOCKS**$_k$, where k ∈ **HVDCLINES**}

3.
$$HVDCLineLoss_k = \sum_{j \in \text{HVDCLINEFLOWBLOCKS}_k} HVDCLineLossBlock_{k,j} \qquad \{k \in \textbf{HVDCLINES}\}$$

This formulation assumes that HVDC links can be treated as single lines, rather than multiple poles. Further discussion may be required to refine the formulation.

We note that a problem can occur with this form of loss model whenever prices become negative. Under these circumstances, the model will attempt to maximize the variable losses incurred by generating "non-physical" losses. Several alternative approaches are used to overcome the problem and we do not wish to limit them at this stage.


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### 3.9.3 Reserves

#### 3.9.3.1 Contingency Risk and Operating Reserve

Contingency reserve and the associated risk are modeled on an area basis. Since only one category of contingency reserve is required in the Philippines, formulation is simpler.

1. Requirement for Contingency Reserve

The risk to be covered by reserve is determined to be the largest contingency which may occur within the nominated area[1].

In this formulation it is assumed that the reserve areas are Luzon, Visayas and Mindanao, hence lines between them are all HVDC lines, and will not respond by transferring any response from plant in one region to a contingency in the other. Thus each reserve region can be treated as being entirely self-contained. If other regions are to be considered the formulation may need to be modified.

The value of the *Are a Risk* may be adjusted by the Area Risk Adjustment Factor, as required, so that the risk to be covered by reserve within an area may be either greater or less than the magnitude of the contingency[2].

$$AreaRisk_{a,x} \geq \text{AreaRiskAdjustmentFactor}_{a,x} \times Generation_g + Reserve_{r(g,x)}$$

$\{g,a \mid g \in \textbf{AREARISKGENERATORS}_a, \text{where } a \in \textbf{AREAS}\}$

$$AreaRisk_{a,x} \geq \text{AreaRiskAdjustmentFactor}_{a,x} \times HVDCLinerisk_k$$

$\{k,a \mid k \in \textbf{AREARISKHVDCLINESFORWARD}_a, \text{where } a \in \textbf{AREAS}\}$

$$AreaRisk_{a,x} \geq \text{AreaRiskAdjustmentFactor}_{a,x} \times -HVDCLinerisk_k$$

$\{k,a \mid k \in \textbf{AREARISKHVDCLINESREVERSE}_a, \text{where } a \in \textbf{AREAS}\}$

$$AreaRisk_{a,x} \geq \text{AreaRiskAdjustmentFactor}_{a,x} \times \text{AreaMinimumRisk}_{a,x}$$
$\{a \in \textbf{AREA}\}$

If the HVDC lines involved are simple, single circuit/pole devices, then the $HVDCLinerisk_k$ referred to in the equation will just equal $HVDCLineflow_k$, and this can be substituted. But more complex equations will be required in more complex cases where, for example, one HVDC pole may partially fail over to another during a contingency.

2. Supply of Contingency Reserve

Contingency reserve response is expected to occur automatically when frequency falls, and:

- Generators with spinning reserve respond under 'free governor action";
- Interruptible loads are tripped by under-frequency relays; and
- Generators which are not currently synchronized may synchronize and commence generation[3].

Generator spinning reserve is offered as a set of blocks. A constraint is placed on total reserve as a proportion of the generator loading, as shown below, partly because some plant can not offer much reserve response at low generation levels, and partly because this is the best approximation available within an LP to represent the fact that no spinning reserve at all is available from a plant which is not generating.[4]

[1] In principle, a contingency could consist of a primary contingency and any associated secondary contingencies. The primary contingency may be the loss of a generator or the infeed from a transmission line, with the subset of generators and transmission lines likely to cause such contingencies being nominated. Secondary contingencies would include all plant which is likely to go off line as a result of a primary contingency occurring. Since secondary contingencies are not in issue in the Philippines they are ignored in this formulation.

[2] Note there is only one reserve category, so $x$ can be eliminated, or set $x=1$

[3] Note that the only reserve category proposed for this market requires a full response within 5 seconds. It is doubtful that any non-synchronised plant can respond in this timeframe, but the category is retained for the sake of generality.

[4] Non-synchronised generation plant does not suffer from a restriction of this form.


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Contingency reserve from interruptible loads is similarly constrained, but for a different reason. Clearly, no more load can be interrupted than is actually being taken from the market and only a certain proportion of the load which is being taken may be interruptible.

$$ReserveBlock_{r,j} \le \text{ReserveBlockMax}_{r,j}$$

$$\{j,r \mid j \in \textbf{RESERVEOFFERBLOCKS}_r, \text{where } r \in \textbf{RESERVEOFFERS}\}$$

$$Reserve_r = \sum_{j \in RESERVEOFFERBLOCKS_r} ReserveBlock_{r,j} \qquad \{r \in \textbf{RESERVEOFFERS}\}$$

$$Reserve_r \le \text{ReserveProportion}_r \times Generation_{g(r)}$$

$$\{r \in \textbf{RESERVEOFFERS}_{synch}\}$$

$$Reserve_r \le \text{ReserveProportion}_r \times Purchase_{p(r)}$$

$$\{r \in \textbf{RESERVEOFFERS}_{IL}\}$$

3. Matching of Requirements and Availability

The reserve scheduled to cover the risk has a proportionality factor applied which is used to compensate for the effectiveness of the reserve in meeting the risk. A limit is also placed on the proportion which must be synchronized. Reserve is scheduled and dispatched in each area to cover the risk in that area. It does not use transmission lines between regions.

$$AreaRisk_{a,c} \le \text{ReserveSynchFactor}_{a,c} \times \sum_{r \in \text{RESERVEOFFERS}_{a,c,SYNCH}} Reserve_r$$
$$+ \text{ReserveIntLoadFactor}_{a,c} \times \sum_{r \in \text{RESERVEOFFERS}_{a,c,IL}} Reserve_r$$
$$+ \text{ReserveNonSynchFactor}_{a,c} \times \sum_{r \in \text{RESERVEOFFERS}_{a,c,NONSYNCH}} Reserve_r$$
$$+ \sum_{j \in \text{DEFICIT5SECRESERVEBLOCKS}_a} Deficit5SecReserveBlock_a$$


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$$\{a \in \textbf{AREAS}\}$$

$$\text{SynchReserveProportion}_a \times AreaRisk_{a,c}$$
$$\le \sum_{r \in \text{RESERVEOFFERS}_{a,c,SYNCH}} Reserve_r$$
$$+ \sum_{j \in \text{DEFICITSYNCH5SECRESERVEBLOCKS}_a} DeficitSynch5SecReserveBlock_a$$

### 3.9.3.2 *Regulating Reserve*

1. Requirement for Regulating Reserve

Regulating Reserve, or Frequency Response, is to be supplied by generators responding under AGC. It is assumed here to involve a symmetrical offer of response, both above and below the planned linear ramp.

The main "risk" to be covered by regulation reserve includes fluctuations around linear load growth, and small generation failures which cause only minor frequency deviations. Since there is no obvious way to estimate, or minimize, this risk within the model, it is assumed to be specified externally.

In this formulation it is assumed that the regulating reserve areas are Luzon, Visayas and Mindanao, hence lines between them are all HVDC lines, which are assumed not to offer AGC response, so that each region must meet its own regulating reserve requirements. No account is taken of any potential need for regulating reserve within particular sub-regions to cover loss of an intra-regional AC line[5]. If other regions are to be considered the formulation may need to be modified.

[5] This same class of reserve might be extended to cover failure of individual circuits in AC lines because it is controlled via AGC and, even though this may be thought of as a line "contingency", it can not be covered by governor response to under-frequncy because, it will not cause any change to system frequency (unlike failure of an HVDC link, or complete failure of an AC line which may divide a system into two separate frequency regions)


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2. Supply of Regulating Reserve

Regulating reserve from generators is offered in the form of AGC response, offered in several blocks, as above.

$$RegulationBlock_{f,j} \leq \text{RegulationBlockMax}_{f,j}$$

$$\{j, f \mid j \in \textbf{REGULATIONOFFERBLOCKS}, \text{where } f \in \textbf{REGULATIONOFFERS}\}$$

$$Regulation_f = \sum_{j \in \textbf{REGULATIONOFFERBLOCKS}} RegulationBlock_{f,j} \qquad \{f \in \textbf{REGULATIONOFFERS}\}$$

But the total response is naturally limited by the fact that AGC can only operate within the range from AGCLow to AGCHigh.

$$Regulation_f \leq \text{AGCHigh}_f - Generation_{g(f)}$$

$$\{f \in \textbf{REGULATIONOFFERS}\}$$

$$Regulation_f \leq Generation_{g(f)} - \text{AGCLow}_f$$

$$\{f \in \textbf{REGULATIONOFFERS}\}$$

Note: Once these constraints are applied the generator will be locked into its AGC response range, irrespective of its offers. Thus it can not generate at full load, and nor can it be ramped down to zero. A procedure is required, outside of the LP, to determine which generators will be committed to their AGC ranges.

3. Matching of Requirements and Availability

There is no need for reserve scheduled to cover regulation to have a proportionality factor applied, since it is all of the same type, and the requirement, itself, is just an externally specified constant, which can be scaled as desired. Regulating reserve is scheduled and dispatched in each area to cover the risk in that area. It does not use transmission lines between regions


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$$\text{AreaRegulation}_a \leq \sum_{f \in \textbf{REGULATIONOFFERS}} Regulation_f + \sum_{j \in \textbf{DEFICITREGULATIONBLOCKS}_a} DeficitRegulation_a$$

$$\{a \in \textbf{AREAS}\}$$

### 3.9.3.3 *Combined Reserve Maximum Capacity*

$$Generation_g + \sum_{c \in \textbf{RESERVECLASSES}} \text{ReserveMaximumFactor}_{SYNCH,g,c} \times Reserve_{SYNCH,r(g),c} + \sum_{c \in \textbf{RESERVECLASSES}} \text{ReserveMaximumFactor}_{NONSYNCH,g,c} \times Reserve_{NONSYNCH,r(g),c} + \sum_{c \in \textbf{RESERVECLASSES}} \text{RegulationMaximumFactor}_g \times Regulation_{f(g)} \leq \text{ReserveGenerationMaximum}_g$$

$$\{g \in \textbf{OFFERS}\}$$

## 3.9.4 ***Security Constraints***

The constraints considered in the sections above are the inherent constraints required to operate the Philippines power system without considering any security and reliability issues other then those imposed by the reserve requirements. In addition to these, the SO may wish to impose other constraints on the operation of the power system. These are imposed through generic security constraints, that allow a mixture of grouped generation, net injection and line flows to be applied. Constraints involving reactive power or voltage must be transformed into appropriate generic constraints.

The way in which a generic constraint is stated can have a considerable impact on the dispatch, and prices, which result. Care is needed, therefore in formulating these constraints.


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#### 3.9.4.1 Generic Security Constraint

1.

$$\sum_{k \in \text{SECURITYACLINESGROUP}_v} \text{SecurityGroupACLineWeight}_{v,k} \times \textit{ACLineFlow}_k$$
$$+ \sum_{n \in \text{SECURITYACNODESGROUP}_v} \text{SecurityGroupACNodeWeight}_{v,n} \times \textit{ACNodeNetInjection}_n$$
$$+ \sum_{g \in \text{SECURITYGENERATIONGROUP}_v} \text{SecurityGroupGenerationWeight}_{v,g} \times \textit{Generation}_g$$
$$- \sum_{j \in \text{SURPLUSSECURITYBLOCKS}_v} \textit{SurplusSecurityBlock}_{v,j} \leq \text{GenericSecurityLimit}_v$$

$$\{v \in \textbf{SECURITY}_{\textit{GenericMaximum}}\}$$

$$\sum_{k \in \text{SECURITYACLINESGROUP}_v} \text{SecurityGroupACLineWeight}_{v,k} \times \textit{ACLineFlow}_k$$
$$+ \sum_{n \in \text{SECURITYACNODESGROUP}_v} \text{SecurityGroupACNodeWeight}_{v,n} \times \textit{ACNodeNetInjection}_n$$
$$+ \sum_{g \in \text{SECURITYGENERATIONGROUP}_v} \text{SecurityGroupGenerationWeight}_{v,g} \times \textit{Generation}_g$$
$$+ \sum_{j \in \text{DEFICITSECURITYBLOCKS}_v} \textit{DeficitSecurityBlock}_{v,j} \geq \text{GenericSecurityLimit}_v$$

$$\{v \in \textbf{SECURITY}_{\textit{GenericMinimum}}\}$$

### 3.9.5 Ramping

The change in output of a generation unit is subject to up and down ramp rate limits. These constrain the unit's output set to be within a band which is set by pre-processing a knowledge of the unit's initial output and its ramp rates.

#### 3.9.5.1 Ramping Constraints

1.

$$\textit{Generation}_g - \sum_{j \in \text{SURPLUSRAMPRATEBLOCKS}_g} \textit{SurplusRampRateBlock}_{g,j} \leq \text{GenerationEndMax}_g$$

$$\{g \in \textbf{OFFERS}\}$$


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2.

$$\textit{Generation}_g + \sum_{j \in \text{DEFICITRAMPRATEBLOCKS}_g} \textit{DeficitRampRateBlock}_{g,j} \geq \text{GenerationEndMin}_g$$

$$\{g \in \textbf{OFFERS}\}$$

3.

$$\textit{Purchase}_p - \sum_{j \in \text{SURPLUSRAMPRATEBLOCKS}_p} \textit{SurplusRampRateBlock}_{p,j} \leq \text{PurchaseEndMax}_p$$

$$\{p \in \textbf{BIDS}\}$$

4.

$$\textit{Purchase}_p + \sum_{j \in \text{DEFICITRAMPRATEBLOCKS}_p} \textit{DeficitRampRateBlock}_{p,j} \geq \text{PurchaseEndMin}_p$$

$$\{p \in \textbf{BIDS}\}$$

where $\text{GenerationEndMax}_g$, $\text{GenerationEndMin}_g$, $\text{PurchaseEndMax}_p$ and $\text{PurchaseEndMin}_p$ are determined by pre-processing.


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# 4.0 FINANCIAL RECONCILIATION FUNCTIONS

Operation of the Philippines Electricity Market (PEM) will require accurate and secure accounting of the purchase and sale of energy and services. The integrity of the PEM demands that the financial reconciliation process, from metering to settlements to billing, be designed with these accuracy and security requirements in mind.

## 4.1 General Requirements

The financial reconciliation functions of metering and settlement shall run in the Market Management System (MMS), along with the other MMS applications.

### 4.1.1 Architecture and Design

All provisions of the specification regarding architecture and design, including specifically Section 7 – Hardware and Software Platforms, and Section 8 – Database Requirements, shall apply to the financial reconciliation functions.

### 4.1.2 Sizing Parameters and Performance

Specific requirements for Sizing Parameters and Performance are included in Section 6 – System Performance Sizing and Requirements.

### 4.1.3 User Interface

The Meter and Settlements data management functions shall each have two user interfaces and shall employ specific levels of security, to be defined by the Market Operator (MO).

1. Web Browser – The normal interface for all queries regarding metering and settlement data by Participants shall be via the PEM Web site. Default forms shall be designed by


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the Contractor and reviewed and approved by the MO to facilitate viewing and reporting. Access and security shall be as described in Section 5 regarding PEM E-Commerce.

2. MO Extensions – The MO (and the Market Auditor and System Administrator) must also have additional access to allow authorized manual data entry, monitoring of error logs, review of audit trails, etc. These capabilities shall also be browser-based.

### 4.1.4 Data Security

Data security shall be a very high priority in all MO Metering and Settlement applications. Data access shall be limited to specific portions of data for which the authenticated party has been authorized. Measures shall be employed to isolate Metering and Settlement data from other applications and accesses, except those expressly authorized within the Metering and Settlement applications.

## 4.2 Metering Process

The Metering Process refers to all system functions from storage of standing meter data, to meter data collection and processing, to storage and archiving of meter values. The overall Meter Data Management System, shown below, includes metering devices at each market trading node monitored by meter data collection systems located in each of the three regions – Luzon, Visayas and Mindanao.


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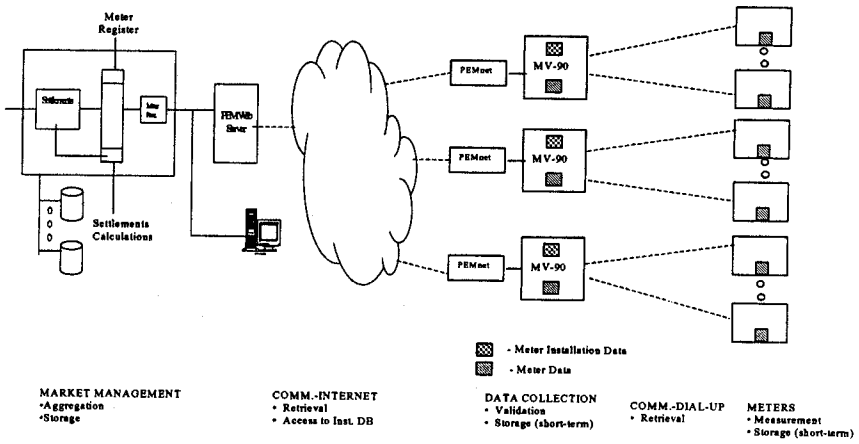


The requirements of the MMS start with the collection of data (both meter values and installation data) from the three regions. Responsibility for the metering devices themselves, the meter data collection systems and communications is not included in this MMS specification. The specific functions to be included in the MMS are:

- Maintenance of Installation Data – The portion of the database which lists all meters in the system, with identifiers for providers, registration status and calibration requirements as per market rules.
- Data Collection and Validation –The periodic and on-demand retrieval of metering data from the regional MV-90 systems. This function shall also assess data quality based on reasonability, and provide for retries as necessary.
- Meter Data Processing – Capability for data substitution, accounting for missing data and aggregation/re-aggregation.
- Meter Database – The meter database shall include all data collected and calculated with appropriate location and time identifiers. Control of access to these data shall be as specified in the market rules.
- Settlements Data – The Meter Database shall be augmented by a Settlements database, which shall include all data calculated and used in financial statements.
- Data Warehouse – Longer-term storage of all meter and settlement data shall be in redundant data warehouses, sized for ultimate system capacity and mandated duration requirements.


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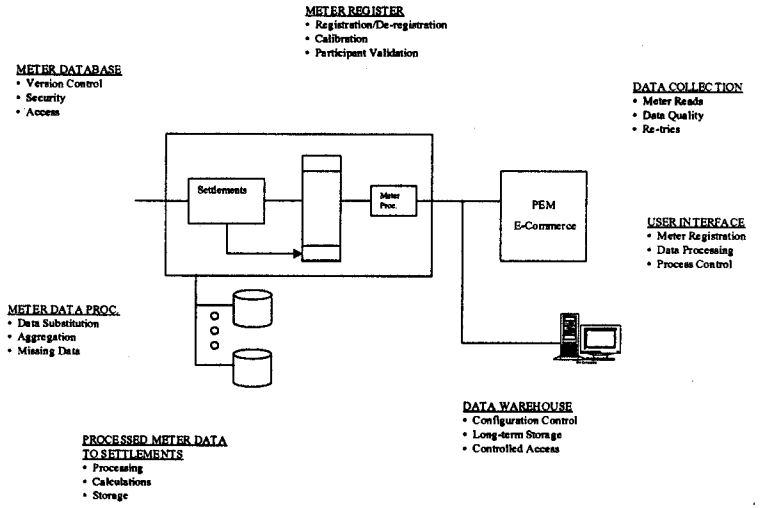
- User Interface – Provisions shall be made to allow manual changes to the meter registry, control of changes to data, data acquisition requests and changes in process by authorized users.

These are shown pictorially below and discussed in the following sections.




### 4.2.1 Meter Register

Each Metering Provider data collection system will contain data regarding the installation of metering devices, which are being monitored in accordance with the PEM. The data will include:

1. Metering point reference details, including:
   a. locations and reference details (e.g., drawing numbers);
   b. site identification names;
   c. standard equipment identification numbering (SEIN) in accordance with the PEM and MO procedures;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   d. details of affected Participants associated with the Metering point; and
   e. the Metering Provider.
2. The identity and characteristics of metering equipment including:
   a. serial numbers;
   b. metering installation identification name;
   c. metering manufacture types and models;
   d. current test and calibration program details, test results and references to test certificates as required under the Grid Code;
   e. calibration tables, where applied to achieve metering installation accuracy as required under the Grid Code;
   f. data register coding details; and
   g. correction factors and multipliers.
3. Data communication details, including:
   a. telephone number(s) (or frequency details in the case of telemetric equipment) for access to data;
   b. communication equipment type and serial numbers;
   c. communication protocol details or references;
   d. data conversion details;
   e. user identifications and access rights; and
   f. "write" password (to be contained in a hidden or protected field).

The MMS shall include a super-set of these three regions' Installation Data as part of the overall Metering Database. These data shall be retrieved from the regional systems upon system initialization, periodically (on a non-interference basis with meter data collection), and on demand.

Data concerning each individual meter shall also be retained in the MMS Metering Database. These data shall include the following.

1. Source meter or meter data server unique identification number and name.
2. Specific meter data by metered point (identification code), meter type (may not be included in reported data but associated with standing meter data), location number, meter owner, meter data factors or corrections, and Metering Provider by name, meter data type (product transfer type code), description, value(s), time period (interval) for which the data applies, and version number of meter data set or file reference with audit trail to meter(s).


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3. The following meter data categories shall be identified:
   a. Kilowatt (kW) demand, Kilovolt Ampere Reactive Demand (kVAR), kVAR Hour, kW Hour;
   b. Quarterly, Biannually, Annually, Monthly, Daily, and Trading Interval (user enterable interval, default to PEM requirements); and
   c. Off-peak, On-peak, Summer on-peak, Winter on-peak, Total, Peak-2, Shoulder, Non-time related demand, Summer off-peak, Winter off-peak, Interval.
4. The Meter Data System shall provide for identification of the following measurement references:
   a. Meter reading-beginning actual/ending actual;
   b. Meter reading-beginning actual/ending estimated;
   c. Meter reading-beginning estimated/ending actual;
   d. Meter reading-beginning estimated/ending estimated;
   e. Meter reading as billed;
   f. Multiplier; and
   g. Pulse width.
5. The Meter Data System shall provide for recognition of the following significance statuses:
   a. Actual normal passed validation;
   b. Estimated automatically (not derived from actual meter readings);
   c. Estimated manually (not derived from actual meter readings);
   d. Validated with no detected error; and
   e. Adjusted (trailer information to reflect specificity).
6. Time polled (if received or not) and received.
7. Transaction set identifier code (or unique equivalent).
8. Transaction set control number (or unique equivalent).
9. Transaction set purpose code(s) (identifies purpose of transaction set).
10. Report type, authorization data, and/or security code associated with transaction set.

Utility identification shall include provision for name or acronym and identification code qualifier (D-U-N-S) Dunn & Bradstreet 9 digit number that may be optionally enabled or disabled by the MO.


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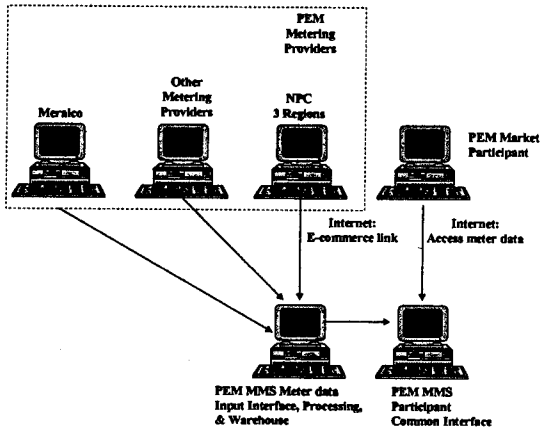
### 4.2.2 *Data Collection and Validation*

Data collection of metering data from the three regional meter data collection sites shall be on a programmer-selectable periodicity or on demand. The collection and validation process shall be on a non-interference basis with all other MMS processes, preferably with a dedicated set of Servers dedicated to the process. Design implementation, however, is left to the Contractor.

Collection of Metering Data shall also include the transfer of metering values from the EMS as listed in Section 3, concerning EMS – MMS Data Exchange and Interface. The data collection process is shown pictorially below.




**Meter Data Collection Overview**

Data shall be retrieved utilizing the standard Itron MV-90 communications protocol.

Validation of the received data shall include:

1. Reasonability check based upon metered point maximum capacity or alternate parameter.
2. Completeness check for required data format completion with valid characters or numbers.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3. Validity of association check that the received data is authorized by submission by the depositing entity (this is also a security check).
4. Verification that data has been received by the MO for all metering points, for each required period.
5. Identification of data received without valid corresponding identifier (termed "Orphan Data").
6. Orphan data processed, tracked, and logged; to be reported for each calendar day and archived for access by day, location, type, meter or server, and hour.
7. Incomplete or missing data triggers an automatic request or poll for a new set of settlement-ready data for the required time period(s).
8. Automatic logging, flagging, and report generation for all incomplete, missing, or invalid data.

Retries shall be automatic, up to three attempts. Data values or files which do not pass validity checks shall have values resident in the meter database for these trading nodes and time intervals flagged as suspect.

All error logs shall be maintained for all validity check failures, retries and flagged data (per item 8 above). The logs will be available to the system administrator, the MO and Market Audit personnel.

### *4.2.3 Meter Data Processing*

Processing of meter data shall include two functional capabilities:

1. Manual Substitution of Data –The MO shall have the means and tools to access and to modify all meter data, providing information received via channels other than Meter Data Collection. All changes made to metering data by manual entries shall be tagged as such and an audit trail of all such operations maintained and archived. Manual substitution shall be allowed only by authorized user(s).
2. The MMS shall provide functionality and databases which accommodate multiple and simultaneous data transfer requests without degradation of performance or functionality.

   The MMS shall support the capability of data transfers, to include but not limited to the following:

   a. Bi-directional data transfer between primary, secondary, and development MMS systems;
   b. Bi-directional data transfer between the archive storage and the primary, secondary, and development MMS systems;


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   c. Data access (read only) by authorized third party users for analysis and review;
   d. Settlement-ready data (send only) to the settlement applications;
   e. Bi-directional or selectable one-way data transfer to/from the Market Operations functions;
   f. Access (read only) for authorized Market Participants to the selective portions of data to which each requester is entitled, through the PEM Website; and
   g. Access (read only) to market surveillance or audit applications within the MMS.

The meter data shall be processed and sorted for use by the settlement application, allocating energy uses by charge type category (use category). The sorting shall be required with respect to any and all of the following:

   a. Metering Provider;
   b. meter owner;
   c. metered entity;
   d. settlement charge type (use category);
   e. date;
   f. settlement period(s) by singular or multiple periods;
   g. metered class (generator class, user class, or other);
   h. location or group of locations;
   i. metered value range (enterable by user);
   j. region or pricing zone; and
   k. node or multiple nodes.

The meter data processing system shall provide the capability for aggregation of selected meter data, trending of individual or aggregated meter data, and definition of meter data sources (individual and aggregated) as any of the following categories:

1. Proprietary (not available except to Metering Provider and MO).
2. Restricted (not available to public, but to selective authorized users).
3. Public, non-proprietary (available to public and website posting, generally aggregated).

Meter data system capabilities shall accommodate: standard time, daylight savings time, on-peak, off-peak, and leap year. Times, peak and non-peak parameters shall be defined by the MO.


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The meter data processing system shall also provide the following capabilities with the user selectable option to enable or disable these functions from a display where the statuses of all functions are maintained and automatically updated. The default for these functions shall be "disabled"; the functions are not intended for initial use:

1. Adjustment factor, enterable by specific metering point and name and calculated per unit of metered quantity.
2. Correction factor for losses or other corrections calculated per unit of metered quantity.
3. Aggregation of any specified group or groups of metering points up to and including 100 groups, each with up to 10000 metering points.
4. Automated estimation of any missing data sets, based upon PEM standards.

### 4.2.4 Metering Database

The Metering Database shall be the repository for all metering values and related information. It shall provide secure storage for these data, meet availability requirements by means of redundancy and provide access to users in accordance with access level constraints. The Database shall consist of four parts:

1. Installation Database – As described above, the Installation Databases of the three regional meter data collection systems shall be combined as a super-set in the MMS Metering Database.
2. Metering Register – The Metering Register shall hold information related to metering installation.

   Metering information to be contained in the metering register shall include such information as the MO considers reasonably necessary and by way of example, may include the following:

   a. Meter identification:
      - metering installation identification number; and
      - identification of equipment related to, and associated with, the metering installation.
   b. Location in market:
      - transmission or distribution connection point identification; and
      - details of the site at which the meter is located, including the owner of the site.
   c. Associated parties:
      - metering data agency identification;
      - Metering Provider identification;
      - Market Participant settling account identification;
      - Local Contractor identification; and


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      - relevant Network Service Provider identification.
   d. Data validation and substitution processes agreed between affected Participants, including:
      - algorithms;
      - data comparison techniques;
      - processing and alarms; and
      - alternate data sources.

   These data shall be input and maintained by the MO utilizing tools provided for this purpose by the Contractor. The data shall be available for Read-only viewing in accordance with Access Level requirements.
3. Meter Values – Meter data collected from the regional systems and validated as part of the meter data collection process for each trading interval; manually-entered meter values and all calculated and aggregated meter values.

   These data shall be available to authorized users via standard database management access screens and tools. Queries will be by trading intervals, market trading nodes, MPs, Metering Service Provider, tagged values, and combinations of these categories.
4. Settlements Data – As described below.

Metering Database replication shall take advantage of tools created for this purpose and shall ensure that no data is lost or corrupted.

### 4.2.5 Data Warehouse

The Data Warehouse shall be the repository for all historical and archived data related to Metering data and its processing. These data shall be stored and made available as defined in Sizing Parameters and Performance Requirements. These data shall include:

- Meter values as retrieved from regional systems;
- Manually-entered meter values;
- Meter Installation Data and Updates;
- Meter Registry Data and Updates;
- All meter data necessary to re-run the settlement for each settlement period;
- Settlement processed data and output;

The Meter data warehouse shall meet Availability and Performance requirements. Access to dual-redundant archiving nodes from dual-redundant MMS Servers must include cross-coupling capability.


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Table 4.2-1 gives additional requirements for the transfer of data to the Meter Data Warehouse.

**Table 4.2-1**

| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 1 | The system shall record actual meter data for each connection point. Data shall be maintained by the system. Information is updated whenever meter files are processed. There shall be one per participant per meter run. The data includes: Unique participant identifier, Trading period identifier, Settlement date, Data version number, Connection point identifier, Metering Data Agent, Net Imported energy value, Net Exported energy value, Last date and time record changed, Date and Time this meter reading became effective | All | MMS | Meter Warehouse |
| 2 | The system shall record and maintain meter registration details. Data will be entered and maintained by the Market Operator (MO). Information is updated whenever a participant changes their meter registration details. There shall be one per Participant. The data includes: Unique participant identifier, Connection Point Identifier, Participant Identifier, Meter data Agent Identity, Unique National Meter ID, Metering Provider, Date of approved registration, Address at location, Last date and time record changed. | All | MMS | Meter Warehouse |
| 3 | The system shall record meter details specifically related to generator sets. Data will be entered and maintained by the MO. Information is updated only when meter details change. There shall be one per generator meter. The data includes: Meter Id, Version no of the record for the given effective date, Generator Set ID, Connection Point Identifier, Station Id, Primary / Check, Revenue / Power, Voltage, User authorizing registration, Date authorized, Date meter Commissioned, Date and Time this meter reading became effective, Last date and time record changed. | All | MMS | Meter Warehouse |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 4 | The system needs to record data for each connection point. A regional summary view shall also be provided. Data is maintained by the system. Information is updated with each Settlement run. There shall be one entry per connection point per meter run. The data includes: Settlement date, Version run no, Settlement Period identifier, Unique participant identifier, Connection point identifier, Region identifier, Import Gross energy into the pool (MWh), Export Gross energy from the pool (MWh), Import Net energy into the pool (MWh), Export Net energy from the pool (MWh), Import reactive power from the pool, Export reactive power from the pool, Regional Reference Price, Excess Energy Price, Connection Point Price, Meter Run Number = version number of the meter file, Last date and time record changed, Metering Data Agent. | All | MMS | Meter Warehouse |
| 5 | The system summarizes meter settlement data for each region. Data is entered and maintained by the Market Operator. Information is updated with each settlement run. There shall be one entry per participant per meter run. The data includes: Calendar Settlement date, Settlement run no, Settlement Period identifier, Region identifier, Import Gross energy into the pool (MWh), Export Gross energy from the pool (MWh), Import Net energy into the pool (MWh), Export Net energy from the pool (MWh), Import reactive power, Export reactive power. | All | MMS | Meter Warehouse |

### 4.2.6 *Access to Metering Data*

In addition to the acquisition and processing of meter data, and storing the Metering Data on-line and off-line in auditable form, the MMS shall:

1. Provide Metering Data access and support to MPs activities.
2. Aggregate metering data before forwarding data to Settlements.
3. Provide access to Metering Service Providers.


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### 4.2.7 System Time

All system databases, including all distributed systems and the MV-90 systems used for data acquisition, shall be synchronized through an automated data acquisition process to synchronize meter data.

### 4.2.8 Timing of Data Delivery

Data acquired for loading into the database will generally be for the previous 24 hours, but may be for any period up to the time of reading.

Automatic data load, reasonability checking and calculation processes shall be run after the data has been acquired and shall be completed in time to allow delivery of the data to Market Participants in accordance with the market rules.

Substitution processes will be manually initiated, where required, at any time after access to the data is available - typically during normal working hours, within two working days of the data being acquired.

Data delivery processes will be manually initiated once the above processes have been completed.

### 4.2.9 Data Validation and Substitution Principles

The timeliness of the detection of data errors and the MO's response to data acquisition malfunctions may place retailers and Market Participants at financial risk.

The MO will coordinate the resolution of issues arising from the non performance of metering systems, including any liaison with associated retailers, network service provider and metering provider(s). It will be necessary to respond promptly to all requests for remedial action when the metering systems malfunction or fail, and to provide data from the Meter itself if remote data collection is prevented.


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The system shall have the responsibility to identify suspected data errors resulting from data collection and processing operations using data validation processes developed in collaboration with the MO and, where required, apply data substitution procedures. This shall include any default substitution procedures necessary to ensure that Metering Data is delivered to the Settlements system to support Timetable requirements.

### 4.2.10 Data Substitution

There are a number of substitution methods that may be employed. Changes to data in the Meter Warehouse will be permitted up to and until the final settlement invoice is issued by the Market Operator. Alterations to metering data beyond this time may be agreed between Participants, however the agreement should not affect the data held within the database.

The first method is to be used where backup metering has been installed (usually energy meters). The intervals to be substituted, including the intervals on either side of the ones affected, will be copied, and a compensation factor (i.e. difference between revenue and backup metering) will be applied to equate the backup with the revenue metering.

A different method is to be used where no backup metering has been installed. The intervals to be substituted, including the intervals on either side of the ones affected, will be plugged in using an average of each interval from the preceding four weeks, or part thereof. However, if data must be substituted for a public holiday, then the most recent available Sunday will be used.

If an affected MP disagrees with the substitution made, all affected MPs and the MO must endeavor to agree on the substitutions to be made. Any dispute or disagreement must be resolved in the manner set out in the Market Rules.

Finally a method must be available to resolve disputes arising from an earlier substitution. How the data is substituted must be decided by mutual agreement of all the affected MPs. A document detailing precisely the substitutions made will be created and signed off by all affected Market Participants.


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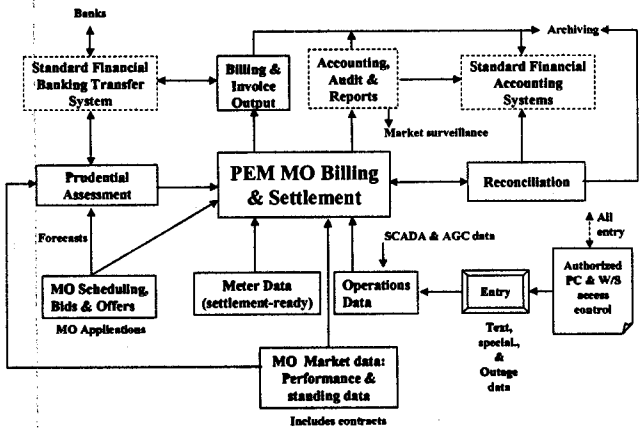
If insufficient data exists to implement the first two methods then the agreement method should be used immediately.

An audit trail shall be provided that records the substitution method used. When substitution method three is used a reference to documentation detailing the agreed method shall be required.

## 4.3 Settlements Process

### 4.3.1 General

The PEM will settle participant accounts based mainly on energy supplied and purchased during a settlement period. Measurements shall be obtained by the MMS for the volume of energy generated or distributed by a Market Participant in each trading period within the specified settlement period for each metered point. Measured amounts for each trading period shall be priced using the Spot Market Price in effect at the time for the pricing zone or node. Participants are paid for generation, and paid for usage based on metered energy volumes. Adjustments and spot market trading charges shall be added to determine the final amount due from or to each participant. The overall process is shown pictorially below:





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The MMS shall run preliminary and final settlements on predefined dates. The preliminary settlement runs allow Participants to make checks of figures against their own numbers before a final settlement run is done. Energy volumes may change between the preliminary and final runs, as meter and interchange readings are finalized.

Settlement processing will be bound by the Timetable defined in the Market Rules. Timing of statements and the types of statements are specified therein. Preliminary statements are the initial statements to be issued within seven business days after the end of the payment period. Eighteen business days after the payment period has ended, final statements will be issued. There may be a number of revisions throughout and after these time periods. There may also be interim statements issued based on results of new meter readings or prudential processes. Therefore, it is essential that the applications within the Settlements module keep track of all versions of data. It is also a requirement that the statement issue procedures and payment receipt timetables are strictly adhered to and fully auditable.

Settlement summary information and the results of these checks shall be available for review by the MO prior to approving the settlement run. Preliminary statements shall be sent to Participants, once the MO has approved the run. Payment will not be required against these statements. Their purpose is to provide an opportunity for the participant to examine the statement content and to resolve any queries prior to the final statement being issued. Once the final settlement statements are authorized and issued, payment is required against these statements regardless of whether a dispute is still outstanding. Payments shall be sent to and received from Participants using electronic funds transfer (EFT) through the MO's designated banking system.

An electronic signature must be entered to approve final settlement runs and release statements to participants. The system shall generate EFT transactions and general ledger postings automatically when final settlement runs have been approved. Settlement types shall include preliminary settlement run (daily, weekly, or monthly, to be user enterable), draft monthly settlement run, final monthly settlement run and reconciliation settlement run All key events in a settlement run shall be tracked and recorded in an audit trail.


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Participants may register disputes once a settlement run is closed. If successful, resolution may result in settlement adjustments being made for a prior production period. As a consequence, multiple settlement runs may be made for any settlement period over time, and each time all of the affected participant accounts must be adjusted and sent to affected MPs.

The Contractor shall provide a Settlement module that supports the calculation of settlement amounts, billing and clearance of all Market transactions. Essentially, this involves clearance of the Spot Market, the collection of Market Fees, and the settlement of compensation transactions (Ancillary Services).

The objectives that the Contractor shall meet when designing the settlements system are that it shall:

1. Be fully auditable;
2. Calculate transactions and provide data on an hourly basis;
3. Accommodate flexible settlement periods;
4. Support dispute resolution with clear audit trails; and
5. Be capable of archiving results and inputs in accordance with requirements given in Sizing Parameters.

The MMS shall provide flexibility for user definition and entry with respect to:

1. The duration of the trading period;
2. The rules that apply to different types of settlement runs; and,
3. The charges that are applied to participant accounts at the time of settlement, including adjustments, trading charges and applicable taxes.

Revisions to standing data and algorithms may occur at any point in time, and Settlements software shall be capable of maintaining multiple versions, such that, in the event of a settlement revision, the appropriate version of software can be run to accurately calculate the revised amount.

The Settlements application shall accommodate:

1. Weekly calculation of daily settlement values;
2. Production of settlement statements;


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3. Settlement payment processing;
4. Maintenance of settlement data;
5. Provision of settlement data to market participants; and
6. Prudential monitoring and processing.

The Settlement application shall accommodate: standard time, daylight savings time, on-peak, off-peak, and leap year. Times, peak and non-peak parameters shall be defined by the MO.

### 4.3.2 *Settlement Data*

The data required for the Settlement process and the data resulting from Settlement runs are detailed in Table 4.3-1:

**Table 4.3-1**

| Item | MMS Data Transfer Description |
|---|---|
| 1 | The system shall maintain the settlement liabilities in Peso amounts that are due to or from a Participant as a result of a settlement that is still outstanding. The data shall be updated by the Settlements Process. There shall be one entry per Participant per Settlement run. The data handled shall include: Calendar Settlement date, Settlement run number., Settlement Period identifier, Unique Identifier of a Business Associate, Net Peso amount due from or to (if negative) a Participant as a result of a settlement run. |
| 2 | It shall be possible to maintain Settlement Process Definitions and therefore, when a particular settlement process comes into effect, the data shall be updated by the MO. When the steps for a settlement process are defined, this entity indicates the date the collection of processing steps becomes effective and expires. The data handled shall include: Code for type of settlement, Date this processing definition comes into effect, Date this settlement process definition expires. |
| 3 | In maintaining a process definition there shall be a requirement to define a specific step in a settlement process. The data will be updated MO when a settlement process definition is created. There shall be 100 entries per Settlement Type. The data handled shall include: Code for type of settlement, Date this processing definition comes into effect, Unique Identifier of a rule, The settlement rule that is applied within this settlement process, Last date and time record changed. |
| 4 | The system shall maintain rules executed as part of a settlement run. The data shall be updated by the MO. The Contractor shall allow for 100 maximum. The data handled shall include: Unique Identifier of a rule, Processing algorithm for this settlement rule. |


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| Item | MMS Data Transfer Description |
|---|---|
| 5 | Run control and information for a settlement run shall be supported. The data shall be updated by the system, except for the actual message, which may be input by the MO. There shall be one entry for each settlement run. The data handled shall include: Settlement date, Settlement run no., Settlement Period identifier, type of settlement run (preliminary, final, reconciliation, etc.), date and time that the settlement run was initiated, effective Date and Time used for the settlement run, a code indicating processing status of this settlement run, (e.g. 'In Progress', 'Suspended due to Error', 'Completed Ok', 'Cancelled' 'Authorized'), the general message for the settlement run, the date and time that settlement details were published (if absent, indicates details have not yet been published), a flag indicating if data has been archived. |
| 6 | Messages may be generated as a result of a settlement run. The data shall be updated by the MO. There shall be a maximum of 100 entries per Settlement Run. The data handled shall include: Unique Identifier of a System Message, Calendar Settlement date, Settlement run no., Settlement Period identifier. |
| 7 | The system shall support the definitions of different settlement types (preliminary, final, reconciliation etc). The data shall be updated by the MO. The vendor can assume 10 maximum. The data handled shall include: Code for type of settlement, Description of code for settlement type, Default message to be displayed on settlement reports and statements for all settlement runs of this type, unless customized for a specific settlement run, a flag indicating if this is a 'Reconciliation' settlement run, a value that drives the calculation of accrued liabilities ensuring that a Final Monthly settlement liability takes precedence over a Draft Monthly settlement liability, and both take precedence over Daily Settlement values, a flag indicating if a settlement run of this type may be approved automatically. |
| 8 | The system shall maintain settlement data for each generation connection point. A regional summary is also to be provided. The data shall be updated with each Settlement run. There shall be one entry per Settlement Run. The data handled shall include: Settlement date, Settlement run number, Settlement Period identifier, Unique station identifier, Dispatchable Unit identifier, Physical unit identifier, Region identifier, Unique participant identifier, Generated energy, Purchased Energy, Regional Market Price, Excess Energy Price, Connection Point Price = RRP * Energy, Net energy MW/hours, Cost of net energy in Pesos, Cost of excess energy in Pesos, Administered Price Cap Compensation (where applicable), last date and time record changed, Purchased Energy (Generator Purchases) MW, Purchased Energy Cost in Pesos, Meter Run No of MDA file used, Metering Data Agent (where applicable). |


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| Item | MMS Data Transfer Description |
|---|---|
| 9 | The system shall maintain summary settlement data for generation within the specified region. The data shall be updated with each Settlement run. There shall be one entry per Settlement Run. The data handled shall include: Calendar Settlement date, Settlement run number, Settlement Period identifier, Region identifier, Generated energy, Purchased Energy, Net energy Mwhours, Cost of net energy Peso, Cost of excess energy Peso, Purchased Energy (Generator Purchases) MW, Purchased Energy Cost – Peso. |
| 10 | The system shall maintain settlement details when an Intervention is in effect. The data shall be updated when intervention occurs in a billing run. This data shall be rarely updated. The data handled shall include: Settlement Date, Settlement Run Number, Settlement Period identifier, Intervention Contract Identifier, Intervention Contract Version, Unique participant identifier, Dispatchable Unit ID, Regional Recovery Flag (Indicates is this is for a region only), Region Identifier, payment to Generator for Intervention, last date and time record changed. |
| 11 | The system shall maintain recovery details when an Intervention is in effect. The data shall be updated when intervention occurs in a billing run. This data shall be rarely updated. The data handled shall include: Calendar Settlement Date, Settlement Run Number, Settlement Period identifier, Intervention Contract Identifier, Regional Recovery Flag (Indicates is this is for a region only), Region Identifier, Unique participant identifier, Demand of Participant in Region/Market, Total Demand of Region/Market, Payment to Generator for Intervention in Peso, Retailer Payment to Pool for Intervention in Peso, Last date and time record changed. |
| 12 | The system shall maintain payments to be recovered from participants when a Force Majeure event is in effect. The data shall be updated with each settlement run. There shall be one entry per settlement run. The data handled shall include: Settlement date, Version number, Settlement period ID, Force Majeure identity number, Force Majeure version number, Participant unique identifier, Amount of Energy Used as the basis of payment, Force Majeure event amount in Peso, Force Majeure payment amount in Peso, Last date and time record changed. |
| 13 | The system shall maintain payments for market fees for each settlement date. The data shall be updated with each settlement run. There shall be one entry per settlement run. The data handled shall include: Settlement date, Settlement run number, Unique participant identifier, Period identifier, Market fee identifier, Fee charge, Energy amount for variable fees, Last date and time record changed. |
| 14 | The system shall maintain an audit trail of all billing runs that have been posted. The data shall be updated when the authorizing person approves a settlement run. This data is updated for each billing run posted. The data handled shall include: Report identifier, Settlement date, Date and time report posted, Settlement run number, Unique participant identifier, Last date and time record changed. |


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| Item | MMS Data Transfer Description |
|---|---|
| 15 | The system shall record hourly spot market price as they relate to settlements. The data shall be updated weekly as part of the billing run. This data is updated every trading interval. The data handled shall include: Settlement Date that this data applies to, Run Number, Region Identifier, Trading Interval Period Number, Regional reference price for this dispatch period, Excess energy price where negative average, Identifies this is a period for which no trading interval was determined, Last date and time record changed. |
| 16 | The system shall identify the actual settlement run used for each settlement day and thus the settlement results. The data shall be updated daily with each day's settlement run. There shall be one entry per settlement run. The data handled shall include: Settlement Date that this data applies to, Region identifier, Ex Post Settlement Run Number, Settlement run status such as posted, Ex Ante Settlement Run No., Settlement run status such as posted, Last date and time record changed. |
| 17 | The system shall maintain a record of payment by a participant by EFT. The data shall be updated by the Market Operation Accounts dept. It is assumed there shall be one entry per Participant. The data handled shall include: Unique Identifier of a Business Associate, Net Peso amount of a payment made by a Participant, Date and Time payment was made. |
| 18 | The system shall maintain and record the adjusted amounts for each bill run, on a participant-by-participant basis, showing the bill run adjusted and the adjusted amounts. The data shall be updated weekly as part of the billing run. It is assumed there shall be one entry per Billing Run. The data handled shall include: PEM Financial year, Week number within the financial year, Unique run number within a given financial year and week number, Unique participant identifier, Participant type (Generator/Customer), Financial year for which the adjustment is applied, Week number for which the adjustment is applied, Bill run number for which the adjustment is applied, Previous amount billed Peso, Adjusted amount billed Peso, Last changed date & time. |
| 19 | The system shall maintain APC compensation amounts for the billing period when applicable. The data shall be updated weekly as part of the billing run. There shall be one entry per billing run. The data handled shall include: PEM Financial year, Week number within the financial year, Unique run number within a given financial year and week number., Unique participant identifier, Region identifier, APC Compensation Value, Last changed date & time. |
| 20 | The system shall identify any Administered Price Cap Recovery for the billing period. The data shall be updated weekly as part of the billing run. There shall be one entry per Billing Run. The data handled shall include: PEM Financial year, Week number within the financial year, Unique run number within a given financial year and week number, Unique participant identifier, Region identifier, Administered Price Cap Recovery amount for week, Last date and time record changed. |


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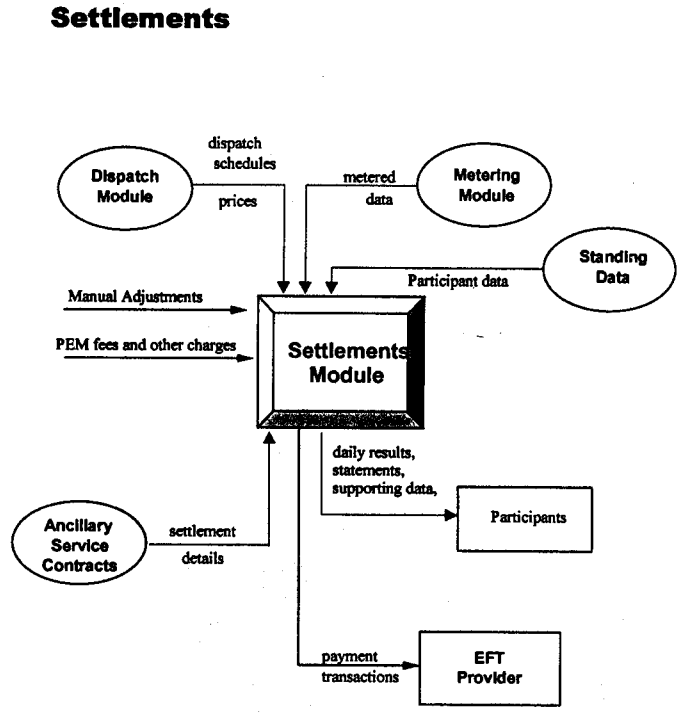
### 4.3.3 *Settlements Processing*

The following diagram depicts the Settlements processes, showing major interfaces and data flows.





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Settlements data will be prepared based on the results of the Constrained Security Dispatch runs for Real-Time Ex Ante and Real Time Ex Post Dispatch runs. The specific algorithm to be used is defined in the Market Rules and referenced in Section 3 of this specification.

Settlement statement processing involves:

1. Input of accepted (processed) bids, offers, and scheduled loads validated and processed by settlements application;
2. The aggregation of daily settlement data for a full billing period from settlements application;
3. The calculation of financial credits and debits based upon the MO established price and product quantity for each trading interval, each charge type, and each market participant;
4. Determination of adjustments and the application of interest if applicable;
5. Preparation of statements and determination of line items;
6. Authorization and electronic issuance of statement to each participant;
7. Acceptance of EFT relating to market transactions and accounting for each; and
8. Taking into consideration all energy and financial transactions, summarizing them, and providing a market accounting balance sheet for each final statement period.

The settlements process is summarized in Table 4.3-2.

**Table 4.3-2**

| Market Participant | Other | Market Operator |
|---|---|---|
| Submit bids, offers, and load schedules (as applicable) to Market Operator (MO) | **Metering Provider**: Submits meter data for each meter point to Market Operator (MO) | Market Operator (MO) validates & processes, bids, offers, schedules, and meter data |
| Market participants receive from MO an ex-ante nodal energy price prior to the commencement of each trading interval | **T&D Owners**: Submit real-time SCADA data to SO that is shared with MO for market applications: including congestion management & load forecasting | MO shall for each trading interval and each node, calculate an ex-ante (before) nodal energy price and an ex-post nodal energy price |
| | | MO applies caps to ex-post (after) unrestrained energy nodal price if applicable |
| | | MO determines ex-ante zonal reserve price for each market reserve zone |


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| Market Participant | Other | Market Operator |
|---|---|---|
| | | MO applies caps to ex-post unrestrained reserve price if applicable |
| | | MO calculates ex-ante energy settlement quantity for each trading interval as net flow into grid, through the trading node, as estimated at the beginning of the respective trading period and by the forecast or target for the trading node for the end of the trading interval as estimated at the beginning of that interval |
| | | MO determines ex-post settlement quantities for each trading node from actual metered flow through that node during the trading period |

The Settlements processes shall provide for initiation by user either by time of day on a given day of the week automatically, or manually through an operators instruction in the event of an adjustment or revision. At a predefined time of day on a given day of the month, settlement processing shall be initiated and data from external sources shall be available for processing. Regardless of the source of the trigger, (automatic or manual) processing shall be identical. Processing for re-runs shall not be dependent upon retrieval of real-time Standing Data because the data relative to each historical market interval must be retained without alteration.

All input source data shall have been previously checked for completeness and validity. This is to ensure that all the relevant data is ready for processing and that the trading interval processing runs smoothly. If input source data has not passed validation, then the responsible application is informed by way of a "Status" message. The Settlements module produces this Status message, and the resolution of the problem is manual. The source applications may have to re-submit data before the Settlements processes can be re-initiated.


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Trading interval settlement values shall be calculated first. These shall be calculated for each relevant participant. Each charge type (category of settlement) shall have its own calculation. Main data inputs include:

1. Regional parameters and congested path data;
2. Meter data for each required market metering point;
3. Participant details;
4. Reserve requirement details;
5. MO calculated energy price details;
6. MO calculated ancillary service prices; and
7. Standing data.

Market fees shall then be applied. Meter fee type may be dependent on the metered energy directional flow. Once flow is determined, a simple Peso value per meter shall be calculated.

#### *4.3.3.1 Settlements Functions*

The Contractor shall provide Settlements functions that calculate settlement values per charge type, per market participant, per trading interval, per calendar day for a billing period. Settlement values per trading interval shall be calculated for the following items:

1. Hour Ahead settlement values using metering data, loss factors and Regional spot prices;
2. Administered Price Cap compensation payments;
3. Excess Generation settlement values using an excess generation price and relevant metered energy; and
4. Ancillary Service payments based upon the dispatch of the services and the contracts in force.

The Settlement application shall provide for a minimum of one hundred charge types with each having up to fifty subordinate sub-charge types. The following charge types as a minimum shall be provided for by the Contractor.


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| Item | Charge Type | Sub-set | Comment |
|---|---|---|---|
| 1 | Ancillary Service Bi-lateral Contract | Allow for up to 50 subordinate sub-sets | Initial contracts to be defined and included with standing data |
| 2 | Ancillary Service Spot Market, regulating reserve price, generation | Allow initially for 3 market reserve zones (ultimately up to 100) | This product is price calculated and provided per Market Operations Section, Settlements multiplies price by respective metered quantity. |
| 3 | Ancillary Service Spot Market, contingency reserve price, generation | Allow initially for 3 market reserve zones (ultimately up to 100) | This product is price calculated and provided per Market Operations Section, Settlements multiplies price by respective metered quantity. |
| 4 | Ancillary Service Spot Market, contingency reserve price, qualified load | Allow initially for 3 market reserve zones (ultimately up to 100) | This product is price calculated and provided per Market Operations Section, Settlements multiplies price by respective metered quantity. |
| 5 | Ancillary Service Spot Market, [future commodity] | Allow initially for 3 market reserve zones (ultimately up to 100) | This product is price calculated and provided per Market Operations Section, Settlements multiplies price by respective metered quantity. |
| 6 | Energy, Spot Market price | Allow initially for 3 market zones (ultimately up to 1000 pricing nodes) | This product is price calculated and provided per Market Operations Section, Settlements multiplies price by respective metered quantity. |
| 7 | Energy, Out-of-market occurrence | | Used only in declared emergency or other allowed by PEM; Price origin is MMS application |
| 8 | Reserve, Out-of-market occurrence | | Used only in declared emergency or other allowed by PEM; Price origin is MMS application |
| 9 | Market fees | Subsets: include Registration, power system operation, metering, billing & settlement, administration and up to 50 others open to definition by MO | Inadequately defined |
| 10 | Special assessments or taxes | Subsets: Allow up to 25 open to definition by MO | Not defined |


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| Item | Charge Type | Sub-set | Comment |
|---|---|---|---|
| 11 | Penalties, interest for late payments, or fines | Subsets: Allow up to 25 open to definition by MO | Not defined |
| 12 | Adjustments | See right >>>> | Normally adjustments will be charged in the respective category and flagged as adjustment with text reason, this is for any other special case |
| 13 | Settlement surplus account | Only for MO internal accounting | This account allows cumulative surplus credits per PEM, with each line item identifying source |
| 14 | Settlement deficit account | Only for MO internal accounting | This account allows cumulative surplus debits per PEM, with each line item identifying source |
| 15 | MO Balancing Account | Only for MO internal accounting | This charge category is for the purpose of providing an overall balancing summary of MO energy and financial activities |
| 16 | MO Internal transfer | Only for MO internal accounting; At least 100 sub-categories shall be provided | This charge category serves to identify transfers within the MO to specific accounts as allowed by the PEM |

#### 4.3.3.2 *Daily Prudential Processing*

Prudential processing shall conduct prudential checks for each day for each of the Participants that are required to provide prudential cover and have traded in the spot and financial markets. It shall occur daily when actual metering data is available and will thus be a day behind the current day. Prudential Checking assures that for each day, a Participant's accrued financial obligation (including financial market trading and bi-lateral obligations) shall be compared to its prudential trading limit. If this exposure is reaching the prudential trading limit, then a warning shall be issued to the settlements staff. They in turn will take the appropriate action e.g. issue a margin call or increase the trading limit.

Prudential processing shall be enterable by the user for daily, weekly or monthly intervals, but can be set as default to be performed by running one ex-post settlement run for each trading day in the past for which sufficient information is available. A report shall then provide a summary


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of all Participants' accrued market debits over the period selected by the report. This report shall list only those Participants and their exposure where it exceeds the prudential limit stored against the Participant in the standing area data.

#### 4.3.3.3 *Settlements Billing Calendar*

Final settlements shall normally be carried out at fixed monthly billing periods within a financial year. Each billing period will have an associated calculation date and payment date. Facilities shall be provided to:

1. Generate the settlements calendar; and
2. View the settlements calendar.

#### 4.3.3.4 *Production of Settlements Processing Log*

Each time settlements are processed, a log shall be produced indicating the type of processing carried out, any errors which occurred, and any intermediate values produced. The log shall be stored with each Settlements run.

### 4.3.4 ***Statements***

The output from the settlement process shall be standardized reports (statements) of the values involved. These reports will also be available for each MP to download from the central system via the PEM E-Commerce Web Site. Participants shall be able to retrieve their own files and process the data provided locally. Files issued over this interface shall be posted on a once per authorized settlement run only. To obtain the underlying details of the trades, the MP shall have the capability to query their confidential web page.

#### 4.3.4.1 *Statements Structure*

The statement structure shall be by Participant type for a billing period and shall be for a given version of data all of which shall be clearly identified. The net position of settlement category


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shall be shown and an overall net position shall be identified. If a Participant requires supporting data, they will make a formal request to view the appropriate Settlement data. The statements will include:

1. Energy consumed/generated in each Settlement Period; .
2. Energy prices in each Settlement Period;
3. Ancillary Service quantities selected for the Settlement Period;
4. Ancillary Service prices for the Settlement Period;
5. Fees for the Settlement Period;
6. Energy Losses allocated in each Settlement Period (if applicable);
7. Other Charges and adjustments in each Settlement Period (if applicable); and

Net amount payable/receivable for the Settlement Period for each Market Participant.

#### *4.3.4.2 Standard Data*

Samples of standardized reports shall include but not be limited to:

1. Identity of the organization to receive statement;
2. Statement identifier;
3. Version control ID;
4. Version Type Description - Preliminary/Final/Revised/Prudential;
5. Billing Period Week Number (1-52);
6. Statement Issue Date;
7. Charge type(s);
8. Settlements Summary;
9. Settlements Statement Total - Financial amount for total settlement statement for the organization;
10. Market Fee identifier e.g. Registration, Metering, Administration and Billing and Settlements;
11. Billing Period Price (amount for each market fee);
12. Billing Period Volume (MWhs for each market fee);
13. Billing Period Total (amount for each market fee);
14. Total Energy PaymentTotal (receipts/payments for energy to the organization for the Billing period);


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15. Region identifier;
16. Connection Point ID;
17. Unique Metering ID;
18. Metered Energy - Metered Energy flow at each metering installation for billing period in MWh;
19. Aggregated Gross Energy - Metered Energy at Connection Point;
20. Metered Energy - aggregate of the adjusted gross energy amounts for that trading interval for each connection point assigned to that transmission network connection point;
21. Settlement Energy - Adjusted Gross Energy;
22. Adjustments, corrections, authorized changes with trailer information; and
23. Daily Interest % applied to Settlement Values. (Only used when a Revision Statement is issued).

#### *4.3.4.3 Statement Totals*

The Settlement process shall also determine the line items and totals for each statement. Line items and line item totals shall be based on participant type.

If the settlement for a particular billing period is using revised data, historical data shall also be a line item as shall any adjusted value, and all highlighted as such. Processing the line items involves the following steps:

- Obtain the total settlement data for each settlement area from previous settlement's processes;
- Apply line items;
- Determine net payment/ receipt based on line item totals, if the line items require adjustment;
- Pass the line item on for further processing; and
- If the line items do not require adjustment send the line items to the next process step, i.e., for authorization and statement issue.

This shall be done for each Participant.


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The data that needs to be accommodated shall include but not be limited to:

1. Spot market settlement values;
2. Excess generation settlement values;
3. Compensation payment settlement values;
4. Bilateral settlement values;
5. Ancillary service settlement values;
6. Market fee settlement values per billing period; and
7. Organization details.

#### 4.3.4.4 *Calculation of Interest*

The Contractor shall provide for the calculation of interest, if any, based on the total adjusted settlement values per organisation. The interest to be charged shall be at the daily interest rate allowed under the Market Rules and is referenced from the Settlements Module standing data area.

This function is usually only necessary for reconciliations since it is assumed that all participants will make the required payments by the due data via EFT. If a revision is not required than the next process step is to authorize and issue the statement.

#### 4.3.4.5 *Statements Process*

After a statement has been prepared and examined by settlements personnel, it must receive authorization before it can be issued. Once authorized, the statements are electronically issued to the appropriate organizations. The details relating to authorization shall be recorded in the audit log. The authorization and issuance of statements shall strictly follow the time frame defined by the Timetable. Therefore, even if there are outstanding queries or data errors, the statement shall be issued. Any disputes or queries with the data shall be processed manually and if necessary the outcome will be to resubmit or override values with the statements application by settlements personnel.


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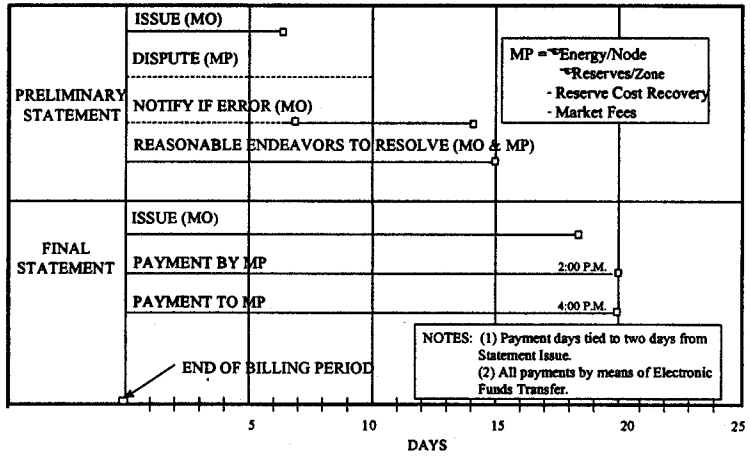
The following diagram provides a summary of the Statements process.




The payments must be made based on the final statements, independent of pending or potential disputes.

### 4.3.5 ***Management of Settlement Runs***

The PEM performs several different types of settlement, as data becomes available and changes over time. The current types of settlement may include but shall not be limited to:

1. Daily
2. Preliminary monthly
3. Final monthly and;
4. Reconciliation;

but new types may be introduced in the future with different periodicity.

Each type of settlement has specific steps to gather data and perform calculations. When a settlement process is initiated, it shall be monitored through to completion, or reviewed after completion. If errors occur in a settlement, it may be cancelled. Some types of settlement require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processing to include adjustments from prior periods. In all cases, a successful settlement run records participants' settlement liabilities.

The PEM system must tightly control the initiation of settlement runs to ensure that they occur in the correct order and for the appropriate production period. When a settlement allows adjustments to be included, the system shall allow these to be specified before the run is initiated. During a settlement run the user shall be able to monitor and cancel it. After a settlement run ends, the user shall be able to review details of its execution and if necessary, cancel it. The system shall be able to perform the steps in a settlement process in a precise order, based on user defined settlement rules. The following processes shall be provided as a minimum.

#### *4.3.5.1 Initiation of Settlement Runs*

This process shall be triggered whenever there is a need to calculate amounts due to the MO from Participants and due to Participants from the MO, either manually or automatically.

The system shall determine if a settlement run is already in progress. If one is, then a new run cannot be initiated, and progress on the current run will be reported. If there is no run currently in progress, the user then can choose the settlement type that they wish to run, the settlement period it is to run for and an effective date time that it is to run for (defaulted to the current date and time).

Assuming this is not a reconciliation run, the system will validate that the settlement period follows immediately from the last settlement run of the same settlement type that was completed satisfactorily, or no such settlement run exists. If no such settlement run exists, an error will be issued and processing will stop.

If the chosen settlement type is a reconciliation run, the system will invoke the required process and the system validates that at least one settlement run was processed correctly for same settlement period. If not, an error will be issued and processing will stop. If one is available, the settlement run with the highest version number will be used and has its settlement run number updated to reflect it as the comparison settlement run.


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Based on the settlement type and settlement period chosen, the effective date time specified and the derived settlement comparison run number (when appropriate), a settlement run is created with processing status 'in progress' after creating a new settlement run number.

Settlement is performed in accordance with the specified process steps and the settlement run is monitored. Security access is permitted to Market Operations staff only.

All changes will be tracked and recorded in the audit log.

#### *4.3.5.2 Settlement Reconciliations*

This process shall be triggered whenever there is a need to calculate reconciliation amounts and the user has specified as part of the run initiation process that this is a reconciliation run.

The system shall create an adjustments table using details from settlement runs that were completed correctly and whose type implies adjustment and whose authorization status is null (implying that the adjustment has not yet been included in a final settlement run). If there are no entries in this table, a message shall be displayed to the user to this effect, and processing returned to Settlement Run Initiated.

If the table has entries, these shall be displayed and the user may check off one or more entries in the list.

For those entries specified, the net Generation Volumes and Values are summed for each Participant in question. The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the net Purchase Volumes and Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.


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For those entries specified, the net Market Fees are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Generation Balance before VAT Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Purchase Balance before VAT Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the VAT on Generation Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the VAT on Purchase Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Generation Balance after VAT Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Purchase Balance after VAT Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Participant Fee Adjustment Values are summed for each Participant in question. The resulting values for each Participant are stored against the specific run number being passed as a parameter.


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For those entries specified, the Other Charges Balance before VAT Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the VAT on Other Charges Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For those entries specified, the Other Charges Balance after VAT Adjustment Values are summed for each Participant in question The resulting values for each Participant are stored against the specific run number being passed as a parameter.

For each entry generated, the respective settlement run is updated with an updated "Reconciliation Inclusion Number" and processing is then returned to process that initiates settlement runs.

Security Access limited to Market Operations Staff only.

#### *4.3.5.3 Monitoring / Cancelling Settlement Runs*

This process shall be triggered by a user requesting to monitor the status of a settlement run or by the settlement run initiation process.

If it is triggered by user requesting that the system shall determine if any settlement run is in progress or suspended due to errors. If one is, the actual settlement run shall be reported. If not the settlement run with the most recent number shall be used.

If the process is triggered by the settlement run initiation process, the settlement run number shall be passed as a parameter.

The system then displays details of the settlement run with the specified number, and requests that the user confirms that they wish to monitor this run. If the user rejects this run, a list of valid


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settlement runs shall be displayed. The user may select from this list and determine the desired run or can discontinue the monitor/cancel process.

For a valid settlement run, the run number is used as a reference to retrieve all relevant messages relating to that run. These shall be displayed in chronological order with the most recent message immediately visible to the user at the top of the list. If the settlement run is still 'In Progress', this shall be reported to the user and the message redisplayed every 5 seconds with an indicator making it clear this message is being updated (e.g. by the use of a timestamp).

The user may request the cancellation of the Settlement Run whose status is reported as 'In Progress' or 'Suspended due to Error'. If such a cancellation is requested and confirmed, the processing status of the run shall be set to 'Cancelled', if it is currently 'In progress', but shall be left at 'Suspended due to Error' if that was the status.

If the run's Processing Status is 'Suspended due to Error', the Cancel Settlement Function process shall be called using the run number as the parameter passed.

Access shall be permitted to Internal market operations staff only.

Cancellation of a settlement run shall be tracked and recorded in the audit log.

#### *4.3.5.4 Settlement Process Steps*

This shall be a background process and its purpose shall be to run all the specified steps in a settlement run.

It shall be triggered whenever a settlement run is initiated after being passed 'Settlement Run Number' as the identifying parameter.

The associated settlement run shall be retrieved based on the run number passed. For the associated settlement run type, the process identity shall be determined based on the process definition in effect for the effective date. For this process identity, the list of settlement process


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steps with their associated settlement rules shall be retrieved and ordered into a list. This list shall be ordered by 'settlement process step number' as defined by a previous user.

For each step in the list settlement, details shall be retrieved based on Settlement Run Number.

If the desired run Status is 'Cancelled', the Cancel Settlement Function shall be called and all further processing shall be stopped.

If run processing status is 'In Progress', the appropriate step algorithm shall be executed.

A message shall be subsequently created indicating the success or failure of the algorithm. If the algorithm executed successfully, processing shall continue with the next listed item. If the algorithm failed, the status shall be set to 'Suspended due to Error' and further processing shall stop.

If all items in the processing list are completed successfully, the status shall be recorded as 'Completed Successful'

For settlements with the automatic approval flag set positive, the status shall also be set to 'Released' and no further processing is conducted.

Access shall be permitted to internal Market Operations staff.

### *4.3.6 Disputes*

In the course of market operation, disputes can arise over settlement payments arrived at as a result of processing settlement data. Facilities shall be provided within the MMS to record the details of any disputes and clearance of such disputes. Disputes can be raised at two levels. Stage one involves the disputing participants attempting to resolve the matter themselves. Escalation to stage two invokes a formal process that appoints a Dispute Resolution Administrator and Dispute Resolution Panel if required.


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A new dispute file shall be created and saved in the system. Dispute details shall be recorded identifying the settlement date, run number, parties involved, and the specific issues. The raising of a dispute shall be recorded in the audit log.

The Contractor shall provide for the details and status of a dispute to be modified. Modification of dispute details will be recorded in the audit log.

Facility shall be provided to authorize the details of a dispute as correct. Authorization of dispute details is recorded in the audit log.

Facility shall be provided to update a dispute status (examples include 'level 1', 'level 2' 'resolved' etc.). Update of the status of a dispute shall be recorded in the audit log.

Where a dispute has been resolved, it will sometimes be necessary to prepare a reconciliation transfer statement. The Statement will be issued to the MO accounts department. The accounts department will calculate the appropriate interest charges for the disputed payments and arrange for the reconciliation payments to be made between participants.

The following reports shall be provided by the system:

1. Record outstanding disputes over a given period; and
2. Record dispute details.

### 4.3.7 Market Suspension

The MMS shall support the MO's decision to suspend the operation of the Market in one or more Regions by issuing a declaration to all MPs. The declaration of Market Suspension will be issued by the MO by broadcasting a market notice that can be picked up via the Web interface and using E-Mail facilities. The MMS shall provide the facility for an appropriately authorized user to create and maintain the Market Suspension status in (a) selected region(s) with an effective date.


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The Market shall be suspended from the beginning of the Trading Interval that the MO specifies as the Market Suspension time. The MO can only suspend the operation of the market in a Region in accordance with the provision of the Market Rules. Typically this is when one of the following conditions applies:

1. The power system has collapsed to a black system or the System Operator has declared that a threat to system security exists and it cannot be remedied while maintaining the market operations;
2. The Market Operator has been directed in a governmental order to suspend the operation of the Market in that Region or operate the Power System in a manner inconsistent with the Electricity Market Rules;
3. The Market Operator has concluded that it is impossible to operate the Market in a Region in accordance with the Market Rules.

To re-establish the operation of the Market within a suspended Region, the MO must issue a notice to all MPs stating that the Market will recommence operation in the Region from a specified date and time. The market re-activation date & time must be provided to MPs at a time specified in the market rules. This notice period is required in order for MPs to submit a day-ahead bid for the first period of Market Operation. The system shall accommodate the following:

1. Region Identifier;
2. Date and Time Suspension issued;
3. Market Status (1 = Suspended, 0 = Active);
4. Effective Date and Time Market Status to Change;
5. Reason for Suspension; and
6. Origin of Suspension order.

The MMS shall complete the settlement calculations for the Billing Period in which the market was suspended up to the Trading Interval from which the Market was suspended. Data within the MMS relating to trading intervals subsequent to the Market Suspension will be ignored by the Settlement processing routines. When the Market is re-activated, the MMS shall process normally.

Settlement trading amounts will not be calculated for the duration of the Market Suspension in the Region(s) affected and an administered price will be enforced.


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## 4.4 Processing Payments

Payments processing will be executed externally to the Settlement system using Electronic Funds Transfer and a standard accounting package. The Settlement system shall provide for the deposit of all required data. Reports shall be generated by the Settlements system in a user defined format to the PEM accounting and audit functions, detailing the payments and receipts.

The Settlement system shall provide for a balance sheet for determining the balance/imbalance of electrical and financial quantities for each settlement period, for designated contiguous settlement periods, and for cumulative contiguous periods by user entered parameters.

### 4.4.1 Electronic Funds Transfer (EFT)

The MO will establish an Electronic Funds Transfer (EFT) capability for use by all Market Participants. The function will provide the means to electronically transfer funds between the MO and the Generators and Customers based on calculated Settlements.

The Contractor shall provide the following capabilities for interfacing with the EFT selected by the MO:

- Secure data transfer and storage of all EFT account information;
- Protected access to all EFT account information, limited to MO, MP and audit personnel;
- Correlation between all Settlement statements and EFT data;
- Summaries of all EFT transactions by trading interval and daily activity;
- Summaries, on request, of account information by MP, trading interval and statement;
- Historical information and archived information as described for Settlements data;
- Full audit capabilities for all EFT transactions.

The specific EFT function to be used will be selected by the MO during the system development phase. It shall be fully operational with the MMS by Site Acceptance Test.


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As far as the EFT provider is concerned, there will not be any requirements to calculate trading amounts, issue statements, perform billing runs or issue invoices; all these functions will be handled by the MO Settlements and the MO accounts department. The EFT provider will however, need to establish a reliable and secure communications link with the MO to electronically receive settlement trading amounts at designated times and move funds between Participant accounts in accordance with a strict timing regime. The receipt of final statements from the MO will be done in two separate transactions to ensure that any shortfalls encountered during the debit of customer accounts is "smeared" across supplier accounts in order that the MO is not financially exposed. The process is described in the simplified diagram below.


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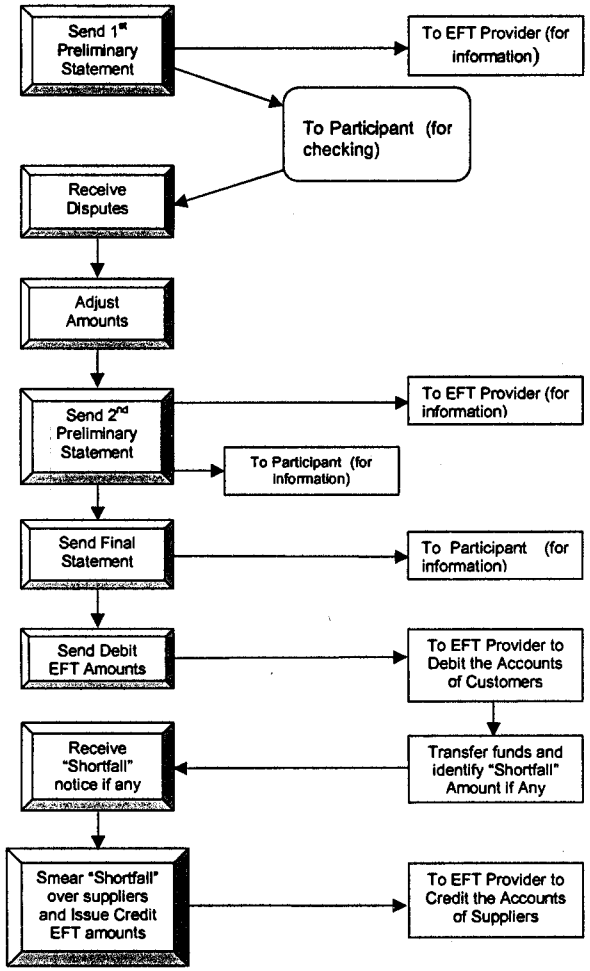



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### 4.4.2 *Interface with the Accounting Department*

The MMS shall provide direct reports on settlement transactions to the accounting department to facilitate financial accounting. Data that shall be provided includes but is not limited to:

1. Statements and statement summaries;
2. Payment confirmations and summaries; and
3. Receipt confirmations and summaries.

### 4.4.3 *Ancillary Service Payments*

As directed by the Market Rules, the SO must secure adequate provisions of ancillary services to support systems security. Some of these services will be paid for through the market clearing price while others will be provided on a contract basis with the SO. The types of contracts entered into will depend upon the type of service and therefore payment processing will track the type of service.

The market management systems shall collect and process all of the necessary data required to settle ancillary services, the data shall include but not be limited to:

1. Manual dispatch instructions issued by MO for Ancillary Services;
2. Contingency reserve prices;
3. Market clearing price for each Trading Interval; and
4. Metered generation for Ancillary Services dispatched units.


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# 5.0 DATA EXCHANGE AND INTERFACE REQUIREMENTS

Operation of the Market Management System (MMS) requires ongoing, efficient and secure communications with other systems and with MMS users. The following table gives the minimum Data Exchange Requirements for the MMS.

| Item | Data Sink | Data Source | Nature of Data Transferred |
|---|---|---|---|
| 1 | Settlements | Meter Data Collection System (MDCS) | Settlement-ready meter data. |
| 2 | Settlements | Market Management System (MMS), generally referring to Market Operator (MO) applications within MMS | Raw schedule and bid data from Scheduling Coordinators (provide option) |
| 3 | Settlements<br>Energy Management System (EMS) – System Operator (SO) | MMS | Processed schedule and bid, offer, schedule data |
| 4 | Settlements<br>MO applications<br>MDCS | EMS | Grid metering data corrections (if any) or adjustments along with trailer documentation. |
| 5 | Settlements<br>MO applications | EMS<br>MO applications | Inadvertent accounting data (if required), Unaccounted For Energy (UFE) data |
| 6 | External archive<br>Settlements<br>MO applications<br>MDCS | Settlements<br>External archive<br>MO applications<br>MDCS | Archiving of all input data and results, to allow re-run and comparison. |


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| Item | Data Sink | Data Source | Nature of Data Transferred |
|---|---|---|---|
| 7 | Settlements<br>MO applications<br>Meter data system<br>Assessment & monitoring | Master standing database [bi-directional] | Standing data such as MP, metering provider, and all relevant names, addresses, electronic transfer routings, maximum and minimum ratings (for reasonability checks), etc. |
| 8 | User workstations, monitoring audit, & surveillance, engineering support staff | Settlements<br>MMS<br>MDCS | Authorized users who (read only) review, evaluate, and recommend actions. |
| 9 | Workstations, MMS high level authorization | Settlements<br>MMS<br>MDCS<br>Reconciliation | Limited few individuals who are authorized to make database changes, execute any overrides or input any allowed adjustments, with audit trail. |
| 10 | Workstations, MMS system support | Settlements<br>MMS<br>MDS | Read only access for real-time data, as well as technology maintenance support of platforms and systems, without authority to make data changes on primary system. |
| 11 | Workstations, customer service | Settlements<br>MMS | Read only access to portions of data necessary to provide answers to MPs or other authorized entities. |
| 12 | Workstations, audit and security office | Settlements<br>MMS<br>MDCS | Read only, for audit review and security. |
| 13 | Workstations, dispute and reconciliation | Settlements<br>MMS<br>MDCS<br>Accounting | Read only for dispute analysis and reconciliation. |


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| Item | Data Sink | Data Source | Nature of Data Transferred |
|---|---|---|---|
| 14 | Production output | Settlements | Necessary data and audit trail required to request and execute payment drafts (electronic or paper) directly and, by user selection, secure electronic request to a third party contractor. |
| 15 | Settlements | MMS<br>EMS-SO | Constraint data, curtailment data, congestion data |
| 16 | Electronic Banking Transfer<br>Settlements & Prudential Assessments | Settlements & Prudential Assessments<br>Electronic Banking Transfer | For electronic payments, any valid source; prudential assessment input data and analysis data |
| 17 | System platform and application maintenance monitoring applications | Settlements<br>MMS<br>MDCS<br>Communications<br>LAN/WAN | Maintenance Engineering access (no authority to change or add data). |
| 18 | Accounting System and Corporate Ledger | Settlements and Electronic Banking Transfers | All financial related output and associated electrical values and service types, charge types, and final settlement data. |
| 19 | EMS- SO | MMS | Dispatch data: Gen. schedules (A/S and non-A/S) and scheduled loads |
| 20 | MMS | EMS | Near-real-time SCADA and AGC performance & monitoring data |
| 21 | MMS | Market Participants | Submission of and receipt of confirmation for bids, offers, load schedules |


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Input data required from the SO are:

- Network Status (transmitted only on change)
- Outages Schedule
- Transmission Constraints
- Generator Preferred Operating Points by Unit
- Load Forecast by Trading Node
- Ancillary Services, non-unit specific Requirements

The results of the Dispatch run shall be transmitted to the EMS for use during the next Trading Interval unless updated by the MMS or an Emergency condition has been declared.

***Market Operations - Dispatch***

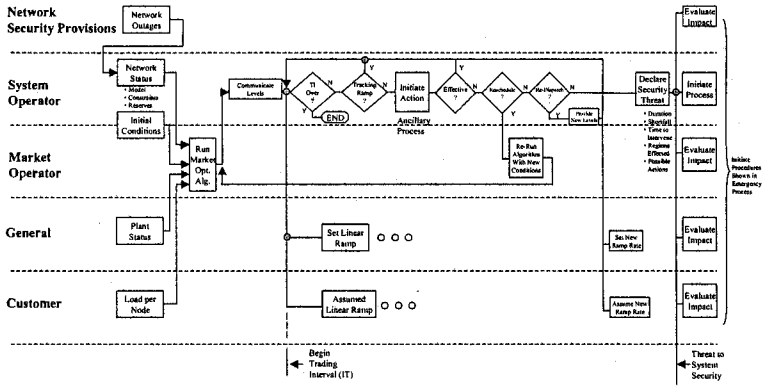


**Figure 5-1**

### 5.1.1.2 *Emergency Operations*

The declaration of an Emergency condition is defined in the Market Rules. Response to an Emergency situation is mandatory.


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The following diagram summarizes the process for all Participants up to and through a declared Emergency.

***Market Operations - Emergency***

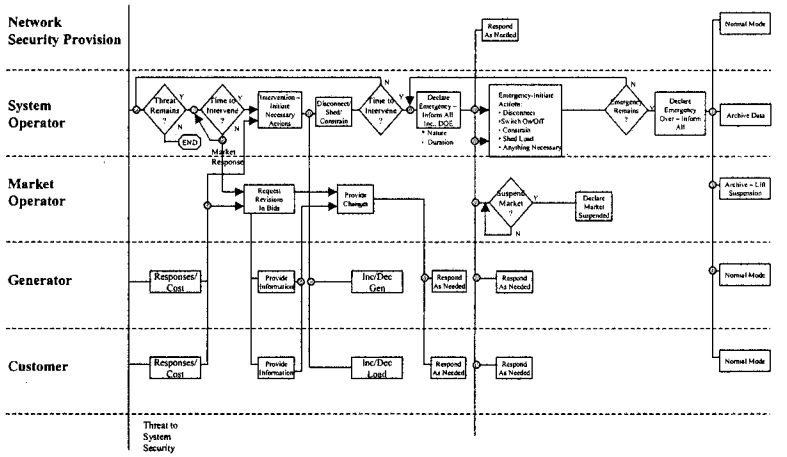


**Figure 5-2**

### 5.1.2 *EMS-MMS Detailed Interface*

The specific data to be exchanged between systems, periodicity of transfer, and the projected volume are included in Section 6.

### 5.1.3 *General Interface Considerations*

The interface to be used for data exchange between the MMS and EMS shall meet the following requirements.


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1. Physical

   The interface shall be a dual high-speed LAN, with one LAN acting as the primary and the other as backup. The backup path shall be tested once per day on a schedule agreed to between the MO and SO.

   Each LAN shall be routed via a separate path, to the extent possible, to provide protection against physical damage.

   Routers and firewalls shall be provided in accordance with overall system design requirements. All hardware shall be compatible with present and planned network infrastructure.

2. Data Exchange Protocol

   The data to be exchanged between the MMS and EMS will be both scheduled and on demand. All data shall be transferred utilizing standard data transfer protocols. Network Model data shall be in CIM-compatible format. Specific protocol(s) to be used shall meet open-system standards requirements.

3. Security

   Security of the Link between the MMS and EMS is essential to market operations. Security provisions shall be defined in detail in the MMS specification and the EMS Requirements document and shall include:

   a. Physical security as described above;
   b. Software firewalls;
   c. Protocols with security provisions; and
   d. Data validation of both MMS and EMS.

## 5.2 Market Participants

The key Participant interfaces and data exchanged are shown below.


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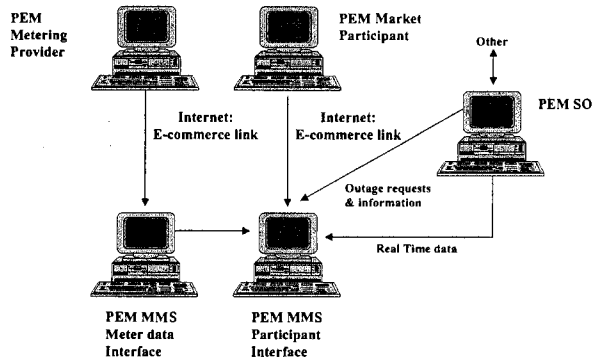


**Key Participant Interfaces With PEM Spot Market**

The MP shall access and provide data to the MMS using PEM E-Commerce. The requirements for PEM E-Commerce capabilities follow.

### 5.2.1 Functions

The web site is to be used during market pre-commencement and as an integral part of market operations. The functions to be accommodated are:

- Registration – All Participants in the PEM need to be registered with and approved by the Market Operator. The Market Rules provide the qualifying criteria for each Participant type and the information required for submittal. The site shall provide the required forms for registration and maintain a register of Participants. The MO shall have control over the criteria and the forms used for registration, and the capability of manually de-registering Participants;
- Offers and Bids – The main on-going use of the PEM site will be the submittal of Offers, including reserves, by Generators, and Bids and Offers by Customers, for each trading interval in accordance with the requirements of the Market Rules. The web site shall be designed to handle the maximum number of offers and bids and re-submissions as defined in the Performance portion of the specification;
- Acceptances and Rejections – The means for the MO to signal acceptance or rejection of the submitted offers and bids shall be provided. Re-submittals shall be accommodated;


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- Week-ahead and Day-ahead Projections – The projections of week-ahead and day-ahead projections for each trading interval shall be published in accordance with the Timetable;
- Market Information – The MO shall use the site to publish all required information regarding the market, including previous day details of dispatched generation or dispatched load, and dispatched reserves for each scheduled generating unit and scheduled load in each trading interval;
- General Information – The PEM web site shall have the capability of publishing general information as required by the MO or under the direction of the Government;
- Meter Data Collection – The MMS will periodically and on demand request data from the three regional meter data collection systems. These data will provide the information used to establish final prices for each trading interval for each Market Participant (MP);
- Settlements Data – The preliminary and final individual financial statements associated with market operations will be forwarded and responded to via the site. Provision for questioning the statements shall be provided; and
- Electronic Funds Transfer – Actual payments of all statements will be authorized via the function and funds dispersed using the Electronic Funds Transfer capability.

### 5.2.2 Access

The PEM Site will be used for the competitive buying and selling of power on a real-time basis. As such a great deal of the information on the site is both sensitive and proprietary. Access to specific portions of the site shall be controlled and subject to the security provisions detailed below. The site shall have at least fifteen levels of access, including the following:

- Market Administrator – Highest level of access. No limitations. Control of passwords and security controls;
- Market Auditor – Unlimited access to all data on the site including archives and current data;
- Market Operator – Unlimited access to all information submitted and published, currently available on the site. Used by the MO to operate the market;
- Network Service Provider – Access only to the details of their network; no "sensitive" market information;
- Meter Service Providers – Access to Participants Register, the Metering information database and general market information;
- Generators – Access to those data directly effecting them such as day-ahead and week-ahead projections and Market Information;


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- Customers – As above for Generators; and
- General Public – Will be restricted to specific information designated by the Market Rules for general publication.

#### 5.2.2.1 User Log-in

Log-in shall be facilitated by a web component. The Contractor shall provide a secure log-in function that restricts user access to specific functionality. The defined access table shall provide levels as defined above.

### 5.2.3 Forms and Templates

All of the information to be exchanged and/or posted on the PEM Site shall be enterable via forms expressly created for this purpose based on templates that shall be provided to the MO.

Default forms shall be built using a standard template editor. These forms shall be designed in consultation with the MO and subject to MO approval. Specific requirements are:

- Creation and modification of templates shall be possible using simple data entry procedures by authorized MO staff;
- Templates shall be implemented using standard technologies, preferably as XML or as spreadsheet tables with Comma Separated Values (CSV);
- All templates shall contain the template identification number, the version number and the effective date of implementation;
- Descriptions of all templates shall be posted on the web site;
- Transition to new or updated templates/forms shall be under the control of the MO and on a non-interference basis with market operations;
- Ease of use by the MPs of all forms shall be a high priority; and
- All changes to templates and installation activities shall be logged and archived.

#### 5.2.3.1 User Customization of the Web Pages

Customization options shall include:


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1. The pages and menu options that can be shown (set by the characteristics of the user and the functions to be performed);
2. The fields and their size and placement on the trading page (selected by the individual);
3. The buttons and navigation choices that are shown for access to allowable functions, favorite reports or saved ad-hoc queries (set by the user);
4. Topic areas to be covered in news messages and participant exchange messages (set by the user);
5. The web pages to which fields in the trading page link; and
6. The color that is used to highlight those records that relate to the participant in question on web pages and fields.

By defining general characteristics of all web page and field functionality, it shall be possible to set out a consistent and flexible approach to the delivery of services to the stakeholders. The requirements below describe:

1. Common Functionality – common processing that all components required to determine their specific characteristics;
2. User Connections – the management of user connections to ensure that users can only use system functionality to which they have been granted access; and
3. User Preferences – the customization of interface components by the user.

#### *5.2.3.2 Common Web Page Functionality*

The general characteristics of web components as retrieved and used shall be common to all functions and all pages. This will enable extension of the delivered system as well as expansion to accommodate new functions. Users shall be permitted to only initiate functions for which they have authorization.

The following parameters shall be received by all functions whenever they are initiated:

1. A unique identifier of the workspace in which the function will appear;
2. A unique identifier that allows a function to determine its characteristics from the PEM database;
3. Data concerning the user initiating the function; and
4. The level of connection that the user currently has with the system and what functionality will be delivered.


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Based on specific Web pages, the relevant parameters shall be retrieved. If the user is logged in and has previously customized the web pages, the preferred attributes shall be loaded in place of the standard attributes.

#### *5.2.3.3 Field Characteristics*

The system shall as a minimum allow customization of height (H) and width (W) of all fields. These parameters define the size (and thus the amount of real estate) that they should consume. Note that in the case of the component identified as the 'home' page for a web page, these parameters allow a user to customize the overall amount (general) of screen real estate they wish to use (determined by their screen resolution). In this manner, users with higher resolution monitors may make more screen real estate available to the PEM system, and will consequently be able to place more fields on the home page.

#### *5.2.3.4 Accommodating User Preferences*

User Preferences shall enable users to maintain their own page and panel customizations and to set general characteristics of their view of the trading page.

A user selects the customization button on a relevant web page. This process identifies the field to be customized, remembering the page on which the request was issued. If a previous customization entry is in place it is retrieved. If one does not exist, it can be specified at this time.

The user shall be allowed to freely change preferences within any predefined limits as to size of color. One or more new characteristics can be defined (for example, changing color). A user shall be able to customize only those pages and panels to which they have access.


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### 5.2.4 Market Participant Operation

A major responsibility of the MO will be to provide information to MPs. Acceptance of the web site and interface by the MPs is of vital importance to the ultimate success of the PEM. Participants need detailed information to allow them to make informed business decisions and to participate in a manner consistent with the objectives of the market. To these ends the web site shall be designed to:

1. Provide a level playing field enabling all participants to access the market system without having to make an investment in specialized computer technology;
2. Provide all participants with equal access to market information;
3. Enable participants to make effective trading decisions by providing market information at the right time and in a suitable and appropriate format; and
4. Encourage the development of effective markets.

All aspects of information dissemination shall share a common set of general characteristics. It is essential that information is accurate and consistent between display presentations and is made available in a timely fashion. Titles and headings must be clearly defined and easily understood. Participants shall control the selection of data and be able to customize the parameters that control the information presentation formats.

All information provision functions and web components shall share a standard set of characteristics to ensure they display and operate consistently.

The market workspace shall provide Participants with one-stop access to information about the markets. Within the total PEM Website, there shall be two views of the information. A general public view shall be presented when a user first accesses the web site. The general view will not be customizable but once a registered user has logged in, the user's customized view of the trading pages shall be displayed.

The trading page shall provide the following:

1. Real-time market display panels;
2. Links to secondary web pages containing reporting and on-line data entry functions;


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3. Links to reports produced manually outside the PEM system;
4. Data entry facilities; and
5. Ad-hoc query facilities.

The trading page will be defined during the project implementation process. Customization for and by individual MPs shall be allowed to the extent that the standard MO interface is not affected.

#### 5.2.4.1 Operations Functions

The Web server shall support:

1. Highly secure login of Participants with different security levels of access to data.;
2. Standard web browsing and navigation among web pages, using the latest released web browser capabilities;
3. XML-supported displays of data;
4. Entry of form data;
5. Download and upload of data according to the formats defined by the Market Rules;
6. "Notification" of events and messages to individual Participants;
7. Broadcast of messages to all Participants;
8. Periodic/on-event updates of the changed data on user's screens;
9. Context-sensitive responses to user preferences and actions;
10. Context sensitive On-line help and manuals;
11. Time-stamped Web log that can be queried for basic site statistics and each Participant's usage and access statistics;
12. Time-stamped Web archive of critical data as posted to Participants; and
13. Other interactive tools.

### 5.2.5 Security

The security of the PEM web site is of foremost importance. With the sole exception of web pages designed for use by the general public, security shall be assured by at least the following:


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- A Public Key Infrastructure (PKI) using standard 1024 bit digital certificates capable of signing shall be used to verify the identity of participants. The PEM web site shall ensure that:
  - The certificates used are registered in the Certificate Registry;
  - Certificates are current and valid, by verifying the Certificate Authorities signature and checking the validity period;
  - The participant has initiated communications from the specified IP address or host; and
  - The certificate has not been revoked.
- Secure Sockets Layer version 3 (SSLv3) and/or Transport Layer Security (TLS) version 1 or above, IP Security or equivalent shall be used for authentication. The following SSL selections or alternatives with equivalent performance characteristics shall be provided:
  - - Asymmetric Algorithm: RSA
    - Symmetric Algorithm: RC4 (128-bit)
    - Digest Algorithm: SHA-1
    - Record Size: Largest size feasible.
- Strong encryption with a minimum 128-bit key shall be required.
- The web site shall provide for lockout of individual participants in the event of authentication failures, automatic logout on loss of connection, and automatic closing of all files and applications in the event of logout.

### 5.2.6 Site Monitor

The Site Monitor function shall process all requests to access the PEM system from all users ensuring that:

1. Requests are routed correctly;
2. Security rules are applied; and
3. Access constraints are handled correctly.

All activity occurring on the PEM web site shall be monitored and the following events recorded for review by authorized access levels:

- Registration of all Participants;
- Registration of all individuals with access beyond that of the general public;
- Logons to the site;
- Unsuccessful logon attempts;
- Logoff and loss of connection;


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- Updates of information shown on the web pages;
- Downloads of files or results of queries;
- Upload of files;
- Submitted forms;
- Acceptance and Rejection Notices;
- Attempts by individuals to access restricted data;
- Web site application failures;
- Web site communications failures;
- Failed attempts for access from unauthorized ports; and
- Any other security breaches.

The log of these events shall include the following information at a minimum:

- Time, to the millisecond, and date of the event;
- Logon name of individual and certificate number;
- Targeted URL address;
- Success or failure of interaction;
- Type of Event;
- Archive of the associated data, if applicable; and
- Security Alarm flag to indicate an unusual aspect of the event.

Access to the security log shall be limited to authorized security engineers, the Market Auditor and the PEM Web Site administrator.

### 5.2.7 General Web Site Operation

When a user first selects the Market Web site, the general public view shall be displayed. This view shall provide the user with a standard set of fields and links to other pages and is not customizable. It shall also provide Participants with a log in function.

When a Participant logs in, the public view of the trading page shall be replaced by the Participant's customized view. In addition to viewing their customized page, Market Participants (as opposed to those only being interested in observing the market) shall then be


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able to access the trading functions as defined by their service level. Each Market Participant's connection shall be monitored and if a specified time out interval is reached, access to the trading functions shall be suspended until the Participant logs back in.

Navigation panels to other pages shall enable the user to move between pages, for example reports and messages.

Public web pages shall still be accessible from within the trading pages. They will be used to display general information about the electric energy markets and operation of the PEM. They will also be used to display public bid/offer information and other market related data entered by the participants. In addition to preformatted public reports, Participants shall be able to select data using an ad-hoc query function.

The Trading Pages shall support the following functions:

1. Allowing users to log in;
2. Displaying connection status;
3. Monitoring user connections;
4. Navigating between pages;
5. Reporting Energy Usage;
6. Reporting Spot prices;
7. Reporting spot market histories;
8. Enabling messages;
9. Reporting News;
10. Viewing Static reports;
11. Viewing Dynamic Reports; and
12. Facilitating Ad-hoc Reports.

#### *5.2.7.1 Displaying Connection Status*

The Connection status shall be presented in a field on all web pages in the same place on the screen. Its purpose is to provide feedback about the status of a user's connection to the PEM


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system. It shall be triggered by a user request to view any PEM web page (public or trading) and updated periodically by a background process.

The basic design of the web page shall be used to determine the user's preferred field characteristics and the panel sized to reflect those characteristics.

#### *5.2.7.2 Monitoring User Connections*

A background task shall be included such that users may leave their workstation at any time without logging off (or simply turn their machines off). Connections that they have made with the system shall be monitored so that they can be cleaned up, or at least 'timed' out, after a default or user defined period of time. The purpose when monitoring user connections is:

1. To protect against unauthorized trading activity; and
2. To clean up user connections that are no longer in use.

#### *5.2.7.3 Navigating Between Pages*

Navigating between pages shall be facilitated by a web panel in each trading web page. The purpose is to enable users to navigate to market web pages from within the trading web site by preparing 'menus' depending on service level and for registered users, customizations.

### *5.2.8 Market Participant Data Input*

Table 5.2-1 provides details of the data to be generated by the MP and transmitted to the MO via the PEM E-Commerce function.


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Table 5.2-1

**High Level Data Input Requirement From Market Participant (MP) To MMS**

*MMS= market management system; MP= Market Participant*

| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| | **Offers & Bids, Required Data** | | | |
| 1 | The Contractor shall provide for Market Participant registration and meter certification requests with associated information in text and table format | Various | MP | MMS |
| 2 | MP data submittal prerequisite to submitting Offers/Bids: Market Participant Name (each MP shall have submitted and have MO approval of "standing data" to include but not be limited to contract tables (if applicable), unit or equipment maximum rating, operating limits, unit governor ramp rate, unit forbidden operating zones, unit AGC ramp rate (if offering regulation), cold start-up (time from start to synchronize), physical location (connection point) for each physical unit or load with an associated MO assigned generator pricing zone or customer pricing zone respectively, certified Metering Provider, financial and business information required by PEM (such as EFT information, account ID, routing numbers, bank, corporate data, addresses, contacts, MO authorized prudential limits, etc. that it applies only to generators) | Text | MP | MMS |
| 3 | Validated offers, bids, schedules from each valid MP for each trading period submitted: Each offer, bid or schedule shall be submitted using an approved MO template; Each template shall provide for the data field identified by this Data Input Table as defined by the following data field descriptions | All | MP | MMS |
| 4 | Offers & bids shall be date and time stamped received by MO: This will be the time used to determine validity with respect to allowed period for submittal | Date | MP | MMS |
| 5 | Each Offer/Bid shall designate: Commodity type Identifier to include initial provision for: (1) energy, generation offer; (2) energy, customer demand bid (corresponding with dispatchable load); (3) Ancillary Service, Customer contingency reserve offer regarding dispatchable load; (4) Ancillary Service, regulating reserve offer; (5) Ancillary Service, contingency, spinning reserve offer; (6) Ancillary Service, contingency, non-spinning reserve offer; (7) Ancillary Service, contingency, replacement reserve (future) offer; (8) Ancillary Service, Black-start service offer; (9) Ancillary Service, generation reduction offer to provide reactive support; (10) Ancillary service, Other (future);and ten additional initial categories, with ultimate accommodation of fifty commodity types; Each commodity type shall be capable of accommodating eight subsets thereof | Codes TBD | MP | MMS |
| 6 | Commodity type offered/bid: Each template shall allow initially for up to twenty different commodity types, with provision to accommodate 24 trading periods in each 24-hour calendar day; ultimately sized to accommodate expanded template to accept thirty different commodity types in any or all of 288 trading periods in each 24-hour calendar day | Text & times | MP | MMS |
| 7 | Commodity trading period to which submittal applies: Beginning and ending times for each commodity type in the specified trading period(s); default will use first entered submittal date for each time segment, unless flagged as standing bid | Times | MP | MMS |
| 8 | Contractor shall provide for commodity trading period "standing bid" flag as allowed by PEM, with beginning date and time and ending date and time for each commodity type | Code TBD | MP | MMS |
| 9 | Non-Participant Participation ID: Market Participant Registration Number (ID) shall also apply for non-participant identification *if applicable in the future* | TBD | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 10 | **Fixed Contracts**<br>Fixed Contract Data submitted as contract table in MO defined format including but not limited to: MP name, registration number, contract type (code to be determined by MO), contract number or identifier, commodity type, contract effective date, contract expiration date, values and prices table, physical location each of plant/unit/load, connection point and associated node and pricing zone, limits/conditions/restrictions; this input will be received and flagged; MO authorization and approval is required for implementation | Various | MP<br>SO (if applicable) | MMS |
| 11 | NOTE REGARDING CORRECTED MP MARKET OFFER/BID SUBMITTALS:<br><br>Flags for corrected submittals are not included herein. The most recent of any valid offer, bid, or schedule for any valid specified trading period or subset thereof, submitted to and processed by MO shall prevail with regard to any earlier submittal. In the event multiple transactions were offered/bid in an earlier submittal and the most recent submittal includes only a subset thereof, only the transactions resubmitted shall constitute change(s) | Various | MP | MMS |
| | **Market Commodity Submittals** | | | |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 12 | Back-start, Contingency, Ancillary Service, generation offer, unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block, Start-up time (Minutes from request to synchronizing my not be less than cold start time in standing data), sustained response rate offered (MW/minute may not exceed governor ramp rate), response to begin immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-600 minute range with 60 minute default setting, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," status flag to indicate fixed contract or market offer (Contractor shall provide for fixed term contract and possible future offer pricing) must include operating range equal or less than that in the standing data, must include governor ramp rate (up) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data | Various | MP | MMS |
| 13 | Date and time submitted | Date | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 14 | Energy reduction, Ancillary Service, action required to provide reactive support, flag as generation offer or requested response, unit specific: Reduction shall be specified in MW per each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable: this may not apply, so zero entry may be selected), must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation reduction, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," operating range equal or less than that in the standing data, offered rate of reduction (MW/minute not to exceed governor ramp rate down), governor ramp rate down (MW/minute) not to exceed those in standing data, and maximum MW will not exceed maximum rating in standing data | Various | MP | MMS |
| 15 | Energy, Customer demand bid, load specific: Must correspond with certified dispatchable load, MW per each of 1-10 blocks per take-off point, must equal or exceed minimum block size (user enterable), must include monotonically decreasing prices (Pesos), must begin from a zero off-take, may have negative prices, all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 16 | Energy, generation offer, unit specific: MW specified in each of 1-10 blocks, each block size must equal or exceed specified MW minimum value (user enterable), must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation, may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down (each in MW/minute) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data | Various | MP | MMS |
| 17 | MP notification messages regarding availability or other market communications (in MO specified template), receipt to be automatically logged, flagged, and displayed as received MP communication | Text | MP | MMS |
| 18 | Other submitted, if authorized agent of MP | TBD | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 19 | Reserve, Ancillary Service, Customer replacement reserve offer (FUTURE), load specific: Must correspond with certified dispatchable load, MW per each of 1-3 blocks per connection point, must equal or exceed minimum block size (user enterable), maximum response level representing maximum MW decrease attributable to this control action from load MW immediately prior to this control action (with change caused directly by this control action), Maximum proportion of the forecast/scheduled load that may be interrupted (user enterable as either percentage of total before control action or MW value), time required to execute reduction (1-10 minutes), must include monotonically increasing prices (Pesos), all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 20 | Reserve, Ancillary Service, Customer reserve offer, load specific: Must correspond with certified dispatchable load, MW per each of 1-3 blocks per connection point, must equal or exceed minimum block size (user enterable), maximum response level representing maximum MW decrease attributable to this control action from load MW immediately prior to this control action (with change caused directly by this control action), Maximum proportion of the forecast/scheduled load that may be interrupted (user enterable as either percentage of total before control action or MW value), time required to execute reduction (1-10 minutes), must include monotonically increasing prices (Pesos), all prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 21 | Reserve, Contingency, Non-Spinning, Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Start-up time (Minutes from request to synchronizing my not be less than cold start time in standing data), Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-60 minute range with 20 minute default setting), sustained response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 22 | Reserve, Contingency, Replacement (FUTURE), unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Start-up time (Minutes from request to synchronizing my not be less than cold start time in standing data), Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon synchronizing and provide full capacity within a specified period (user enterable 1-600 minute range with 60 minute default setting), sustained response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 23 | Reserve, Contingency, Spinning, Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response for this commodity, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum dispatch level (MW) at which maximum reserve response will be available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, Maximum response level (MW) for converting reserve capacity to energy (must begin response immediately upon request and provide full capacity within a specified period (user enterable 1-10 minute range with 10 minute default setting), Response rate offered (MW/minute may not exceed governor ramp rate), may include negative prices as allowed by PEM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data, status flag to indicate fixed contract or market offer | Various | MP | MMS |


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| Item | MMS Data Transfer Description | Data Type | Source (from) | Sink (to) |
|---|---|---|---|---|
| 24 | Reserve, Regulating (AGC), Ancillary Service, generation offer, (aggregate) unit specific: Maximum MW response (Raise and Lower) for this commodity from the operating point, MW specified in each of 1-3 blocks, each block size must equal or exceed specified MW minimum value (user enterable), Minimum and maximum dispatch level (MW) at which maximum raise and lower reserve response will be respectively available, must consist of monotonically increasing prices (Pesos) beginning with zero MW generation for the first offer block that must correspond to the mandatory reserve capability required from that generator under its connection agreement, AGC response rate (MW/minute raise and MW/minute lower)) for providing regulation (must begin automatic response immediately upon control command), AGC response rate offered (MW/minute may not exceed governor ramp rate), prices must fall between the market price floor (user enterable) and the market price cap (user enterable) if specified by PEM (future), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down not to exceed those in standing data, maximum MW may not exceed maximum rating in standing data, and response up or down may not exceed real capacity available, status flag to indicate fixed contract or market offer | Various | MP | MMS |

## 5.3 Metering and Settlement Data

### 5.3.1 Meter Data Collection System

The MMS has the responsibility to collect all meter data required for establishment of market prices and generation of settlement data for each trading interval. These data shall be collected


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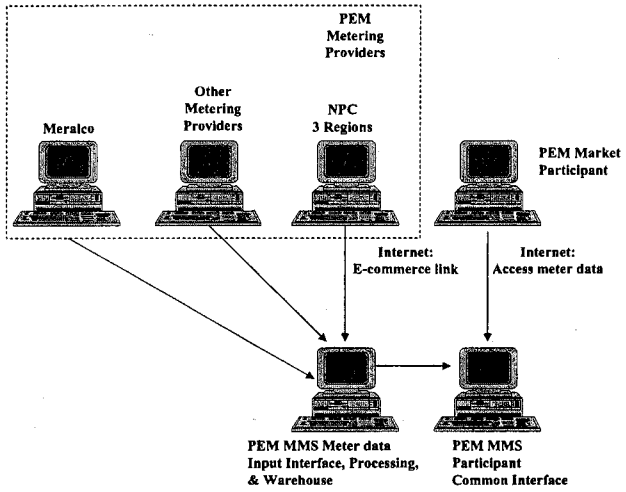
from the three regional meter data collection systems in Luzon, Visayas and Mindanao, as well as from all other Metering Providers using the PEM E-Commerce capability.




**Market Meter Data Collection By MO**

The National Power Corporation (NPC) will install Itron MV-90 systems in each of the three regions. Each of the three systems will include compatibility with the final communications medium selected for return of data to the MMS (see below). The systems will be upgraded with Itron components or perhaps augmented by PEM Web interface boxes as necessary to meet MMS interface requirements.

The MV-90 systems will include the Installation Database.

1. The Installation Database will contain the following information regarding the installation of metering devices:
   a. locations and reference details;
   b. site identification names;
   c. standard equipment identification numbering (SEIN) in accordance with the PEM and MO procedures;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   d. details of affected Participants associated with the Metering point; and
   e. the Metering Provider.
2. The identity and characteristics of metering equipment including:
   a. serial numbers;
   b. metering installation identification name;
   c. metering manufacture types and models;
   d. current test and calibration program details, test results and references to test certificates as required under the Grid Code;
   e. calibration tables, where applied to achieve metering installation accuracy as required under the Grid Code;
   f. data register coding details; and
   g. correction factors and multipliers.
3. Data communication details, including:
   a. telephone number(s) (or frequency details in the case of telemetric equipment) for access to data;
   b. communication equipment type and serial numbers;
   c. communication protocol details or references;
   d. data conversion details;
   e. user identifications and access rights; and
   f. "write" password (to be contained in a hidden or protected field).

The Meter Data Collection Systems shall retain all data returned from individual meters in a database for transfer to the MMS as scheduled or on demand. Standard Itron database formats will be used for data storage.

#### *5.3.1.1 Communications – Data Collection Systems to MMS*

The communications medium to be used to retrieve all meter data as well as the meter installation database from the data collection systems to the MMS will be either:

1. E-commerce capability – The main function of the e-commerce function will be for communications between Market Participants and the Market Operator. However, consideration is being given to recommending this capability for meter data retrieval as well. Additional investigation in the areas of data security, and costs for both MMS and data collection systems will be needed to make this decision.


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2. Dial-up Communications – The default choice for MMS-data collection systems communications will be dial-up or leased telephone lines.

#### 5.3.1.2 *Meter Data Protocol*

All metering data will be stored in the MV-90 systems in native Itron data formats and shall be retrieved from the systems using standard Itron protocol(s). The MMS Contractor shall have responsibility for all data conversion and ensuring that data is settlement-ready.

#### 5.3.1.3 *Data Exchanged*

Section 4 of this specification includes a Table providing details of the data to be exchanged between the MMS and the Meter Data Collection Systems.

### 5.3.2 *Settlements, Accounting and Billing*

The MMS shall prepare all preliminary, adjusted, and final settlement information for each MP and for each trading interval and provide these data to the MP in both preliminary and final form. The MMS shall provide for receiving data to Settlements from the market applications (schedules, bids, and offers), from System Operations (real-time data and relevant entries), meter data from the meter data acquisition and warehouse application, and authorized adjustment or correction entries. The Settlements application shall provide for full data retention so that the settlement for any period can be re-run at any future date. The MMS market operations applications and the Settlements application shall provide for on-line data transfers to storage and to archiving (off-line) in accordance with the Tables in Section 4 of this specification.

The overall Settlements and Billing process is depicted below.


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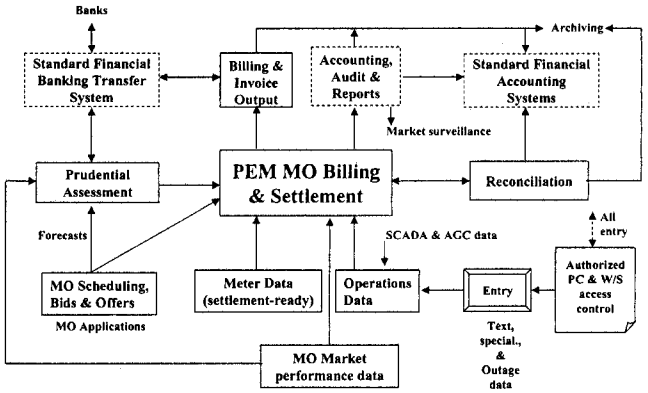


**Settlements & Billing**

Major interfaces for the Settlement function are internal to other MMS processes such as Metering and Market Operations. External interfaces are to:

1. Market Participants – Issuing preliminary and final Statements; and
2. Electronic Fund Transfer – Issuing invoices based on Settlement runs.

The PEM E-Commerce function shall be used both for distribution of settlement statements and invoices via Electronic Funds Transfer.


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# 6.0 SYSTEM PERFORMANCE AND SIZING REQUIREMENTS

The Market Management System (MMS) will provide the Information Technology infrastructure for the Market Operator (MO) to manage Philippines Electricity Market (PEM) operations at market commencement and into the foreseeable future. This section provides requirements for both initial and ultimate system sizing and performance. The tables contained in this section provide market operations and metering and settlement functions.

## 6.1 Critical and Non-Critical Functions

All functions shall be considered to be ***Critical*** unless explicitly shown as ***Non-Critical*** in Section 6.1.2 below.

### 6.1.1 Critical Functions

The following major functions are explicitly defined as ***Critical.*** They shall not be lost as the result of a single failure.

1. Data exchanges with Market Participants;
2. Provision of market information in a timely manner to Market Participants and other parties;
3. Retrieval of metering data;
4. User interface functions;
5. All Market Operations functions;
6. All Settlement, Metering, and Billing functions;
7. Interface with the System Operator;
8. System switchover, failover, and restart without loss of data; and
9. On-line diagnostics.


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### 6.1.2 Non-Critical Functions

The following functions are defined as Non-Critical, in that automatic failover is not required in order to keep them available. It is acceptable to require manual switching or reassignment of processors in order to restore them to use.

1. Software development and testing; and
2. Access to on-line documentation

## 6.2 System Utilization

The MMS shall comply with the performance requirements given here and elsewhere in the Specification. To demonstrate full compliance, the loading on the computer and communication subsystems in its **ultimate** configuration (as defined in Section B-6) shall be simulated during Factory Acceptance Testing.

### 6.2.1 System Activity Levels

For the purpose of specifying system performance under different system activity levels, the following definitions shall apply:

1. Steady State-Normal market operations over a one-hour interval to bracket a trading interval.
   - All Market Operator user stations operational;
   - Normal data exchange via the EMS-MMS data link;
   - Meter data collection (including re-tries) from the three regions;
   - Pre-dispatch and dispatch runs per timetable for trading intervals;
   - Settlements processing for previous trading interval;
   - Market Participants providing offers and bids (including re-submittals);
   - Data archived in accordance with procedures; and
   - All user stations operational and in use.
2. High Activity – Operations over a one-hour interval as defined for Steady State with the addition of an Emergency state declaration.
   - Additional network security information transmitted from the EMS;
   - MMS-EMS data exchange per Emergency procedures;
   - All Market Participants notified of Emergency and newly submitted data processed;
   - Pre-dispatch in accordance with Market Rules and Market Operator decision;
   - Market Suspension in accordance with Market Rules;
   - All data, both normal and that pertaining to the Emergency condition, actions taken and resolution of the condition archived; and
   - General Information regarding situation published in a timely manner to all Participants.
3. Overload – Electric network system conditions which cause system or communications outages making it impossible to maintain market operations.

   In an Overload state the MMS must continue to provide critical functions to the extent possible with the external situation, ensure that no data is lost, retain an audit trail of all MMS events and update general information as possible and practical.

### 6.2.2 Utilization Requirements

Over any five (5) minute period (including end-of-hour, end-of-day, and end-of-month) during which the MMS is in the *Steady State*, utilization of resources shall not exceed the following limitations:

1. The total loading of each major processor shall not exceed thirty percent (30%);
2. Each disk associated with the major processors shall not be busy with data transfer for more than twenty percent (20%) of the time; and
3. Each local area network shall not be busy with data transfer for more than twenty percent (20%) of the time.

Within a five-minute period, during which the MMS is in the *High Activity State*, the utilization of resources shall not exceed the following limitation:

1. The total loading of each major processor shall not exceed sixty percent (60%);
2. Each disk associated with the major processors shall not be busy with data transfer for more than forty percent (40%) of the time; and
3. Each local area network shall not be busy with data transfer for more than thirty percent (30%) of the time.


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The MMS shall be provided with the hardware and software tools for precise measurements of the utilization of all computing resources, LANs, and relevant peripheral devices.

## 6.3 User Response Time Requirements

### 6.3.1 Display Call-up Response Time

Display Call-up Response Time will vary greatly between local user consoles connected directly to the MMS Local Area Network and those at remote locations connected via PEM E-Commerce. The following requirements shall apply to the local consoles only.

A user may call a display to any monitor of the user's console by any of the methods specified in the User Interface section. The display response time is defined as the time elapsed from the moment of executing the last step of a display request procedure until the requested display is completely shown on the monitor. Since identical display requests could produce different display response times, depending on the availability of the system resources at the instant of the request, the display response time requirements are defined in statistical terms for 95% of the observations and 100% of the observations. The specified display response times shall apply to all the display call up methods and to paging forward/backward.

When the system is in the Steady State or High Activity State, the display response time for all consoles shall conform to the requirements of Table 6.3-1.


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**Table 6.3-1: Display Call-Up Response Requirements**

| Item | Not-to-Exceed Response Time for Steady State and High Activity State: 95% of the Time (Seconds*) | Not-to-Exceed Response Time for Steady State and High Activity State: 100% of the Time (Seconds*) | Not-to-Exceed Response Time for Overload State: 100% of the Time (Seconds*) |
|---|---|---|---|
| Displays without real-time data *(Text, Directory, Message, etc.)* | 1.0 | 1.5 | 5.0 |
| Market Operations Displays for LAN-connected consoles | 1.0 | 1.5 | 5.0 |
| Market Operations Displays for Market Participants* | 2.0 | 3.0 | 5.0 |
| Summary Displays | 1.5h | 2.5 | 5.0 |
| Queries-based tabular displays | 1.5 | 2.5 | 5.0 |
| Queries-based list displays | 1.5 | 3.0 | 10.0 |
| Historical Data Displays | 1.5 | 2.5 | 5.0 |
| Archived on-line data | 1.0 | 2.5 | 5.0 |
| All other displays | 1.0 | 2.5 | 5.0 |

* From the moment that the request is made until the Website has completed outputting the display to the PEM Operations Network.

## 6.4 Market Applications Functions Completion Time

### 6.4.1 Market Applications Functions Completion Time

The "not-to-exceed" completion times for the major functions are summarized as follows:

1. Validation of data input by Market Participants: within 1 second of receipt;
2. Notifications, acknowledgments, and other responses sent to Market Participants: within 1 second of the triggering event;
3. Posting of time-critical information on the Website: within 5 seconds of the time it must be posted;
4. Start of download of a file to a Market Participant: within 2 seconds of the request; and
5. Metering, billing, settlement: within 30 minute after each billing period.

## 6.5 Market Activity Estimated Volume

The tables below provide estimated volumes for the market size and activities.


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### 6.5.1 Business Information

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| **Business Information** | |
| ***Participant Registration*** | |
| Create a new contact or maintain key data for a current contact (based upon 400 initial MPs) | 400 initially, with immediate expansion up to 1000, and additions at10 per company per year up to a maximum of 50,000 for 5 year outlook |
| Create a new Participant | 400 initial MPs, with 120 additional MPs per year or any higher number per year up to a maximum of 1000 MPs (5 year outlook) |
| Maintain data for current participant | Up to 20 changes per month per MP, for an initial rate of 9000 changes/month (96,000/year) with accommodation up to a maximum of 20,000 changes per month (240,000/year) |
| Maintain notes about the status of a participant | 10 per MP per year, for initial of 4000/year and ultimate of 10,000/year) |
| Log information regarding any participant contacts including employees, bankers etc. [each with field sizing for accommodation of 150 lines with maximum line width per specification] | 150 per Market Participant per year, initially 60,000 per year with an ultimate of 150,000 |
| Create and maintain the relationship between a market participant and a unit, meter, and/or agent thereof | 15 per Market Participant per year, initially for 6,000/year and ultimately for 15,000/year |
| Create and maintain information about the physical constraints of a unit | 5 per Participant per month, initially for 2,000/month and ultimately for 4,000/month |
| **System Administration Information** | |
| Maintain the definition of parameter tables which are used within the PEM MMS system *(assumes 50 tables)* | 50 times per month initially, ultimately 100 times/month |
| Maintain the details about parameter tables which are used within the PEM MMS system *(assumes 50 tables)* | 40 times per month initially for 50 tables, ultimately for 200 tables with 40 times per month |
| ***System Components*** | |
| Define web component pages and panels | 5 per month |
| Maintain parameters associated with each of these components | 5 per day |
| Maintain the list of public reports available on the web via the PEM MMS system | 1 per day |
| Maintain the list of participant confidential reports available via the PEM MMS system | 1 per Participant per Month, initially 400/month, ultimately 1,000 per month |
| Maintain an individual's access to the PEM MMS system | 10 per month initially, ultimately 40/month |
| Define functionality allowed based on Participant's security level | 10/month initially and 20/month ultimately (includes contractor changes) |
| Modify the system functionality that is accessible by a particular user | 10/month initially and 30/month ultimately (includes contractor changes) |

### 6.5.2 Participant Interfaces

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| **Participant Interface** | |
| ***General Functionality*** | |
| Create new or modify existing Web Pages | 20 per month initially, 100/month ultimately |
| Handling User Connections | Two per User per day |
| Enable users to specify their own page layout / panel customizations | One per user per month |
| ***Trading Pages*** | |
| Populate and present that page that a user initially sees when they enter the Market Worksite | Twenty per User Per day |
| Maintain a security login function to control user access to the Market Website. | No of participants x 20 re-logins per day |
| Provide feedback about the status of a user's connection to the PEM MMS system. | Number of Participants x 10 data items every 5 seconds |
| Protect against unauthorized trading activity by timing out user connections to the system | 30 per day, initially, ultimately 150/day |
| Navigate to alternative market web pages from within the main trading screen | Number of Participants x 5 per hour |
| Initial Request for spot market prices and volumes for each dispatch period | 3000 data items per trading interval per day. |
| Refresh of spot market prices and volumes for each dispatch period | 150 data items every 5 seconds initially, ultimately 300 data items every 5 seconds |
| Initial Request to provide pre-dispatch prices for the coming dispatch period | 1200 data items per day |
| Refresh of pre-dispatch prices for the next dispatch period | 800 data items per trading interval |
| Initial Request to provide information on the history of Pool price over time | 150 data items per day per MMS user |
| Refresh a display showing the history of PEM price | 10 items per trading interval initially, 60 items ultimately |
| Send participants with messages | 20 per hour per participant, with maximum of 120 per hour per participant and simultaneous transmission capability without pre-transmission delay exceeding 10 seconds to any one participant |
| Receive Participant's messages | 20 per hour per participant, with maximum of 120 per hour per participant and simultaneous transmission capability without pre-transmission delay exceeding 10 seconds to any one participant |
| Initial Request to Provide events history | 20 data messages per MMS user per day (200 bytes each) |


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| | |
|---|---|
| Refresh Events History | 4 messages per MMS user per hour (200 bytes each per event) |
| Provide general reports | 3 reports per Participant per day (30KB per report) plus 5 reports per day per MMS user, and 28 reports per day for the SO |
| Provide confidential Reports | 3 reports per Participant per day (30KB per report) plus 3 reports per day per MMS user |
| Merit Order Dispatch for energy and ancillary services, as well as other dispatch Instructions | 10000 items per day reporting for multiple (separately identified) trading periods initially; and ultimately 25,000 per day reporting for multiple (separately identified) trading periods |
| Produce and send Merit Order dispatch of energy and reserve commands | |
| Receive ad hoc reports requests | 6 queries per market participant per day requesting 1000 data items per report |
| Produce Participant ad hoc reports | 3000 data items per market participant per day |
| Publish manually complied documents on the web | 3 per day (2400K in size) |

### 6.5.3 *Offers and Bids*

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| **Handling** | |
| Receive batch bids and offers / re-declarations using a secure web connection | 10 per Participant per day for 400 MPs, up to an ultimate of 40 per MP per day for 1000 MPs |
| Reports to the Participants an acknowledgement (either positive or negative) for a daily bid or re-declaration using the bid originally submitted by the participant as the basis | 1 per bid submitted (100 k size per report) |
| Maintain standing bids and offers | 20 per participant per Week for each of 400 MPs initially, up to 30 per MP per week for 1000 MPs |
| Reports to the Participants an acknowledgement (either positive or negative) for a standing bid using the bid originally submitted by the participant as the basis | 1 per bid submitted (100 k size per report |
| Validates bid and offers received from participants | 1 per bid submitted (100 k size per report |
| Accepts validated bid/offer transactions and loads them into the offer file | 1 per bid valid submitted (assume 100% of all bids submitted are valid for sizing, but provide for up 100% rejections on sizing for invalid offers/bids) |
| Reports to Participants the actual bid used by the dispatch engine for any given dispatch interval | 1 per Participants per Dispatch Interval |
| **Management of External Files** | |
| Maintain the external file types and related records types that are handled by the system | 20 per year |
| Define the processing required for a type of external file | 20 per year |
| Define rules that are used in handling external files | 20 per year |
| **External Files Handling** | |
| Check submitted batch files for viruses | Run virus check on each incoming file for each MP submission |
| Validate file submission data to ensure that the correct parameters are received | 1 per MP submission |


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| | |
|---|---|
| Store the file in a temporary table for subsequent processing | 1 per MPO per submission |
| **Dispatch Processing** | |
| Close & process bids and offers for a particular dispatch period | 1 per trading interval |
| Process and execute re-dispatch function | Initially up to 4 per trading interval, ultimately up to 12 per trading interval |
| Compile dispatch offer file and inform pre dispatch engine that the file is available | 1 per trading interval and initially up to 4 additional times per trading interval |
| Receive Results file from Pre Dispatch engine | 6 per trading interval (assumes multiple scenario) |
| Look for re-declarations and update dispatch file | 4 per dispatch interval, initially, up to 12 ultimately |
| Receive Results file from Dispatch engine | 1 per dispatch interval and for each re-dispatch instance |
| Inform dispatch engine that the file is available | 1 per dispatch interval and for each re-dispatch instance |
| Receive Results file from Dispatch engine | 1 per dispatch interval and for each re-dispatch instance |
| Post File to Database | 1 per dispatch interval and for each re-dispatch instance |

### 6.5.4 *Market Operation Data Transfer*

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| ***Maintaining Data Transfers*** | |
| Define the interface dataset types that are handled by the system | 6 per year, up to 12/year |
| Define the transfer process for each of these interface dataset types | 6 per year, up to 12/year |
| Define the interface data definition types that are used by the system to transfer data across the interface | 6 per year, up to 12/year |
| ***Managing the Data Transferred*** | |
| Initiate outbound data transfers at the proper time or time Interval *(assumes that the system checks every 10 seconds)* | 6 per minute, up to 12/minute |
| Process an outbound data transfer | 6 per minute, up to 12/minute |
| Test for inbound data transfers *(assumes that the system checks every 1 second)* | 1 per second |
| Process an inbound data transfer *(assumes that one in ten tests find data)* | 6 per minute, up to 12/minute |
| Monitor a data transfer run | 2 per minute |
| Restart a data transfer run that was stopped by the system after a specified number of retries | 1 per day |


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### 6.5.5 *Prudential Assessment*

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| **Prudential Assessment** | |
| ***Prudential Instruments*** | |
| Maintain records of a participant's prudential instruments | 1 per Participants per year, up to 12 per MP per year |
| Define the types of prudential instruments that are acceptable by the market Operator | 1 per year |
| Define the Peso value of prudential instruments, where applicable | 3 per year per Participant |
| ***Prudential Test Parameters*** | |
| Maintain the prudential test algorithms that are handled by the system | 1 per year |
| Maintain the definition of steps in prudential monitoring. | 1 per year |
| Define the rules that drive prudential tolerance, expiry and review activities. | 10 times per year |
| ***Prudential Status Handling*** | |
| Notify the participant that a pending prudential instrument is about to expire | 1 per Participant per month |
| Notify the Market Operator of pending prudential assurance review | 1 per Participant per month |
| Review and acknowledge prudential tolerance, expiry and review messages | 1 per day |
| ***Report Prudential Status*** | |
| Display prudential status summary information for all or selected participants | Once per day per type of Report |

### 6.5.6 *Settlements*

| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| **Settlements** | |
| ***Settlement Charges*** | |
| Define the VAT rate *(as may be required by changes in legislation)* | Once per year |
| Maintain the types of charges that are applied to participant accounts by the Pool | Once per year |
| Maintain the Pool charge rate, where a charge type is rate-based | Once per year |
| Maintain the Pool charge amount, where a charge type is amount-based | Once per year |
| ***Settlement Parameters*** | |
| Maintain the algorithms that are associated with steps in the settlement process | Once per year |
| Define the steps in the settlement process | Once per year |
| ***Settlement Runs*** | |
| Initiate a settlement run *(assumes 1 per day plus 5 draft + final + 3 reconciliation settlement run)* | 40 per month |


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| DESCRIPTION | ESTIMATED VOLUME |
|---|---|
| Specify what reconciliations are to be included in a normal settlement run | 3 per month |
| Monitor a settlement run | 40 per month |
| Perform the steps in a settlement run | 40 per month |
| Calculate participants' accrued liabilities | 40 per month |
| Review information for a specified settlement run *(to be specified during the detailed design phase)* | 200 per month |
| Approve the settlement run *(one per day + final + reconciliation)* | 45 per month |
| Maintain participant-specific statement messages to be included on a participant's statement | One per settlement run |
| Issue statements to participants (2 preliminary + 1 final + 1 reconciliation) | 4 per Participant per month initially, up to 33 per participant per month (31 preliminary + 1final+ 1 reconciliation) |
| Create EFT transactions and transfer them to the Pool's banking institution | 1 per month up to 6 per month (allowing for 5 special transactions) for every MP (initially 400, ultimately 1,000) |
| Create general ledger transactions and transfer them to the Pool's accounts (general ledger) system | 1 per month up to once per day |
| ***Settlement Reports*** | |
| Report settlement value information for all or selected participants | 1 per Participant per day |
| Report generation output / consumption information for all or selected participants | 1 per Participant per day |
| Summarize participant information for all or selected participants | 1 per Participant per day |
| ***Ad Hoc Reporting*** | |
| Extract settlement history data for ad hoc reporting | 5 per Participant per month |
| ***Report Prudential Status*** | |
| Display prudential status summary information for all or selected participants | Once per day per type of Report |


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## 6.6 MMS Sizing

The following Table provides sizing information for the user interface and constrained security dispatch function.

| Table 6.6-1 Sizing Table | Initial | | Ultimate | |
|---|---|---|---|---|
| **User Consoles** | | | | |
| 3-Monitor Consoles[1] | 8 | Consoles | 20 | |
| 2-Monitor Consoles[2] | 8 | Consoles | 40 | |
| 1-Monitor Consoles | 20 | Consoles | 40 | |
| 2-Monitor Remote Consoles | 10 | Consoles | 6 | Consoles |
| 1-Monitor Remote Consoles | 4 | (6 x 4) panels | 10 | (6 x 4) panels |
| Strip chart recorders, multi-channel (electronic acceptable) | 0 | | 0 | |
| | | | | |
| **Printers** | | | | |
| Laser B&W Printers (hardware provided by MO) | 5 | Printers | 10 | Printers |
| Color Printers (hardware provided by MO) | 5 | Printers | 10 | Printers |
| High Speed Printers | 2 | Printers | 4 | Printers |
| | | | | |
| **System Database Points (provided by SO):** | | | | |
| **Analog** | | | | |
| Telemetered | 2913 | Points | | Points |
| Non telemetered/ Calculated | 1171 | Points | 94900 | Points |
| From SO | | Points | | Points |
| | | | | |
| **Digital** | | | | |
| Telemetered | 4227 | Points | | Points |
| Non telemetered/ Calculated | 684 | Points | 59900 | Points |
| From SO | | Points | | Points |
| | | | | |
| **Supervisory Control** | | | | |
| Control Commands | 2572 | Points | | Points |
| | | | | |
| | | | | |
| **Generator Control (Via SO)** | | | | |
| Setpoint Control (Luzon only) | 7 | Setpoints | See "total" | Setpoints |
| Total | 120 | AGC units | 800 | AGC units |
| **Disturbance Data Collection** | | | | |
| Disturbance Data Saved Cases | 100 | Saved Cases | 200 | Saved Cases |
| Disturbance Trigger Points | 100 | Points | 200 | Points |
| Analog Points Saved per Case | All in RTDB | Points | All in RTDB | Points |
| Status Points Saved per Case | All in RTDB | Points | All in RTDB | Points |

[1] 17 consoles in the control center, one for development one for backup facility, and three for the OTS.

[2] Two consoles for DA scheduling, 10 Engineering, one computer room, and five for EMS support engineering.


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| Table 6.6-1 Sizing Table | Initial | | Ultimate | |
|---|---|---|---|---|
| Pre-disturbance Snapshots | 60 | Snapshots | 120 | Snapshots |
| Pre-disturbance Time Interval | 10 | Seconds | 5 | Seconds |
| Disturbance Snapshots | 300 | Snapshots | 300 | Snapshots |
| Disturbance Time Interval | 2 | Seconds | 2 | Seconds |
| Post Disturbance Snapshots | 60 | Snapshots | 120 | Snapshots |
| Post Disturbance Time Interval | 10 | Seconds | 5 | Seconds |
| | | | | |
| **Historical and Audit Records** | | | | |
| Power System Snapshots | 10,000 | Snapshots | 50,000 | Snapshots |
| Power System Alarm & Event Log | 100,000 | Log Entries | 200,000 | Log Entries |
| Market Transactions Log | 400 | Days | 400 | Days |
| On-line Power System Historical Records | 400 | Days | 600 | Days |
| On-line Market Operations Audit Records | 400 | Days | 800 | Days |
| Off-line Electronic Audit Records | 5 | Years | 10 | Years |
| | | | | |
| **Generating Units Types:** | | | | |
| Thermal | 32 | Units | | |
| Gas Turbines | 30 | Units | | |
| Hydro | 105 | Units | | |
| Mini hydro | | Units | | |
| Diesel | 176 | Units | | |
| Combined cycle | 18 | Units | | |
| Geothermal | | | | |
| Non-conv. | 63 | Units | | |
| IPP ( excluded in the total no. of gen. Plants ) | 52 | Units | | |
| **Total:** | 476 | Units | 700 | Units |
| | | | | |
| **Power System Application & Optimization Dimensionality:** | | | | |
| Network Parameters | 1000 | | 2000 | |
| Areas and Companies | 75 | | 300 | |
| Congestion Zones (MO only) | 50 | | 200 | |
| Stations | 500 | | 2000 | |
| Buses | 700 | | 3000 | |
| Voltage Levels | 10 | | 25 | |
| Nodes | 500 | | 2000 | |
| Logical Devices | 70,000 | | 100000 | |
| Loads | 2,000 | | 5000 | |
| Generation Units | 476 | | 700 | |
| Shunt Capacitors/Reactors | 200 | | 400 | |
| Series Devices | 100 | | 200 | |
| Phase-Shifters | 5 | | 15 | |
| Transmission Lines | 500 | | 1000 | |
| Transformers | 2500 | | 5000 | |
| LTCs (A Subset Of Transformers) | 250 | | 500 | |
| Isolation Pocket Areas (maximum separation) | 16 | | 50 | |
| | | | | |


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| Table 6.6-1 Sizing Table | | Initial | | Ultimate | |
|---|---|---|---|---|---|
| **Market Operation & Optimization Training Simulation Dimensionality:** | | | | | |
| | Congestion Zones (MO only) | 50 | | 200 | |
| | Buses | 700 | | 3,000 | |
| | Generators | 424 | | 600 | |
| | Turbines - | 120 | | 250 | |
| | Boilers - | 49 | | 100 | |
| | AC Transmission Lines- | 500 | | 1000 | |
| | AC Substations- | 500 | | 2000 | |
| | Transformers | 2500 | | 4000 | |
| | DC Lines | 2 | | 10 | |
| | DC Substations | 4 | | 20 | |
| | LTCs | 250 | | 500 | |
| | Phase Shifters | 5 | | 15 | |
| | Protective Relays | 2000 | | 5000 | |
| | Switches | 10000 | | 20000 | |
| | Circuit Breakers | 2000 | | 6000 | |
| | Disconnects | 20000 | | 30000 | |
| | Shut Capacitors | 1000 | | 5000 | |
| | Shunt Reactors | 1000 | | 5000 | |
| | Series Capacitors | 50 | | 100 | |
| | Reactors | 50 | | 100 | |
| | Static Controllable Series Devices | 1 | | 5 | |
| | Loads | 2000 | | 5000 | |
| | AGC Areas | 3 | | 10 | |
| | Voltage Levels | 10 | | 25 | |
| | Isolation Pocket Areas (maximum separation) | 16 | | 50 | |
| | Base Cases | 100 | | 200 | |
| | Events | 10000 | | 10000 | |
| | Conditional Events | 2000 | | 2000 | |
| | Conditions Per Conditional Event | 50 | | 100 | |
| | Total Conditions For Conditional Events | 3000 | | 3000 | |
| | Load Profiles | 50 | | 100 | |
| | Snapshots. | 50 | | 100 | |
| | Training Scenarios | 300 | Scenarios | 600 | Scenarios |
| | Events per Scenario | 300 | Events | 500 | Events |
| | Transmission owners | 5 | | 100 | |
| **Network Analysis Functions** | | | | | |
| | Real-Time Saved Cases | 50 | Saved Cases | 100 | Saved Cases |
| | Study Saved Cases | 50 | Saved Cases | 100 | Saved Cases |
| | Security Analysis Contingencies | 200 | Contingencies | 400 | Contingencies |
| | | | | | |
| **Market Operations System** | | | | | |
| | **Market Participants** | | | | |
| | Market Participants | 400 | Participants | 1000 | Participants |
| | Utility Companies | 130 | Participants | 250 | Participants |
| | Auditors | 10 | Participants | 20 | Participants |
| | Others authorized to log on | 20 | Participants | 100 | Participants |


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| Table 6.6-1 Sizing Table | | Initial | | Ultimate | |
|---|---|---|---|---|---|
| | Consultants, development & Test, and Regulators | 20 | | 40 | |
| | Market Reconciliation | 5 | | 10 | |
| | Planning, coordination, and review | 10 | | 20 | |
| | | | | | |
| | **Generating Units in Market** | | | | |
| | Active Units | 389 | Units | 800 | Units |
| | Units on AGC (Luzon only) | 10 | Units | 200xx | Units |
| | Blocks Per Unit | 10 | Blocks | 10 | Blocks |
| | | | | | |
| | **Market Parameters** | | | | |
| | Dispatch Period (adjustable by user entry) | 5 | Minutes | 1 to 30 | Minutes |
| | Settlement Period (adjustable by user entry) | 60 | Minutes | 15, 30, 60 | Minutes |
| | Offers/Bids/Schedules per Settlement Period | 2500 | Schedules | 25000 | Schedules |
| | Ancillary Services Offers per Settlement Period | 500 | Schedules | 2000 | Schedules |

## 6.7 System Availability

The annual availability of the MMS shall be ninety-nine point ninety-nine percent (99.99%) (i.e., downtime for the MMS shall not exceed 52 minutes per year). After the completion of its Site Acceptance Test (SAT), the MMS shall be subject to an Availability Test for a 2,200-hour period, during which the accumulated downtime shall not exceed 13 minutes. Additional availability testing may be required after the completion of any phased acceptance tests.

### 6.7.1 Calculation of Availability

*Availability* is defined as:

$$Availability\ (\%) = \frac{Total\ Operating\ Time\ -\ Cumulative\ Downtime}{Total\ Operating\ Time} \times 100$$

### 6.7.2 Downtime Accumulation

The MMS is considered down and downtime shall be recorded upon occurrence of any of the following circumstances:


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1. One or more of the critical functions has become unusable. "Unusable" shall be construed as either continuously inoperable or intermittently non-functional to a level that the MO determines that it is necessary to take actions resulting in the loss of critical functions in order to perform corrective maintenance;
2. A critical function is interrupted by removal of System equipment for mandatory corrective maintenance or preventive maintenance;
3. More than one operator console in the MMS Control Center is "down". A console shall be considered to be "down" if any critical function is not fully available at the console due to problems with hardware or software furnished by the Contractor; and
4. Any critical function is not available at any three or more of the consoles, including consoles outside the Control Center, due to problems with software furnished by the Contractor, or due to problems with hardware (including interfaces to consoles such as routers and bridges) that was furnished by the Contractor.

Downtime directly attributable to failures of equipment for which the Contractor is not responsible will not be included in the computation of MMS downtime assessed to the Contractor. If the system is down or not available because of failure of equipment or communications facilities provided by the MO or a third party or the EMS or other IT infrastructure are not available, the Availability Test shall be suspended until the problem is corrected, and neither downtime nor operating time shall be accrued.

A two-minute penalty shall be added to the cumulative downtime for every automatic failover or switchover of a processor. A fifteen-second penalty shall be added to the cumulative downtime for every restart of a MMS console necessitated by a failure at the console.

### 6.7.3 End of Downtime Accumulation

System downtime accumulation shall be stopped upon occurrence of either of the following:

1. When all critical functions become usable and are restored to fully operational service.
2. The Contractor and MO agree that the MMS is usable to a level that it should be in service.

If the MO elects to restore equipment to temporary or interim operational service during repair procedures, and repairs could otherwise have continued, availability testing shall be suspended. In this case, the time that the equipment is in temporary or interim service and the time necessary


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for repeated maintenance caused by the temporary or interim service period shall not be included in the cumulative downtime or in the Total Operating Time.

## 6.8 System Security

System security for the IT System managing the PEM is a primary concern and the system design must incorporate all appropriate safeguards protecting it. Security is used here to mean both the integrity of system data and the protection of confidentiality for all parties involved.

### 6.8.1 General

Provisions for security shall be explicitly included in each Functional and Design specification to ensure that the issue is properly addressed.

Protection shall be included for all data repositories, including relational database management system, temporary storage memories, historical storage and archives. There shall be protection against external unauthorized access and internal data corruption.

### 6.8.2 Data Links and E-Commerce

Data exchanged via data links, i.e., EMS-MMS and Meter Data Collection, shall use industry-standard protocols with full security provisions. The use of firewalls and protective network equipment shall be recommended by the Contractor for system interconnection.

Security for all data to be exchanged via the Internet and the use of E-Commerce for billing and funds transfer require special provisions. Section 5 defines the requirements for E-Commerce, including detailed requirements for security, but the Contractor shall also recommend additional provisions as appropriate.


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### 6.8.3 *Monitor and Audit*

Provisions for monitoring security throughout the system, including the above, shall be provided. These shall be compiled into a separate report which includes all security checks and results.

The MO has the responsibility under the Market Rules to monitor market operations and will use the Security Monitor report as one element in performing that task. In addition, the PEM Auditor will review all operational procedures and adherence to them, including Security.

## 6.9 *Applicable Standards*

Except where otherwise specified, the design, construction, and performance of all equipment and software furnished by the Contractor shall conform, as applicable, to the latest version of at least the standards listed below:

1. International Electrotechnical Council (IEC) Standards;
2. International Standards Organization (ISO) Standards;
3. National Electrical Manufacturers Association (NEMA) Standards;
4. American National Standards Institute, Inc (ANSI) Standards;
5. Electrical Industry Association (EIA) Standards; and
6. International Consultative Committee for Telephone and Telegraph (CCITT) Standards.

In case of conflict between the requirements of any of these authorities, the conflict shall be referred to the MO for resolution.


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# 7.0 HARDWARE AND SOFTWARE PLATFORMS

## 1.1 General

The Market Management System (MMS) shall incorporate standard hardware and software platforms to the maximum degree possible, both to limit costs and to ensure long-term support and maintenance.

The system components integrated by the Contractor into the overall MMS design shall meet the following criteria:

Major Contractor – Vendors and subcontractors selected shall have extensive experience and be a major supplier of the product(s) being used.

Current Product Line – Components must be currently in production by the vendor.

Ongoing Research and Development (R&D) Program – Vendors selected must have a commitment to the product type, demonstrated by their having an ongoing R&D program.

Standard Application – The function of the product within the MMS must be consistent with the standard use of the product in industry.

Not Modified – The product must be used by the Contractor as delivered by the vendor without modifications.

Vendor offerings shall include maintenance support contracts as options.

Licenses required for use of software and/or hardware shall be for the life of the system with prices for future upgrades to other platforms identified.

Licenses for any software to be used in the user interface consoles shall be for the Philippine Electricity Market (PEM) sites as opposed to being limited to individual consoles.

## 1.2 MMS Configuration

The MMS shall support market operations, and settlement, metering, and billing activities that are needed for the MO to fulfill its responsibilities for the Philippines Electricity Market (PEM).


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Figure 7-1 presents the conceptual configuration of the MMS. Details of the actual or proposed configuration may vary, as long as the intent and the functional, performance, availability, and other requirements of this specification are met.

The MMS shall be designed as a redundant, distributed, system, in such a way that redundant parts may be installed in separate areas, not necessarily within the same building and possibly not even in the same location. An open architecture that facilitates the maintenance, expansion, and upgrading of the MMS is mandatory.


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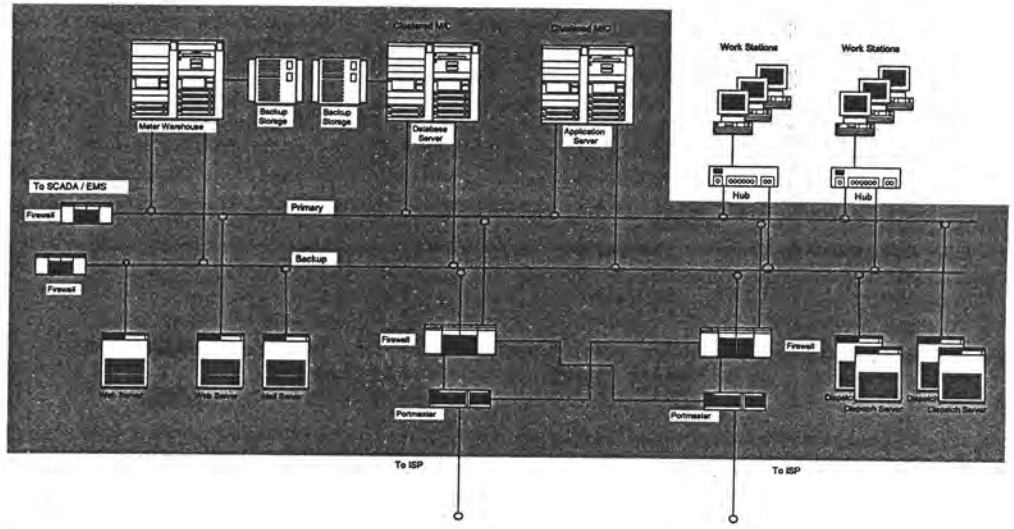


Figure 7-1


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## 7.3 Distributed Open Systems Requirements

The configuration of the MMS shall comprise a distributed computing environment with an open systems architecture. The system architecture shall be open internally and externally to hardware or application software additions, whether supplied by the original supplier or obtained from third party vendors, both for capacity expansion and for upgrading functionality, without affecting existing MMS components or operation.

To be recognized as a true open computer system, all internal communications among the processors and all external communications between the MMS and other computer systems shall be based on widely accepted and published international or industry standards which are appropriate and relevant to the open systems concept. This applies to the operating system, database management system, and display management system, as well as to APIs providing standardized interfacing between System software and application software. The MMS shall be configured as a network of several computers, connected by two or more redundant Local Area Networks (LANs), among which the processing is divided.

The following distributed and open-system design concepts shall be used:

1. The MMS Configuration shall be based on Open Systems Standards or have a clear migration path toward an open architecture in which the software is totally transparent of the hardware, such that any hardware adhering to these standards can be replaced/upgraded with a functionally similar device not necessarily manufactured by the original manufacturer.
2. The MMS shall be designed to provide the highest possible level of hardware and software independence through the use of standard products, the use of standard toolkits, and through application modularity.
3. Major subsystems shall be distributed to different sets of processors, such as Meter Data Collection processors, Application processors, Data Warehouse processors, and User Interface processors.
4. All processing units of the MMS shall be interconnected using industry standard Local Area Networks (LANs). The LANs shall support exchange of data from the various system components to include: processors and servers, user consoles, communications processors, terminals, gateways, any stand-alone disks and tape drives, etc. These system components may be dissimilar in architecture and/or operating systems. Redundant LANs operating at least at 100 Mbits-per-second shall be provided.
5. All software shall be written in standard ANSI high-level languages.
6. Expandability shall be provided through the use of a hardware and software platform that allows for vertical growth, and a configuration that allows for horizontal growth and distributed computer/server support.
7. Expansion of the transmission and market power system models in the MMS shall be a simple and quick task. Expansion of the database shall occur without any recompilation.
8. Capability to run cloned applications on the Development System shall be provided, so that applications can be tested without impacting the on-line system.


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## 7.4 Redundant System Design Requirements

### 7.4.1 Redundancy Requirements

The following redundancy capabilities are required:

1. A redundant configuration is required, in which no single component failure can result in the loss of any Critical Function or in degradation of performance below the required level.
2. To prevent latent hardware failures from going undetected, standby units shall be automatically switched into active, on-line, use so that they do not remain inactive for more than preset time.
3. Failure of one LAN shall not result in the loss of functionality or in any degradation of performance.
4. Under no circumstances shall it be possible to lose, corrupt, or generate information, or create any other condition that may cause malfunctioning of the MMS.
5. It shall be possible to manually induce failure conditions in order to routinely test failover mechanisms.
6. Each processing unit shall be replaceable/upgradable by simple change-out, without affecting the rest of the MMS and without requiring any software modification.
7. Replacing/upgrading any processor shall be totally transparent to the functionality of subsystems which reside on other processors.
8. Database residency is at the Contractor's discretion. However, it must be possible to edit the database(s) from a single location and to cause the database(s) to be updated over the LAN(s) and WAN(s) via a simple and secure procedure.


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9. Display residency is at the Contractor's discretion. However, it must be possible to edit displays from a single location and to cause the displays to be updated over the LAN(s) and WAN(s) via a simple and secure procedure.
10. Backup databases shall be maintained by the DSS so that no data is lost upon failover of any processor.

### 7.4.2 Design Options

The Contractor may choose either of the following two approaches, or a combination of the two, to design a system that continues to perform all critical functions and to meet the performance and availability requirements in the event of failure of a unit of equipment:

1. *Dual-redundant design:* Using pairs of units, one on-line and one off-line, to perform critical functions.
2. *Cluster design*: Using clusters of units that under normal circumstances share the processing load. The processing load is redistributed when a unit fails.

### 7.4.3 Failover/Switchover

The failover software shall be responsible for detecting the failure of a processor or associated disk, memory, power supply, or other critical component, and for automatically initiating an appropriate action to recover from the detected failure by *switchover* – automatically transferring processing responsibilities to a hot standby or between the surviving processors of a cluster or *failover* – automatically starting redundant equipment. Automatic switchover is required when time-critical power dispatch or market operations are affected. Automatic failover, including the redistribution of processes to the surviving members of a cluster, shall not result in the degradation of system performance below the specified levels.

Failure detection and recovery capabilities are required for all redundant devices. For example, a redundant interface unit responsible for communications between the MMS and an external system must be able to detect failure of the unit that it backs up, generate alarms, and provide for failover to the redundant unit (or to have its functions assumed by another unit of the cluster). Failover software shall also supervise the process of switching from the use of one processor and disk to the use of an alternate on command by an authorized user. Failover logic shall reside in


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both the on-line and backup processors, each monitoring the performance of the other and ready to take appropriate action as necessary.

The "failover" requirements below apply also to "switchover":

1. Failover shall not disrupt any on-going processes, such as calculations. These processes shall continue, using the backup database. Periodic calculations that were interrupted by failover shall automatically be completed or repeated. User data entries that were made before failover shall not have to be re-entered by the operator. Reports that were in the process of printing when failover occurred shall not be lost, and shall be resumed where interrupted or shall be restarted.
2. Failover shall not disrupt work at any console. The users' sets of windows and displays shall not be affected. While a failover is in progress, users shall be notified to that effect through a message displayed on the consoles, and shall be prohibited from performing any action that cannot be successfully completed under the circumstances.
3. Events leading to a failover shall include:
   a. Failure of an on-line processor or any of its critical components;
   b. Failure of a disk associated with an on-line processor;
   c. Power failure affecting the on-line equipment; and
   d. Failover request by an authorized user. However, if a backup processor is unavailable, then the command shall be rejected and the user shall have the option to request a hot restart.
4. If the system is configured with redundant dual-ported RAID disks, then a failover shall not be performed on the failure of an on-line disk. Instead, the backup disk shall be used without causing a processor failover.

If the MMS is configured with on-line spare components, then upon the detection of the failure of one of the on-line components, the failover software shall automatically substitute a spare component. If failover at the level of the failed equipment is not successful, then failover at the next level shall be initiated.

Failover or switchover of any system component shall cause a major alarm to be generated. The alarm shall indicate the reason for the failover, the failed unit, and the unit that assumed responsibility. Upon the failure of an off-line processor or one of its critical components, or upon the failure of the disk associated with the off-line processor, a major alarm shall also be generated, but no failover or switchover action shall be performed. If a failed processor had


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exclusive possession of a system resource (such as access to a file or to a peripheral), that resource shall automatically be re-assigned to the new on-line processor.

### 7.4.4 System Restarts

A mechanism for automatically and manually (user selectable) restarting each processor of the MMS shall be provided. Three modes of restart are required: "hot" restart, "warm" restart, and "cold" restart. For all modes, all programs residing on the failed processor shall be activated or scheduled according to a predetermined initialization sequence, regardless of which programs were being executed prior to the restart, and all data shall be re-acquired as quickly as possible. An alarm shall be generated for all automatic restarts. In addition, in the event that a user console is restarted, an explanatory information window shall be posted to the user of that console.

1. A *hot restart* means that all the applications are automatically reinitialized, and the most recent version of the entire memory-resident database continues to be used.
2. A *warm restart* is a complete automatic re-initialization (booting) of the MMS using the most recent database restored from disk. A warm restart shall be automatically initiated for a processor, user console, or the complete system after loss of power.
3. A *cold restart/startup* is a complete automatic re-initialization (booting) of the MMS from an archived version of the database. A cold restart shall be initiated only in response to a request issued from an authorized console.

   * Automatic unless user selected for manual initiation; default shall be "automatic"

Following failover or switchover, hot restart, or warm restart, no user log-in or manual intervention shall be required for the affected processor and the complete MMS to recover its data, its functions, and the full unchanged set of displays on each monitor.

### 7.4.5 Manual Failover/Switchover and Restart

It shall be possible for an authorized user to command a manual failover/switchover or to restart an on-line or backup processor. Manual restarts shall be recorded as events.

After a manual failover/switchover, the previous on-line unit shall promptly go into the backup mode and shall be available for failover/switchover. The user shall, however, be able, before


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commanding the failover, to instruct the original on-line unit to freeze in its final state before the failover.

## 7.5 Hardware Requirements

The hardware platforms shall be able to support the specified functional, performance, maintenance, availability, and expansion requirements of the MMS. Printers, tape drives, and other peripherals shall be included as needed for efficient and secure operation and maintenance of each function and element of the MMS. Certain specific hardware requirements are given in the following sections. Detailed hardware requirements shall be established during contract negotiations, based on the proposed hardware platform. All MMS equipment shall operate on 230 VAC, 60 hz.

### 7.5.1 Processors

Each general-purpose processor shall be a current-model computer of state-of-the-art design incorporating all features necessary for efficient operation of a real-time system. All the general-purpose processors (with the exception of the processors of the user consoles) shall be members of a single family of processors, manufactured by a single manufacturer, and conforming to the same architectural design. Different models of these processors may be included in the System as appropriate for achieving a cost-effective design. It shall be possible to replace or upgrade each processor with compatible processors which become available in the future, without changing other components of the System or the applications software. The hardware platform shall be POSIX compliant, such that whenever a hardware upgrade is required, the application software shall be portable to whatever POSIX-compliant platform offers the best price/performance ratio at that time.

Single-function processors, such as gateways and routers, may be provided by other manufacturers and are exempt from POSIX-compliance.


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### 7.5.2 Compact Disk-Recordable (CD-R) Units

The System shall include CD-R units that shall provide a removable transferable medium suitable for the following applications:

1. Backup of all software, databases, and display files.
2. Input of source files for system generation.
3. Storage of software source code.
4. Loading of off-line diagnostic programs.
5. Exchange of database and program files between the Market Operator (MO) and the Contractor during system development and for maintenance support.
6. Delivery of software updates from the Contractor, the supplier of the operating system, and suppliers of any other software included in the system
7. Archival storage of data.

At least two CD-R units, accessible from any processor which may require any of the services listed above, are required.

### 7.5.3 System LAN Connectivity

The System shall connect all general processors via a dual redundant Local Area Network (LAN) which is based on International Standards Organization (ISO) standards 8802.1, 8802.2, 8802.3, and/or 8802.4. If high throughput is required between some processors, additional redundant LANs or higher speed Ethernet (100 base T) LANs shall be used.

### 7.5.4 MMS User Consoles

The user consoles shall consist of workstations with monitors that meet the following requirements:

1. 20" diagonal viewing area.
2. 0.27 mm or less dot pitch.
3. Refresh rate of at least 84 Hz.


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### 7.5.5 Expansion Capabilities

In order to accommodate system expansion to, and possibly beyond, the Ultimate size, the MMS shall be designed to facilitate the addition of processors and memory, as well as disk units, as follows:

1. The installed memory in each major processor shall be expandable to at least three (3) times the installed size at the time of MMS acceptance.
2. The installed disk capacity shall be expandable to at least two (2) times the installed capacity at the time of system acceptance for the processors of the data storage, five (5) times for all other major processors.

It shall be possible to meet the indicated expansion requirements with the field addition of processors, workstations, memory, disks, and peripherals.

The Contractor shall demonstrate in acceptance tests that the MMS can adequately meet the indicated hardware expansion requirements.

### 7.5.6 Upgrade Capabilities

The expansion capabilities required are based on probable growth rates, known application additions, and the desire to balance system cost against capabilities. However, expansion beyond Ultimate sizes may be necessary in the future. Accordingly, the following capabilities are required for the MMS:

1. **Processors:** A growth path shall be provided that allows upgrading of computational power and main memory by means of field expansion or change out of the processors. Such upgrades shall be possible by changing processors or adding processors while retaining software and hardware compatibility.
2. **Computer Peripheral Equipment:** All peripheral equipment shall be standard products with standard interfaces that can be replaced with more powerful or newer models without requiring additional hardware or software changes.
3. **User Consoles:** The design of the user consoles shall enable the MO to take advantage of new and improved Contractor software versions and offerings as they become available. No modifications to standard hardware, the operating system, or any other third party software if used, shall be allowed.
4. **Local Area Network (LAN):** An internationally recognized standard LAN and associated protocol shall be used for the interconnection of processors, workstations, user


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consoles, communications interfaces, and system support equipment. The LAN shall allow for several important growth features including: incremental expansion and the ability to add processors, resource sharing, parallel operation of functions, and backup of functions.

5. **Data Communications:** All data networks and links shall conform to internationally recognized data communication standards, except where this contradicts explicit data exchange and interface requirements specified by the MO. All communications shall be supported by the software protocol access interfaces such that physical connections and details of the link procedures are transparent to the application programs.
6. **Market Participant Interfaces:** All interfaces with Market Participants shall conform to browser and data exchange standards recognized by the World Wide Web Consortium and used over the public Internet.
7. **Applications Software:** In developing applications programs, MMS shall be able to utilize all standard high-level languages (necessarily including C, C++ and Java) supported by the computer manufacturer.
8. **Documentation:** All documentation supplied shall be sufficiently detailed to allow the MO to maintain the MMS, and to design and integrate new applications and capabilities into it without requiring additional design information. The use of proprietary designs for which design information will not be made available to the MO is absolutely not acceptable.

## 7.6 System Software Requirements

This Section presents requirements for the software platform of the MMS. This includes the operating system, backup and failover, resource monitoring capabilities, and compilers and software development tools.

All software written by the Contractor shall be written in an industry standard high-level language. Software sources shall include clear and unambiguous comments written in grammatically correct English and, for each program, a comprehensive description of its purpose, functions, inputs, outputs, and resources.

### 7.6.1 Software Development and Integration

Software management shall be based on the concept of a master source code repository for centralized management of source code. Procedures shall be established to check source code out for development and for submittal of new or revised source code. No source code shall be kept in


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run-time environments, and source handling procedures shall be established to prevent spreading of source code outside the source code repository. A single repository shall exist at all times.

A hierarchically organized programming development environment shall be established for all software. Programs and data files shall be placed in different disk directories, and programs belonging to different subsystems shall be placed in different directories. A consistent naming convention shall be enforced to distinguish programs in different subsystems, and to distinguish between program source files, parameter source files, object files, command files, libraries, executable code, and program documentation. Software released for the operational system shall be maintained in completely different directory structures than software that is under development. The time and date of the last update and the login identification of the programmer submitting modified code shall be kept in the source code repository.

### 7.6.2 Version-Control Software

Version Control software capabilities, such as the Revision Control System (RCS) for Unix, shall be provided to manage software maintenance and update processes for all aspects of the MMS. Version control tools shall be provided to allow an individual user to maintain control over an item such as a source file while they implement and test changes to it. During the period that the file is "checked out," no other user shall be allowed to modify it. When the user is satisfied that the changes have been implemented successfully, the file shall be "checked in" to the baseline database for use by everyone.

An audit trail shall be maintained of modifications to each program's source code to allow the sequence of changes to be automatically reconstructed, starting with the latest version of the program that was released for integration into the MMS. The generation process shall use the latest version of all inputs, unless explicitly directed otherwise. Tools and procedures that use the audit trail in order to restore the MMS to a previous known state are required.


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### 7.6.3 *Operating System Software*

A widely accepted version of the UNIX operating system, supplied by the manufacturer of the processors, shall be used in all the general-purpose processors of the MMS (except for the processors in the user consoles; see below). The same revision of that UNIX operating system shall be uniformly employed throughout the system. It shall be the latest revision. If a new revision is released within six months of the Factory Acceptance Test (FAT), it shall be used during that test.

User consoles shall be able to run Windows applications.

In order to facilitate operating system upgrades, the operating system directories shall not include any files that are irrelevant to the operating system.

The operating systems shall provide robust security features of at least C1 level (per the US Department of Defense Trusted System Evaluation Criteria).

### 7.6.4 *Diagnostics*

Both on-line and off-line diagnostic programs shall be provided for all hardware components of the system supplied by the Contractor.

1. On-Line Diagnostics

On-line diagnostics shall operate initially when power is first applied to the device. At start up, the diagnostics shall report error messages on engineer consoles. Errors detected during startup shall be logged in an MMS Errors file. Startup diagnostics shall detect and report such problems as configuration errors, a corrupted disk, failure to access memory, failure to access a LAN, or failure to access a required peripheral device.

After the device has been powered up, self-check capabilities incorporated in the equipment controllers and monitoring software shall provide continuously active error detection while the


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device is in operation. All detected errors, including non-critical and automatically corrected errors, shall be logged in the MMS Errors file. Equipment failures shall also generate alarms.

An on-line diagnostic program shall be provided to monitor the loading and performance of every system processor, server, and LANs. The LAN diagnostic shall be able to scan for a preset pattern (e.g., source address, destination address, specific data field, etc.), store all messages that include that pattern in a circular buffer, and display the messages on user request in an easy to interpret and well documented format. The LAN diagnostic shall be able to generate, on any LAN of the MMS, traffic as needed to simulate the loading that could be imposed on the LAN by any device. LAN diagnostics shall also allow system analysts to configure devices on the LAN for test purposes (e.g., block messages from being received or sent by certain devices).

2. Off-Line Diagnostics

Off-line equipment diagnostics shall be performed while the MMS is fully operational, with only the equipment being tested in an off-line state. The off-line diagnostics shall also be executable in the backup units of redundant configurations while the backup unit remains available for failover. The off-line diagnostics shall be automatically terminated in the event of a failover. Engineers shall be able to use MMS configuration control displays to declare equipment to be off-line and unavailable, and to perform the appropriate diagnostics under interactive control.

Off-line diagnostic programs shall test and evaluate the performance and analyze the failures or errors of all the processors, peripherals, and other devices of the MMS. These off-line diagnostics shall provide extensive facilities for printout and user interaction from user consoles that are assigned to maintenance personnel. The off-line diagnostic programs shall comprise a complete analysis and diagnostic tool for verifying the correct operation and for detecting and analyzing problems in each piece of equipment.

A complete set of off-line executable diagnostic program files shall be installed in the MMS, and shall also be included in the software delivered on CD-ROMs or other medium supported by the MMS.


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### 7.6.5 Virus Detection

Processors that use Microsoft operating systems shall include a virus detection program that shall run at startup, when initiated by the programmer, and whenever data or programs are loaded into any processor in the MMS. The virus detection program shall search for and report the existence of software viruses in memory and on associated disk devices. A processor or user console shall not be allowed to connect to the MMS if it has been found to harbor a virus.

An update service shall be available for the virus detection program, with updates for new known viruses provided to the MO as soon as they become available. The contractor shall be responsible for this service and support the installation of updates during the warranty period. Updating shall be required only on one processor, with the updated version distributed to the rest of the MMS.

### 7.6.6 Programming Tools

The system software shall include a comprehensive set of programming tools and aids. These software modules shall be executed at the lowest system priority, during what would otherwise be idle time of the processors. Programmers shall also be able to run the programming services in the backup processors of the on-line system. These processors shall remain available for automatic updating and failover.

The Contractor shall describe the proposed software development and maintenance tools. It shall be possible to run these tools on-line without materially affecting the operation of the real-time programs. Sufficient memory and disk space shall be provided for editing, compiling, and linking the largest programs without interference with real-time functions or with automatic failover functions.

The MMS shall provide complete facilities for program execution and testing in such a mode that operation of the real-time system is not jeopardized and the performance of the MMS is not degraded below the required levels.


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On-line debugging aids shall enable the programmer to halt program execution, step execution one line at a time, insert break points with counts, display associated memory contents referenced by symbolic names, display/print "breakpoint" values during program execution, display the last subroutine calls, and display and change the contents of program variables. Post-mortem information such as the value of specified variables and the last few subroutine calls shall be displayable for abnormally terminated programs.

The system databases shall be indirectly useable by programs being tested; however, writing to the databases shall be inhibited during debugging.

It shall be possible to install new programs in the real-time environment. Commands shall be provided for allocating computer resources, allocating disk memory, downloading a program from a development processor to another processor, writing a program to any suitable storage device included in the MMS, reading and loading programs from the CD-ROM and other storage devices, substituting one program for another, setting up or modifying task definition tables in the executive program, and activating the new program without interfering with normal operation.

Updating of software on any processor shall automatically be logged for auditing purposes.

### 7.6.7 System Generation

Hardware and software shall be provided to generate the MMS software or portions thereof on the computer system without interfering with (i.e., delaying, suspending, or aborting) critical MMS activities. Input shall be possible from the hard disk, from a CD-ROM, and from any other supported storage device.

System Generation shall be directed from a single console. The system generation process shall create a complete, automatically booting MMS software system, ready to be distributed to all the processors and consoles, loaded, and started. The System Generation process shall generate a log of the activities that also shows any errors that may have been detected. The user shall be able to


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store the entire new software system on any suitable storage device that is included in the MMS, for later loading.

### 7.6.8 Third Party Software Interfacing Requirements

Provisions are required for the MO to add applications, developed in-house or by a third party, to the MMS. The capability of high-level language programs to access the databases by referencing unique variable names shall be provided. The residency (main memory versus disk, or the identity of the applications processor) for the referenced variables shall be transparent to the programmer. In addition, the MMS shall include well-documented non-proprietary Application Program Interfaces (APIs) which may, at no cost and with no restriction, be used by the MO or provided to a third party engaged by the MO for development of applications for the MMS. The APIs and database documentation shall be appropriate to enable the MO or a third party to successfully integrate new programs with the MMS.

### 7.6.9 System Resource Monitoring

The MMS shall include programs to monitor and record the utilization of resources and queuing of requests for the various components of the MMS, including:

1. Utilization (i.e., percentage of processor or channel time being used) of the following resources:
   a. Servers, workstations, and data storage systems.
   b. MMS LANs, routers, and bridges.
   c. Communications servers and data links.
2. Queue lengths and average wait-times for the following queues:
   a. I/O queues for disks.
   b. I/O queues for access to the LAN and wide-area network.
   c. Processing queues for major tasks, such as database access, alarm generation, scan data processing, etc.


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The utilization/performance information shall be sufficient for the following objectives:

1. To enable MO staff to track the system usage, determine bottlenecks, and plan system upgrades.
2. For verification, during MMS acceptance tests, of compliance with the performance requirements.

It shall be possible to use any console, when it is assigned to maintenance, for viewing and printing of MMS utilization and other performance information. The utilization parameters shall be accessible to statistical analysis programs written by the MO.

## 7.7 Emergency Backup System (EBS)

Disruption of the PEM operations cannot be tolerated. Therefore an Emergency Backup system (EBS) shall be installed off-site to ensure continuity of operations if the normally used system (referred to as the "Main System") becomes unavailable for any length of time.

### 7.7.1 EBS Design Philosophy

The EBS will be used only as a last resort, and therefore the MO wishes to limit the cost of the EBS and of associated facilities such as data links, and to reduce the effort and cost of maintaining the EBS. At the same time, operations cannot be compromised when the EBS is in use. The Contractor shall take the following approach to achieve these goals:

1. The hardware configuration shall comprise a subset of the configuration of the Main System, with those elements omitted that may not be needed in the EBS. Provisions are however desired to expand the configuration of the EBS in case that longer term operations from the emergency control center become necessary. So, for instance, user consoles outside the control center may be omitted from the EBS, but shall be supported by it;
2. In addition to a redundant configuration, a non-redundant configuration shall be proposed as an option; and
3. A replica of the software package of the main system shall be used, with functions that are not supported by the hardware configuration of the EBS disabled if necessary to avoid problems. Disabled functions shall be identified by the user interface (e.g., by dimming inactive functions) or, alternatively, users shall be notified when attempting to perform an unsupported function. Such a design will facilitate updating the EBS with software


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revisions made to the Main System, and will provide a way to increase the functionality of the EBS should long-term emergency operations become necessary.

The MO will consider practical alternative EBS design approaches which meet the stated goals.

The MO will provide a data link or network communications between the main system and the EBS, adequate for supporting the required coordination between the systems. The MO will also provide access to the EMS and the Market Participants Communications Network.

### 7.7.2 EBS Functions

In principal, the EBS software should be identical with that of the Main system, to ensure full functionality as well as to facilitate maintenance. Functions that are not essential for operation may, however, be omitted if this results in cost savings and does not impede system management.

### 7.7.3 Database Maintenance

The database (including displays and reports) of the EBS shall be a clone of the database of the main system, with the exception of unavoidable differences if any. It shall be possible to perform all database generation and maintenance activities on the main system, and under normal circumstances all the database maintenance activities shall be performed there too. All database updates, including structure changes, shall be transmitted to the EBS when they are activated in the main system. No manual activities shall be required, at the main system or the EBS, in order to keep the database of the EBS fully compatible at all times with that of the main system. The database maintenance functions shall however be included in the EBS, for use during emergency operations when the main system is down. Furthermore, in order to facilitate recovery from emergency operations, a method is required to upload database updates introduced at the EBS to the main system. A manual procedure is acceptable, and it shall be possible to test the uploaded version in the main system before committing it to on-line operation.


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All the data that may be required for the functions that are active in the EBS shall be sent by the main system. This includes data received from EMS systems and market participants (to ensure compatibility between the data in the EBS and the main system, the EBS should not communicate with these entities under normal operating conditions), entered data, calculated data, and data generated by applications. New data that is needed for real-time operations shall be forwarded to the EBS as soon as it received by the main system, entered in it, or generated by its; user inputs to set up study conditions, and the results of studies, shall not be sent. To ensure full compatibility, snapshots of the contents of the database of the main system shall automatically be downloaded to the EBS on a periodic basis. The download periods or intervals shall be adjustable by the MO. The MO shall also be able to request immediate downloading. Initially downloading shall occur once a day, late at night, but faster updating shall be possible if supported by the link to the EBS. It shall be possible to segment the downloaded snapshots as may be needed to control the data flow as necessary to avoid excessive loading on the communications link or network that is used.

### 7.7.4 Support for User Consoles

The EBS shall operate with the same consoles as the main system; no hardware changes, software changes, or different settings shall be required at consoles when they are transferred for operation with one system or the other. The EBS shall support all the console configurations (various numbers of monitors, etc.).

### 7.7.5 Transferring of Operations Between the Main System and EBS

Transferring of operations from the main system to the EBS and vice versa shall be manual. Authorized persons at a console that is connected to the EBS shall be able to transfer operations to it at any time. Transferring operations to the EBS shall not depend on the main system. Under no circumstances shall the state of the main system or problems with the main system impede or prevent the transfer of operations to the EBS or degrade the operation of the EBS in any way. When the EBS takes charge of operations it shall cease accepting data (such as new data and database snapshots) which the main system may still attempt to send.


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The Contractor shall provide tools and procedures for an orderly restoration of operations to the main system. These procedures shall include synchronizing the database of the main system with that of the EBS, and the recovery of historical data collected by the EBS.

### 7.7.6 ***EBS Integrity Testing***

The MO plans to periodically verify that the EBS is fully operational and ready for emergency operations. To this end it shall be possible to put the EBS into a test mode in which:

1. All the EBS functions shall be activated, including communications with the EMS (concurrently with the main system), collection of historical data, and applications.;
2. Data acquired in the test mode shall be stored in a test clone of the database. The operational database shall not be impacted, and shall continue to be updated by the main system;
3. No interference with the operation of the main system shall be experienced;
4. No transmissions to the EMS or market participants shall occur. The EBS shall not be allowed to affect external systems in any way; and
5. Tools shall be available to facilitate verification of proper operation of functions and applications which normally interact with external systems, e.g., to process data received from the main system, and verify that the same results are achieved.

During test activities the EBS shall remain ready for emergency operations.


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# 8.0 DATABASE REQUIREMENTS

This section specifies requirements for the on-line and historical databases of the Market Management System (MMS) and their associated maintenance tools.

## 8.1 Database Design Requirements

### 8.1.1 Design Concepts

In distributed and networked systems, efficient database design, secure database access, standard database access methods, and management of data consistency and data exchanges across multiple network nodes are major requirements. The MMS shall be designed such that:

1. A single source is established for each type of data, although copies of data may be propagated to other databases for reasons of performance and ease of use. The user shall not be required to enter the same data more than once.
2. Speed of access to each database matches the type of access required.
3. Publish/subscribe concepts are used for all data exchanges across networks.
4. The following are prevented:
   a. Unauthorized access (read-only, read-write, create-delete);
   b. "Write" access by multiple users simultaneously (the system shall ensure that only one user at a time has write access to any single database item);
   c. Lockup of databases due to mismanagement of resources or the lack of necessary resources;
   d. Storage of invalid data;
   e. Propagation of corrupted data; and
   f. Failures that cause the permanent loss of critical data.
5. Data communications and data formats use international and utility standards in all cases unless otherwise approved by the Market Operator (MO).
6. Data is consistent across all nodes of the network, unless implicit or explicit time stamping permits users to be aware of and to handle data inconsistencies.
7. Management of database generation and modifications is consistent, easy, modular, and rapid.


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8. Management of data exchanges between network nodes, both internally within the MMS and externally between the MMS and other systems, permits consistent and easy modification and expansion of automatic data exchanges, and keeps track of what data was transmitted where and when.
9. The file system is scaleable (i.e., increasing the size of the databases or changing to a larger disk drive shall not require rebuilding databases or result in the loss of data).
10. Modifying portions of the database does not require the entire database to be recompiled, but only those portions that have changed. No data shall be lost or require manual re-entry during this process.
11. Modifying portions of the database does not require the recompilation or relinking of application software, except in the event that the application software has been changed to reflect the modification of the database.
12. The database is redundant in order to maintain system availability in the event of a hardware or software failure. All data in the primary and backup databases shall be kept synchronized and consistent.
13. On-line database edits do not require system restarts.
14. Table writes are prohibited from extending beyond the table boundaries.
15. On-line backups of the database are permitted and do not affect on-line operations. It shall not be required to take equipment out of service or perform a failover to back up any component of the system database.

### 8.1.2 Design Conventions

The databases shall be defined and maintained by a set of interactive, English language, editors. The editors shall use a consistent style, fill-in-the-blank format, or shall use a library of standard defaults based on type, and shall be supported by warnings that shall appear automatically to alert the user of inappropriate entries. The system database shall be documented in a complete database manual that shall be available on-line, and that explains the interrelationship of all databases. The database manual shall provide both visual samples and text description of the entry format and purpose of all fields in all of the system databases.

The database foundation shall include both the schemas (logical descriptions of the databases) and the instances (run time databases) of the real-time, historical, and relational data structures. It shall also encompass all aspects of database management across a distributed architecture composed of dispersed processors connected in a peer-to-peer network.


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The software shall provide for Global Naming Conventions to be used in conjunction with display and database point definition. This global naming shall provide for unique names throughout the system.

### 8.1.3 Database Model

The different databases shall be distributed among various servers and workstations with operations coordinated via networking and data exchanges. While the dispersed architecture dictates that multiple physical databases will be implemented, and while some databases may be structured for fast access (e.g., the market operations database and some of the application program databases) and others may be structured to provide easy and standard access (e.g., the Market Participant (MP) offers and the historical and archival databases), from an operational point of view there shall be a single, integrated system-wide "logical" MMS database.

The MMS database shall make use of templates and other mechanisms to facilitate database generation and maintenance. The user shall interact with the database via a graphical user interface. The user shall also have the capability to interact directly with the database source via ANSI SQL-compatible queries. Report generation and other non-real-time applications shall have access to the data via ANSI SQL-compliant calls to the historical and other non-real-time databases.

The software shall support archiving the databases to off-line storage (e.g., magnetic tape or WORM disks) and retrieving the data back from off-line storage for replay or analysis of events.

### 8.1.4 Common Information Model (CIM) Data Objects

The power system data shall be maintained such that it is accessible in the CIM structure and format.

The CIM is an object model being standardized by the IEC. The CIM describes the contents, structure, and format of data objects that are used in electric utility control centers.


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The CIM transmission and generation data objects shall include:

1. Real-time generation and transmission data, updated in the relational database upon exception whenever received from the Energy Management System (EMS).
2. Study generation and transmission data, updated in the relational database upon exception whenever the specified application data is updated in the EMS model and forwarded to the MMS.

### 8.1.5 Relational Database Requirements

The Market Operations database, the historical database, and the archival database shall be relational, object-oriented databases.

#### 8.1.5.1 Basic Requirements

The relational databases shall support ANSI SQL-compliant queries and shall have the following additional features:

1. An object-oriented structure, with the use of standard object-oriented techniques in general.
2. The use of the CIM constructs, and CIM import/export facilities, where feasible.

#### 8.1.5.2 Multi-User Database Integrity

As a minimum, the following requirements shall be met to ensure the integrity of the database while accessed by multiple users:

1. Individual records within a table shall be lockable such that other records within that table are still accessible.
2. Deadlocks in database access shall be prevented. If a deadlock is detected, the server shall choose a transaction to abort and return a specific error code to allow the application to take an alternate action.
3. Within a non-real-time database, it shall be possible to treat a single step change request as a transaction with automatic commit. Multiple change requests may be treated as transactions with explicit commit commands.
4. Database access methods shall support the following capabilities:
   a. Queries shall be definable and executable from menu-driven screens;


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   b. Menu-defined queries shall be stored for future execution either on-line or in batch mode;
   c. Selection criteria for previously defined queries shall be capable of parameterization, thus alterable upon each execution;
   d. All programming language compilers shall support SQL database access via library functions and embedded SQL commands; and
   e. Access to all values associated with a single component shall be retrievable by specifying only the component (e.g., all variables associated with a transformer must be retrievable by identifying the transformer). Direct access to specific variables shall also be supported.
5. Security measures shall ensure only authorized access to the databases.
   a. Authorization granularity shall be supported by database, by table, by item, and by record for all relational databases;
   b. The different authorization levels shall include no-access, read-only, read-write, create, and delete; and
   c. For critical and sensitive data, unauthorized access attempts shall be logged. Successive access failures larger than a programmer-entered number shall cause an alarm.
6. The non-real-time databases shall support date and time data types.
7. The databases shall support time stamping of data entries.

### 8.1.6 Database Backup and Security

All databases shall use a redundant design for high availability. The data in the primary and backup databases shall be kept synchronized and consistent. It shall not be necessary to bring the system down for backups.

Security of data is of paramount importance. Mechanisms shall exist to ensure all security threats are countered:

1. Only authorized access shall be permitted to the data (no-access, read-only, read-write, create, delete). All applications shall be authenticated before being permitted access to the database.
2. Other security threats, such as spoofing, eavesdropping, Trojan horses, masquerading, repudiation, theft, replay, integrity violation, lockout, etc. shall be prevented.


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## 8.2 Market Operations Database Management

Market operations databases shall contain data related to:

1. Registration information from MPs;
2. Offers/Bids for energy;
3. Offers for Reserves and Ancillary Services;
4. Outages and System Constraints; and
5. Logs and archives related to Market Operations.

### 8.2.1 Multiple Database Instances

The Market Operations functions shall support multiple database instances in order to permit parallel operation of these functions on different platforms in different environments, which are functionally isolated from each other. As a minimum, the following database instances shall be provided:

1. Production environment for real-time operations;
2. Maintenance environment for off-line modification and updating of databases and system parameters, which will be rolled over to the production environment after testing; and
3. One or more development environments for application development and upgrading, testing "what-if" scenarios, unit testing, system testing, training, or other non-production activities. Different activities executed simultaneously in different development environments shall not affect each other.

### 8.2.2 System Rollback

The databases used in the on-line environment shall be designed and implemented such that they can be 'rolled back' to their state at a previous point in time, implying that both database and processing shall be date effective. All such rollbacks shall be logged to ensure that auditing personnel can determine which database state was in effect at any point in time.


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### 8.2.3 Referential Integrity

The Market Operations databases shall implement declarative and procedural referential integrity to ensure that an entity cannot be inserted, updated or deleted in such a way as to have invalid primary or foreign key references or orphans of any of its dependants. This referential integrity shall ensure that the databases are not corrupted and that audit capabilities are not compromised.

### 8.2.4 Synchronization with Template Modifications

Since the templates for transmitting information between MPs and the MO will change over time, the mechanisms for synchronizing Market Operations databases to these changes shall be flexible and easy for authorized staff to implement. In addition, during the cut-over time when a modified template is implemented but while the old template is still valid, the process for extracting data from templates submitted by MPs shall be capable of handling both the old and the modified templates, based on template version number.

All changes to databases which have been restructured in order to reflect template changes (or for other reasons) shall be logged. Archives of information derived from templates shall indicate the type of template and the template version number. Access to this archived information shall ensure that all information fields are correctly identified, even after template modifications.

## 8.3 Historical and Archival Databases

The Historical and Archival databases shall be located in multiple nodes within the MMS as required to meet system performance criteria.

### 8.3.1 Capabilities of the Historical and Archival Databases

The historical data needed by the MMS market operations, metering and settlement applications, as well as all historical data needed by users and applications external to the MMS shall be stored in a historical database. All the data needed for the preparation of market operations


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reports shall be derived from this database. It shall be possible to select from this database any or all of the historical data collected or processed by the MMS for archiving or transfer for off-line processing. All historical data shall be saved on-line in the historical database for the period specified in the MMS Sizing Parameters.

With proper authorization, it shall be possible to enter or override data for any particular historical point for any particular time of storage. Edited historical data shall be given a special data quality tag. If manual entries are made to one or more components of a calculated point, the system shall automatically recompute the calculated values and their data qualities.

Historical data shall be stored in such a way that it will be possible to identify and display the absolute date and time of each entry, and to request specific data for specified time periods. User oriented procedures, based on pointing and requiring minimal typing, shall be provided for the selection of historical data for display, archiving, printing, or any other purpose.

Historical data shall be stored without truncation or loss of precision. It shall also be possible to view historical data associated with points that have been subsequently removed from the real-time database.

The size of the historical database shall be constrained only by the capacity of the storage devices. It shall be possible to increase the number of historical items, and the duration for which historical data is saved, by changing programmable parameters and, if necessary, by expansions of storage capacity.

### 8.3.2. *On-Line Market Operations Records*

The MMS shall support the on-line storage of market operations data for the length of time specified. The market operations data shall include the following:

1. All load forecasts data made available to MPs;
2. All MP offers and bids for the day-ahead and week-ahead projections;
3. All updates and changes to previously submitted offers and bids;


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4. All nodal prices and spot market prices made available to MPs;
5. All resource schedules;
6. All results from the Dispatch function;
7. All results from the Resource Monitoring function;
8. All results from ancillary services monitoring;
9. All results from settlement and re-settlement processes;
10. All results from billing processes;
11. All alarms and events related to market operations; and
12. All other information required to ensure that complete audits of market operations can be made.

### 8.3.3 *Off-Line Archiving and Transfer of Data*

The MMS shall also be able to copy historical data periodically from the database to optical disks, magnetic tape, or any other removable storage medium for long term archiving and for file transfer to other systems. The capability to restore archival data to the historical database for viewing and editing shall be included.

Selection of historical data for archiving shall be initiated from MMS consoles. Pre-defined sets of historical points and time periods that shall be copied, and the destination device (if there is more than one) shall be selectable. More flexible selection of points shall also be possible.

Data shall be archived in a format that is supported by commercial databases.

## 8.4 Report Generation and Maintenance

It shall be possible to create reports based on data stored in the databases. Authorized users shall be able to view, edit, and format reports, schedule their printing, and specify the site or sites of printing and the printing devices. It shall also be possible to print the reports on user demand. It shall be possible to format operational reports for printout on any printing device, or to output reports to a named file. Each individual report shall be stored to a distinct file. The file name shall include the date and the report title.


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### 8.4.1 Creation of Reports

A reports editor shall support the creation, modification, scheduling, and deletion of system reports. All data stored in the real-time and historical databases shall be available for inclusion in reports. Report definition capabilities shall include the following:

1. Text definition;
2. Formatting (layout, color, bolding, fonts and font size, background, titles, page breaks, etc., for displays and color printers);
3. Selecting whether or not data quality codes shall be shown;
4. Data definitions;
5. Definition of calculations;
6. Output of date and time of report generation, and the date and time each item was saved in the database;
7. Assignment of output printing devices, including the assignment of a report to a file or to a socketed connection to an external system; and
8. Ability to generate a report in various formats, including ASCII, PostScript, PCL printers, Adobe PDF, and HTML.

It shall be possible to format reports for printing on black-and-white and color laser and ink-jet printers, in either portrait or landscape mode. Font sizes and styles shall be easily selectable.

### 8.4.2 Printing of Reports

All reports shall always start printing at the top of a new page and each page shall have a specially designed header identifying pertinent data, including time and date.

Once started, a report shall not be interrupted until it is completed, unless cancelled by the user. At no time shall a page of printed output contain any information other than for the report started on it.

If the designated printing device is unavailable or becomes unavailable before printout is completed, the entire report shall automatically be rerouted to a backup device preselected by the


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user. If no backup device is available or has been designated, the entire report shall be saved and automatically printed as soon as a printing device becomes available.

The following capabilities are required for the scheduling of reports:

1. Scheduled Printing: It shall be possible to specify, as part of the report generation process, whether the report is to be printed automatically and when it is to be printed. Printout scheduling capabilities shall include hourly printout, daily printout, printout on a given day of the week, printout on a given day of the month, and printout at given time intervals. It shall also be possible to specify the time of day for printout.
2. Manual Printing: It shall be possible to request the printout of any report at any time. If the time range of the report is not completed by the time of the request, data available so far shall be printed.
3. Event Triggered Printing: It shall be possible to trigger the printout of a predefined report upon the detection of a specific event (e.g., completion of a trading interval). Applications programs shall also be able to request printing of reports.

### 8.4.3 Viewing and Editing of Reports

Authorized users shall be able to view reports on their consoles. The methods used to select the reports shall be the same as for manual selection of reports for printout. To the extent that the report does not physically fit on the monitor, the dispatcher shall be able to scroll vertically and horizontally to view the entire printable area of the report.

For sets of reports of historical data, the operator shall be able to step forward or backward in time to view reports for different time periods.

For reports on specific data, the user shall have the capability of producing reports where the data is sorted by any key logically appropriate to the report (e.g., by company, trade interval, market trading node, or MP).

Authorized users shall be able to edit historical data from automatically formatted reports that can be displayed. Whenever a database point is edited, all calculated points using the modified data shall be recalculated, preferably automatically. If recalculation must be manually initiated,


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then a clear warning message shall be shown when recalculation is needed, both on the monitors and in all affected printouts.

## 8.5 Database Generation and Maintenance Requirements

Database Generation and Maintenance shall use standard tools tailored as required to facilitate use by MO personnel. General requirements follow.

### 8.5.1 Database Generation

A database generation program shall automatically generate the system databases from sources (internal off-line database source files, manual inputs, and inputs from external systems) that completely identify all the information needed to build the database. The database generation program shall automatically generate the Participants Registration, Market Operations, Meter Data Collection, and Settlements databases, as well as any other databases that may be needed in the MMS. Parameters, if any, that are needed during the database generation process shall be solicited by the database generation program at the initiation of the generation process. No interaction with the user shall be required during the generation process, other than recovery from error conditions.

References to each data point or to an array of data shall be by variable name, and shall not be by address location or index. When filling data entry forms on-line, it shall be possible to create references to data points by dragging and dropping the name of the entity being referenced. When only certain predefined values may be entered in a field, then it shall be possible to select the desired entry from a pull-down menu.

The MMS shall create and maintain an offline source database. The generation of any portions of online database, for any processor, shall be done automatically from the offline database as part of the database generation and maintenance process.


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### 8.5.2 Database Generation Tasks

The database generation scripts shall perform the following tasks:

1. Validate the input data, confirm that the values of all entries are valid, and flag all conflicts among input sources, all logical errors and inconsistencies, and all missing data fields. Power equipment parameters shall also be checked for reasonability;
2. Build and maintain database directories sufficient to fully describe the database;
3. Build a market management database which includes tables for MP registration information, MP credit information, MP offers, nodal prices, resource schedules, metering data, settlements, billing, market operations logs, market operations archives, and other database items required to manage the market transactions;
4. Build Web pages to support MP transactions;
5. Transmit a replica of the database to the emergency backup system (if applicable);
6. Create database source files and directories in a format suitable as input for regenerating and reloading the entire database system;
7. Create printable reports that document the database structure and contents in an easy-to-read format; and
8. Log each database modification, whether manual or automatic, in a journal with a time stamp and user identification. The journal shall be automatically moved to archival storage when it exceeds a predefined number of entries or on user demand.

### 8.5.3 Database Update

No modifications to program logic, automatically or otherwise accomplished, shall be required for performing database update and maintenance. Furthermore, the update software itself shall be table-driven insofar as possible and shall be modular in structure, thus allowing easy modification for the incorporation of new data types or conventions.

During any modification of the database, all manually entered data as well as all calculated data shall automatically merge or carry over into the newly built database. Examples of manually entered data are: calculated points which are manually overwritten, aggregated meter points, limits, application parameters, dispatcher annotations, and MP offers. Following database or software modifications that result in restructuring of the database, operators shall never be required to manually reenter data that has previously been entered.


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### 8.5.4 Input Validation

Input data shall be validated wherever possible. It shall, however, be possible to mark specific input data entries as exempt from data validity checking.

All validation errors for database generation shall be posted in a single run of the database generation process. The process shall not stop when an error is detected. The error messages shall be in plain English and shall identify the problem. They shall direct the user to the source of the problem and require no reference to other documentation. It shall be possible to correct errors during the generation process, without repeating it from the beginning.

It shall not be necessary to enter the same data more than one time. After the updates have been verified and accepted at one processor, the MMS shall, on command, propagate the changes to all the processors. The user shall not be required to repeat the update procedures on other processors. Database changes at one node shall not require manual, dependent, or synchronized changes at other nodes.

### 8.5.5 Database Maintenance Functions

Database maintenance functions shall be provided, including the capability to add, delete, or change database parameters associated with telemetered data, manually entered data, application data, program-calculated data, system hardware components, and, in general, all database parameters which affect system operation. Procedures for change control of the database shall be similar to the ones used for programming control.

Tools shall be provided to allow for the flexible and easy definition of new objects along with their attributes, presentation of attributes, alarming, and user dialog. Possible modifications to the database shall include but not be limited to:

1. Addition, deletion, and redefinition:
   a. Participants;
   b. Market trading nodes;


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   c. Meter data aggregation; and
   d. Data security and access.
2. Assignment of which data points shall be copied to the historical database, with an indication of whether by exception or periodically.
3. Redefinition of data retrieval frequencies.
4. Addition, deletion, and redefinition of models and parameters based on EMS changes.
5. Creation of reports that interrelate owners, users, tables, and application programs.
6. Maintenance of data tables: restructuring, loading (imports), and extracts (exports).
7. Archiving of changes with time stamp and, optionally, change agent identifier (all on-line changes must be automatically resolvable with asynchronous off-line maintenance).
8. Roll-back and roll-forward of changes (i.e., provision of the capability to go back to a previous database).

### 8.5.6 Interactive Database Updating

An on-line interactive database editor shall be available to users with appropriate privileges. Authorized users shall be able to make changes to real-time data on-line, without affecting normal system operation or other data. All the modifications or updates made with the editor shall be recorded, with user identification, for audit purposes.

The interactive database maintenance editor shall allow the user to query information about the database structure definitions, to assist with the modification process. The execution of the online editing tasks shall be permitted from any user console with proper authorization. This feature shall, at a minimum, support ANSI SQL-compliant queries of the database definitions. The editor shall be structured so that access to information can be menu or function-key driven, with sufficient text messages available to assist the user with the operation of the editor.

When database entries are modified, the old values shall be displayed in conjunction with the request for new values. All entries shall be checked for reasonability and validity before being accepted. All modifications shall be recorded in a database edit audit trail report.


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### 8.5.7 *Database Redundancy and System Reliability*

Data integrity and security are critical to PEM operation. The Contractor shall provide, in response to this procurement specification, descriptions of the system and database designs, the provisions for security, the selected Oracle products and their functions in the system and the proposed methodologies to ensure that system performance and availability requirements will be met.


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# 9.0 DOCUMENTATION REQUIREMENTS

The Contractor shall provide functional, design, operation, maintenance, and testing documentation, as well as training materials and any other documents needed for the operation, maintenance, enhancement, and expansion of the MMS.

All the Contractor-generated documents shall be provided both in electronic format and as hard copies. Electronic and hard copies are also required for all the drawings prepared by the Contractor. Original Equipment Manufacturer's (OEM) documentation and drawings shall also be provided in electronic form, in addition to hard copies. The requirement to provide hard and electronic copies applies to all the revisions of the documentation, initial and interim revisions that are delivered for review as well as final documentation.

It is the MO's intent to maintain the system documentation primarily in electronic format, and the MO shall have the right to edit the electronic documentation files, and employ and print the original and revised documents for in-house use and for use by parties hired to assist in the maintenance and upgrading of the MMS. The MO shall also have the right to produce, for the same purposes, additional copies from the hard copies furnished by the Contractor.

## 9.1 Categories of Documentation Required

Figure 9-1 lists required categories of documentation. Unless otherwise directed by the MO, the Contractor shall send three hard copies and an electronic file of the initial and each interim revision of each document or drawing to the MO. The number of hard copies to be sent of the final revision of each document is specified in the figure. If a consultant is engaged by the MO to assist in the MMS project, then the MO may direct the Contractor to send one additional hard copy and an electronic copy of each review-submittal document to the Consultant, concurrently with the submittal to the MO. The same delivery method (e-mail, first class mail, courier service, etc.) shall be used to deliver documentation to the MO and to the Consultant.


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Each set or piece of documentation submitted by the Contractor to the MO shall be accompanied by a letter of transmittal. Each document shall be identified by the purchase order number, document number, drawing number, revision or issue number, and date of release.

**Figure 9-1: Requirements for Documentation Submittal**

| Title | Hard Copies * |
|---|---|
| Facilities/Installation Manuals<br>•MMS Facilities Requirements<br>•MMS Installation and Phaseover | 2 |
| "As-Built" Software | 2 |
| Hardware Functional Design Document | 4 |
| Software Functional Design Document<br>•MMS-EMS Interface<br>•Constrained Security Dispatch<br>•Market Operations<br>•Metering<br>•Settlement and Billing<br>•Market Participant Interface | 4 |
| User Manual<br>•Basic system operation procedures<br>•Generation Dispatch<br>•Market Operations<br>•Metering<br>•Settlement and Billing | 4 |
| Detailed Hardware Design Document | 4 |
| Detailed Software Design Documents<br>•MMS-EMS Interface<br>•Constrained Security Dispatch<br>•Market Operations<br>•Metering<br>•Settlement and Billing<br>•Market Participant Interface | 4 |
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| Title | Hard Copies * |
|---|---|
| Acceptance Testing Plan | 4 |
| Factory Acceptance Test (FAT) Procedures | 4 |
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| System Availability Test Procedures | 4 |
| Hardware and Software Maintenance Manuals, including third party vendor manuals | 4 |
| Master Documents Directory | 4 |
| Documentation Plan | N/A |

* Final document

The user manuals for the Market Operations and Metering and Settlement functions shall be standalone documents oriented and structured for use by market participants personnel and meter data management agents. The MO shall have ownership of these documents, including the electronic files thereof.

## 9.2 Documentation Plan

The Documentation Plan shall comprise a list of all deliverable documents, grouped by subsystem or by some other logical grouping. Major documentation, such as software functional design or detailed design documentation, is expected to consist of many documents, and each individual document shall be represented in the list. The list shall be structured to support documentation submittal and review activities. To this end, it shall include for each document:

1. Document name;
2. Document number;
3. Document subsystem (Metering, Market Operations, etc.);
4. Document class (Functional Design, Detailed Design, Test Procedure, etc.);
5. Sections of the Contract addressed by the document;
6. Scheduled date of submittal and actual date of submittal for the original revision; and
7. Current revision and status (Pending, MO Review, Approved, etc.) and date for next action (date pending revision will be submitted, date review comments are due, expected approval date, etc.).


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The scheduling of the individual document submittals shall be compatible with the project schedule, and shall allow reasonable time for the MO to meet its objective of completing document reviews in 30 working days.

The Documentation Plan shall serve as a tool for managing the preparation, review, and approval of documents throughout the project. It shall be updated, and if necessary, revised by the Contractor to reflect changes in the project schedule and shall be resubmitted with each project progress report.

## 9.3 Documentation Preparation Requirements

### 9.3.1 Documents

#### 9.3.1.1 Preparation of Documents

All the documents generated by the Contractor shall be prepared on the latest revision of Microsoft Word or MO-approved alternative. The complete text shall be contained in the document's electronic file, including all mathematical equations, notes, and corrections. Handwritten text or other attachments or annotations are not acceptable. Graphics shall fit on A4 sheets, and shall be embedded in the documents so that they can be viewed on an MMS console and are automatically included when hard copies are printed.

All documents shall be written clearly and unambiguously in grammatically correct English. Manuals and other written documents shall be legibly printed on standard A4 sheets, and all shall be bound. High quality printing produced by a laser printer is required for both review and final documents. Large documents shall be arranged into separate volumes such that each volume will be less than 3 inches thick. High quality plain paper copying, offset printing, or other approved printing process shall be used to produce the required documents. Binders shall be labeled on the spine of the binder.


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A complete table of contents, listing all numbered sections and the corresponding starting page numbers, shall be included for each document. A complete identical table of contents shall be provided in each volume of a multi-volume document. A complete list of figures and appendices shall follow the table of contents. A glossary of acronyms shall be included with each set of documents. An index shall also be included with each document.

Where a manual is revised to reflect a change in design, or a change for any other reason, each such revision shall be noted by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid review of revisions, all changes shall be highlighted on the revised pages of the manual by strikethrough for deleted text, underscoring for new text and sidebars for both. These highlights shall be removed from the final documents.

#### 9.3.2 Contractor's Drawings

Drawings, including hardware configuration and cabling drawings, shall be prepared using AutoCAD.

"Typical", "standard," or "off-the-shelf" drawings are unacceptable unless they are fully applicable to the MMS. Any non-applicable sections shall, preferably, be removed or else explicitly noted on the drawings. Any drawings that contain options shall clearly show which option(s) apply to the MMS to be furnished, and non-applicable options shall be marked out.

Individual drawings shall be submitted for each unit of different design. It is not acceptable to submit a single multi-purpose drawing (one drawing title and one drawing number) to show a "typical" design, with exceptions noted for equipment or software modules having various deviations.

When a drawing is revised, revision numbers shall be clearly legible, easily distinguishable from the drawing number, and shall be located as close as possible to the title box. A short description


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of the revision shall be included, and the affected areas on the drawing shall be circled and identified with a revision number.

## 9.4 Documentation Review and Approval Rights

### 9.4.1 General

All deliverable documents shall be submitted by the Contractor to the MO for review and approval, in accordance with a submittal schedule included in the approved Documentation Plan. The MO intends to complete the review of each document within thirty (30) working days.

For purposes of documentation review and approval, two classes of documentation are hereby defined:

1. Standard Documentation
2. Custom Documentation

*Standard* documentation includes third party vendor documentation and Contractor documents that have been produced and used prior to the award of the Contract, and that do not require any changes to accurately describe the MMS. *Custom* documentation includes all other documents, in particular documentation associated with functions and hardware specially prepared for the MMS.

Whenever standard third party vendor documentation is supplied, each document shall include a preface indicating which portions of the document, if any, do not apply to the MMS being furnished and hence do not constitute parts of the MMS documentation. All drawings and illustrations contained therein shall apply specifically to the MMS furnished to the MO, with all non-applicable information properly identified.

All standard documentation written by the Contractor must fully apply to the MMS. If previously written documentation does not completely apply to the MMS, or is inaccurate or incomplete, or


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if amendments are necessary, then such documentation shall be made complete and correct, and shall be considered custom documentation.

If the Contractor submits to the MO any documentation or technical information that is considered proprietary, it shall be clearly marked as such. However, the following types of documentation shall *not* be proprietary: documentation of database structure; Interface Control Documents (ICDs); and documentation of all protocols and interfaces to devices on the MMS LAN, to external systems, and among the computer subsystems.

The MO shall have review and approval rights on all *standard* documentation, with the approval focused on ensuring that the documentation is complete, correct, legible and, as determined by the MO, fit for its intended purpose.

For the *custom* documentation, including standard documents that were changed for the MMS, the MO shall also have complete review and approval rights on the *contents* of the documents. The MO shall determine not only whether the custom documentation is complete, correct, legible, and fit for its intended purposes, but also whether it describes the functions clearly, and whether the proposed functionality meets the requirements of the Contract.

The MO reserves the right to reject any documentation (standard or custom) which is incomplete, incorrect, illegible, does not properly cover the subject matter, or where the writing is not up to acceptable standards. Any documentation so rejected shall be corrected and resubmitted within thirty (30) days for further review and approval.

#### 9.4.2 Approval of Documents

After receipt and review of the documents by the MO, the Contractor will be informed either that the documents are approved as submitted or that revisions are required. If approved, the Contractor shall furnish the required additional copies in final form. If revisions are required, one set will be returned to the Contractor with the required revisions indicated. The required


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revisions shall be promptly incorporated in the documents, and the revised documents shall be resubmitted within thirty (30) calendar days for approval.

#### 9.4.3 Approval of Drawings

The Contractor shall submit four (4) full-sized prints of each custom drawing. One print of each drawing submitted by the Contractor for the MO's approval will be returned to the Contractor marked "approved," "approved with changes noted," or "not approved."

If a custom drawing is "approved with changes noted," the Contractor shall promptly revise the drawing in accordance with the changes noted and submit another set of copies for approval within thirty (30) days of the date of notification.

If a custom drawing is "not approved," the Contractor shall correct the drawing and resubmit another set of copies for approval within thirty (30) days of the date of notification.

#### 9.4.4 Contractor's Responsibility

Approval of any of the Contractor's documents or drawings shall not relieve the Contractor of the responsibility for the correctness of the documents or of the responsibility to meet all of the requirements of the Contract. The Contractor shall make no claim for additional costs or time extensions because of delays due to revisions of the documents that were necessary to ensure compliance with the Contract. In case of later discovery of error, omission, or inconsistencies within a Contractor's document, the Contractor shall promptly submit the revised document for approval within thirty (30) days of the date of notification.

### 9.5 Functional Design Documentation

The Contractor shall submit Functional Design Documentation for both MMS hardware and software to the MO for review and approval.


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### 9.5.1 Hardware Functional Design Documentation

The Hardware Functional Design Documentation shall address all hardware and shall contain the following:

1. A complete block diagram showing and identifying the major hardware components of the MMS and their interconnections;
2. Detailed MMS cabling diagrams;
3. An interface design for all areas where the MMS interfaces with MO-furnished hardware, such as data links, connections to external systems, etc;
4. A list of the diagnostics furnished to detect and locate malfunctioning hardware components; and
5. A drawing, to scale, of the physical layout of the MMS equipment in the facilities.

### 9.5.2 Software Functional Design Documentation

#### 9.5.2.1 General Requirements

The Software Functional Design Documentation shall provide a complete description of the functions of the MMS in such a way that they can be clearly understood without understanding the detailed design of each software module, and without detailed knowledge of software engineering. It shall also describe, in detail, what functions are to be performed by each software subsystem.

The Software Functional Design Documentation shall include, but not be limited to, the following items for each subsystem:

1. A brief overview of the subsystem, which shall describe each application and its major functions;
2. A description, from a *user's* standpoint, of all the functions to be performed by the subsystem. Related displays, dialog menus, and report formats shall be included;
3. An overview of major algorithms;
4. A diagram and description of the manner in which the subsystem interfaces with other subsystems;


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5. A detailed description of all interfaces between the subsystem and the user. Related display formats shall be shown and user operating procedures shall be explained. Relevant excerpts from the Users Manual may be used in the functional design document to describe user interaction aspects of functions and applications;
6. Statements on the performance that will be delivered by the subsystem. This shall include response times and wall-clock execution times; and
7. A description of the handling of power failure, system failover, restarts and other anomalies that may be encountered by the subsystem.

#### 9.5.2.2 Documentation of Application Functions

The functionality of the applications is of special concern to the MO, and therefore detailed functional design documents shall be provided for review and approval by the MO for each area of applications, including:

1. Security Constrained Dispatch;
2. Market Operations;
3. Meter Data Management; and
4. Settlements Processing.

The functional design documents shall describe the functions from the *user's* point of view. They shall include a detailed layout of the associated displays with explanations of each field and its range of valid values, and descriptions of operating procedures with explanations of associated pushbuttons, dialog menus, and messages posted for the users. It may be acceptable for relevant sections of the Users Manual to be used in the functional design document to describe user interaction aspects.

## 9.6 Detailed Design Documentation

### 9.6.1 Detailed Hardware Design Documentation

The Detailed Hardware Design Documentation shall contain hardware reference manuals and complete sets of reduced drawings. Parts lists shall be furnished with reference manuals for each piece of equipment.


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The design document shall include electrical schematic drawings and logic diagrams, if available, for third party vendor equipment. Network addresses shall be noted. Specifically, the hardware design documents shall include the following drawings and diagrams:

1. System equipment power distribution drawing;
2. Wiring lists and connection diagrams;
3. Interface terminal block drawings;
4. Assembly drawings and parts lists;
5. Module and network (IP) address assignments; and
6. As available for third party vendor equipment:
   a. Block Diagram;
   b. Schematic diagrams;
   c. Logic diagrams; and
   d. Firmware charts and descriptions.

### 9.6.2 Detailed Software Design Documentation

The Detailed Software Design Documentation shall provide detailed descriptions of the design of the functions that were described in the Software Functional Documentation. The Detailed Software Design Documentation shall be organized on a subsystem/area of applications basis. For each subsystem/area, it shall include:

1. An overview of the operation of the subsystem/area;
2. A diagram of the overall subsystem/area, showing its modules or programs, data structures, and data flows among the programs within the subsystem;
3. Descriptions of each program or module within the subsystem/area, and the functions that it performs; and
4. Detailed descriptions and explanations of algorithms.

Information on the structure and meaning of all data communications on the MMS LANs and across the MO Operation Network and Market Participants Networks shall be non-proprietary, and shall be described in great detail. It is required that LAN and WAN protocols be sufficiently documented to make it possible for the MO to later add new processors to the LAN and to have such additional processors exchange data with the Contractor's MMS over the LAN (i.e., to read


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data from and write data to the MMS databases). Database structures and contents, database interfaces, and APIs shall be sufficiently documented to make it possible for the MO or a third party to add new programs in the future.

#### 9.6.2.1 Application Programs Design

The following requirements apply to documentation of the applications software for the MMS, including applications that may originate from a third party. For each software module, the Software Design Document shall include, but not be limited to, the following:

1. A program abstract;
2. A description of the program;
3. All external interfaces to the program, including calling sequences and output to other programs;
4. All error messages produced by the module, with an explanation of the reason for their occurrence and remedial measures;
5. Initialization considerations;
6. Identification of any data that is referenced or modified; and
7. Instruction for the compilation, linking, loading, and scheduling of the application and its programs. Program parameters and considerations that have to be taken into account in the generation and activation of programs shall be explained.

Each module of a program, including subroutines, must be documented sufficiently to allow experienced programmers of the Contractor to code the module (under supervision by the designer), as well as to allow MO personnel to maintain the software in the future. Coding for the MMS shall follow the functional design documents approved by the MO, and the documents shall be updated and resubmitted for approval if the actual design deviates from that previously approved by the MO.

### 9.6.3 System Software

All detailed documentation that is available for programmers and developers of application on the operating systems, including compilers, editing and debugging tools, utilities, libraries, and


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diagnostics, and other software associated with the computing equipment of the System shall be furnished to the MO.

### 9.6.4 Database Manual

The Database Manual shall describe the structure of each database of the Market Systems. Tabular examples and text descriptions of the data storage formats shall be included, with explanations of the purpose of all the fields. The interrelationships among the databases shall be explained, graphically and by means of data flow diagrams.

### 9.6.5 Interface Control Document

The Interface Control Document (ICD) shall describe in detail all the communication interfaces and data exchanges between the MMS and MO-furnished subsystems, the EMSs, Meter Data Collection Systems, market participant systems, and all other external systems and applications.

## 9.7 Hardware Maintenance Manuals

The Hardware Maintenance Manuals shall describe in detail preventive and restorative procedures required to keep the MMS in good operating condition. Maintenance manuals shall make reference to appropriate diagnostics, and all necessary settings and adjustments shall be documented. Maintenance manuals shall be furnished for all delivered hardware, including third party vendor equipment.

The Hardware Maintenance Manual shall include the following information:

1. Operation Information

   This information shall include a detailed description of how the equipment operates, and a block diagram illustrating each major assembly in the equipment. Descriptions of external data transfers with other equipment shall be included. The operational sequence of major assemblies within the equipment shall be described and illustrated by functional block diagrams and timing diagrams. Detailed equipment layout, wiring and terminals, and schematic diagrams shall be provided as needed for troubleshooting, analysis, and field repair actions.

2. Preventive Maintenance Instructions

   These instructions shall include all applicable visual examinations, hardware testing and diagnostic routines, and the adjustments necessary for periodic preventive maintenance of the MMS. Instructions on how to load and use diagnostic programs and any special or standard test equipment shall be an integral part of the maintenance instructions.

3. Corrective Maintenance Instructions

   These instructions shall include procedures for locating malfunctions down to the level specified in the training requirements. The instructions shall be detailed enough to quickly and efficiently locate the source of an equipment malfunction.

   The corrective maintenance instructions shall include guidelines for tuning or adjustment of equipment, and for replacement of all equipment, including replaceable printed circuit boards. Schematic diagrams of electrical, mechanical, and electronic circuits, and illustrations of the location of parts, photographs, cable routing diagrams, and sectional views giving details of mechanical assemblies shall be provided as necessary to replace faulty parts. The instructions shall include cautions or warnings that must be observed to avoid damage to the equipment.

4. Safety Information

   Warnings on hazards, such as high voltage, and safety instructions to avoid injury shall be included.

5. Parts Information

   This information shall include the identification of each replaceable part, and all the information that is needed to procure replacements. Cross-references between the Contractor's part numbers and manufacturer's part numbers shall be provided where applicable.

## 9.8 Software Maintenance Manuals

Software maintenance manuals shall cover all the features and functions *as implemented*. Supplementary documents or appendices to cover the maintenance of recently introduced software are not acceptable. To the largest extent practical, maintenance manuals shall include all explanations and information needed by the maintenance personnel, so that references to other documents are kept to a minimum. On-line versions of the manual shall be accessible for viewing on MMS consoles, and shall include links to references.


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### 9.8.1 Standard Software Manuals

The Contractor shall deliver to the MO standard software maintenance manuals for the processors, servers, workstations, user consoles, and other programmable equipment furnished by the Contractor. They shall include, as applicable, the following:

1. Operating system manuals;
2. High-level language compiler manuals, including instructions and examples on the calling of executive services of the operating system;
3. Software system generation manuals;
4. Programming tools manuals;
5. Software utilities manuals;
6. Diagnostic software manuals;
7. Database generation and modification manuals;
8. Database access manuals (for historical and application databases);
9. Display generation and modification manuals;
10. Report generation manuals; and
11. User manuals for commercial applications included in the MMS, such as word-processor, spreadsheet, database, browser, etc., to the extent that they are available from the Contractor.

If standard software has been modified or supplemented for the MMS, the corresponding manuals shall be considered to be custom documents for approval purposes.

### 9.8.2 Custom Software Manuals

Custom software manuals shall be provided to cover all the maintenance areas that are not addressed by the standard software maintenance manuals. These shall include subjects listed in the previous subsection when the software was modified for the MMS, and the following:

1. Custom functions developed for the MMS;
2. Customized application software;
3. Customization of databases to support system applications;


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4. Data links and LAN bridges; and
5. Special diagnostics prepared for the MMS.

The custom software maintenance documentation shall specifically include an explanation of the redundancy and failover scheme of the MMS, instructions for the tuning of backup and failover parameters, and instructions for extending the failover scheme to new equipment at least up to the Ultimate configuration.

### 9.8.3 System Administrator Manual

This manual shall include all the information needed for management of the configuration, performance, and proper operation of the MMS and of its interfaces to external systems. This includes information and instructions on:

1. Generation and configuration of the software;
2. Configuration, set-up, and adjustments of hardware;
3. Monitoring and tuning of system performance; and
4. Use of diagnostics and troubleshooting.

The MMS Administrator Manual shall include step-by-step procedures for building parts or all of the MMS software, including the applications, databases, and console software. Step-by-step procedures shall be included for MMS startup, replacement of old parts of the software with new revisions, and installation of new applications and databases.

### 9.8.4 Manuals for Development and Debugging Tools

Manuals shall be provided for each of the software development, testing, and debugging tools that are required. This applies to OEM manuals as well as to software development, testing, and debugging tool manuals developed by the Contractor.


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## 9.9 Facilities and Installation Manuals

Manuals are required to instruct the MO on the preparations of facilities for MMS equipment, and the installation of the equipment.

The facilities and installation documentation shall cover the following:

1. Space and environmental requirements, such as electric power and air conditioning;
2. Interfaces and cabling of the equipment delivered by the Contractor to MO supplied equipment, to electric power, and to external systems and applications; and
3. Requirements for communications between the installed MMS and the Contractor's factory for system commissioning and maintenance support.

The installation manual shall include drawings, to scale, of the layout of the MMS equipment at the MO facilities, and of the conduits, cabling, and wiring that have to be installed by the MO.

Installation instructions for the System shall include:

1. Rack-up drawings showing appropriate dimensions and mounting instructions;
2. Special handling requirements;
3. Locations of external connections;
4. Locations of power input;
5. Itemized power requirements;
6. Grounding requirements;
7. Types and sizes of connectors;
8. Inter-cabinet cable runs;
9. Intra-cabinet cable runs; and
10. Check-out procedures.

## 9.10 Users Manuals

The Users Manuals shall cover operating procedures for all standard and custom functions and applications of the MMS. They shall consist of a set of integrated manuals, organized by area of application (basic console operating procedures, Market Operations, Metering and Settlement,


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etc.) and by function within each area. The Users Manuals shall be custom documents, written or edited in non-technical language specifically for the MO. The manuals shall be organized for quick access to the detailed description of each procedure, with the help of a table of contents and index. On-line versions of the manuals (see Section 9.10.3) shall be accessible for viewing on MMS consoles, and shall include links to references.

The Users Manuals shall *not* include system maintenance and administration information. Such information shall be included in the System Administrator Manual and software maintenance manuals.

### 9.10.1 Information Presentation Requirements

Replicas of displays associated with each function shall serve as the main means of explaining user procedures. Toolbars and dialog menus shall be included. Actual and up-to-date copies of displays from the MMS shall be used in conjunction with the descriptive text. Color reproductions shall be incorporated where the use of color is essential for the presentation of the information. User instructions for each function shall start with a brief overview of the purpose and capabilities of the function. This shall be followed by:

1. Replicas of all relevant displays and dialog menus;
2. The purpose of each radiobutton;
3. A description of each displayed data field. Valid ranges of values or the set of possible legends shall be described;
4. A description of all data entry fields or selectable entries with the valid possible set of entries that may be made for each field;
5. The purpose of each radiobutton or data field in dialog menus;
6. Operating procedures and sequences;
7. User messages and their interpretation; and
8. Error recovery procedures.


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### 9.10.2 Contents and Structure

The functional areas listed below, as well as any other areas involved in the operation of the MMS, shall be covered by the user manuals:

1. Overview of Console Operations:
   a. Basic operational procedures: keyboard, mouse, logging on and off, management of windows, toolbars, dialog menus, the Help function, etc.;
   b. Display/function navigation tools;
   c. Display call up methods; and
   d. Recovery from errors and equipment failures.
2. MMS Applications: Separate sections of the manual shall be provided for each of the following areas of applications, and operator inputs, modes of operation, and interpretation of the output shall be explained for each function:
   a. Security Constrained Dispatch;
   b. Market Operations;
   c. Metering; and
   d. Settlement and Billing.
3. Management of Historical and Archival Data:
   a. Data review and editing;
   b. Scheduling and requesting reports; and
   c. Archiving of data and retrieval of archived data.

### 9.10.3 Viewing of the User Manuals on MMS Consoles

Users are expected to rely largely on context-sensitive help screens for fast assistance. They shall, however, be able to refer from their consoles to the Users Manuals for more comprehensive information and to look up information on functions associated with displays that do not appear on their screens at the time. Therefore, the users manuals shall be easily accessible for on-line viewing. Consistent fast searching and selection methods, that do not require extensive scrolling through text, are required for accessing information in the on-line version.


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## 9.11 Test Documentation

The following test documents are required:

1. Acceptance Testing Plan;
2. Factory Acceptance Test Procedures;
3. Site Acceptance Test Procedures; and
4. Availability Test Procedures.

### 9.11.1 Acceptance Testing Plan

This document shall present the plan for all the acceptance tests that are required for the MMS.

The plan for the Factory Acceptance Test (FAT) shall include:

1. Testing philosophy, rules, and guidelines;
2. Functions to be tested;
3. A day-by-day and hour-by-hour test schedule, which shows the time slot that is assigned to each of the tests, with enough detail to manage the FAT and to estimate its duration. The tests shall be sequenced so as to minimize the efforts for preparations and system initialization for each test. *The rationale for the proposed sequencing of tests shall be explained in the plan.;*
4. Test bed descriptions for the FAT: Block diagram showing all major components of the test configuration, simulation hardware, and the associated interconnections;
5. Scenarios for testing MMS functionality and performance;
6. Simulation methods used to verify the performance and response of the MMS in the Ultimate configuration, including *analyses* that prove that the proposed simulation methods properly represent operation in the Ultimate configuration:
   a. Description of all simulation hardware and software to the depth necessary for the MO to understand the purpose and function of each device and program, and to evaluate the validity and accuracy of the simulation; and
   b. Description and justification of any proposed extrapolations, to the depth necessary for the MO to evaluate the validity and accuracy of the proposed extrapolation and determine whether to accept extrapolation in lieu of simulation.
7. Methods for monitoring and recording test results; and
8. Procedures to report and correct variances.


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In order to assure that a realistic and accurate schedule is available for the FAT, the test schedule shall be verified and updated during the PreFAT. The actual duration of the tests shall be recorded in the test forms whenever the tests are performed, and shall be used to refine the final test schedule for the FAT.

The plan shall also include plans and guidelines for the Site Acceptance Test and the Availability Test.

### 9.11.2 *Factory Acceptance Test (FAT) Procedures*

Detailed procedures, designed to meet the FAT requirements shall be presented in the Acceptance Test Procedures document(s). The procedures shall comprise detailed guides for tests that verify the following:

1. The development of each function is complete;
2. MMS hardware and software, including that furnished by the MO, is fully integrated;
3. All the functional, performance, and sizing requirements of the Contract are met;
4. Communications and data exchanges with the EMS, Meter Data Collection System and Market Participants are successful; and
5. Each function that is included in the MMS, whether or not required by the Contract, operates correctly.

Supplemental test procedures may be supplied by the MO. The supplemental tests shall be incorporated by the Contractor into the Acceptance Test procedures document.

The test procedures shall be prepared in the form of detailed step-by-step test guides. They shall be designed to test:

1. The operation of the functions under normal conditions;
2. The behavior of the functions under all possible abnormal conditions; and
3. The response of functions to user errors.

An attempt shall be made to devise procedures that verify correct operation and performance of the MMS under all possible normal and abnormal conditions. The goal shall be to rigorously test


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the MMS by strictly following carefully pre-planned procedures, with minimum reliance on unplanned testing devised during the FAT.

Test procedures shall be broken into short segments. Each segment shall include:

1. Test identification numbers;
2. Statement of the purpose of the test;
3. A complete list of initial conditions. It shall not be necessary to refer to previous tests to determine the requirements for the initial condition. Whenever practical, the previous test shall prepare the MMS and leave it ready for the next test in a sequence of tests;
4. Detailed procedure steps;
5. Expected responses and results. These must be described immediately following the last step that generates them. ***Explicit expected test results*** are required; terms such as "verify reasonable results" are not acceptable. *The test results shall be confirmed and refined during PreFAT;*
6. Space to record test results;
7. Space to record, during PreFAT, the duration of the test;
8. Space to enter references to variance reports for failed tests; and
9. Space for test sign-off by both the Contractor and the MO.

*Detailed test conditions, inputs, and expected results must be explicitly stated in the procedures,* so that they can be examined by the MO in the review of the FAT procedures document. The goal is to avoid spending time on calculations and documentation searches on the test floor during FAT, to achieve consistency between the PreFAT and the FAT, and to allow tests to be accurately repeated when necessary.

All the information needed to conduct the FAT shall be included in the FAT Procedures documents. When appropriate, such information may be included in appendices; however, references to other documents shall be avoided.


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### 9.11.3 Site Acceptance Test Procedures

The Site Acceptance Test (SAT) procedures shall be designed to verify that all hardware and software perform as required after installation, and that the MMS performs satisfactorily under real operating conditions. These procedures shall comprise:

1. A carefully selected subset of the Factory Acceptance Test Procedures;
2. New procedures added for functional and performance testing which was not possible with the FAT configuration and environment. Refer to Section 10 for additional details regarding Site Commissioning; and
3. Supplemental Site Acceptance Test procedures which the MO may prepare. These procedures shall be incorporated by the Contractor into the SAT procedures document.

### 9.11.4 Availability Test Procedures

The Contractor shall submit for review and approval an MMS Availability Test Procedures document. These procedures shall include:

1. Instructions for conducting the Availability Test;
2. Contacts and arrangements for Contractor and OEM support during the test; and
3. Forms and procedures for documenting and reporting test problems and results.

## 9.12 As-Built Documentation and Software

Prior to system acceptance, the Contractor shall provide as-built documentation and software for the MMS.

### 9.12.1 Final System Documentation

The Contractor shall submit final "as-built" MMS documentation to the MO for review and approval. This documentation shall include any deliverable document that has been revised for any reason since its approval, and now reflects the as-built MMS. Modifications to the MMS resulting from the FAT, SAT, or Availability Test shall be reflected in the "as built" documentation.


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When the "as built" documents are approved by the MO, hard copies of the final documents shall be provided in the quantities indicated in Figure 9-1. The "as-built" revision is also required for the documents that are accessible on-line. In addition, the word processor files and electronic drawing files for all of the documents that were prepared by the Contractor shall be furnished to the MO on CD-ROMs or DVDs.

The Contractor shall update incorrect custom documentation as required by DSTAR, without charge, even after final payment.

### 9.12.2 Final Software

#### 9.12.2.1 Source Code

One set of "as-built" program source code shall be furnished for the delivered software and firmware, except for the operating system and related standard software maintenance and development tools. The source code shall be in electronic form on CD-ROMs or DVDs, and shall be easily accessible for viewing on MMS consoles and for printing. Source code shall be in a format that can be used as input for program compilation and system generation. The source code shall include clear and comprehensive comments.

Source code shall include, but not be limited to, the following:

1. Command files and scripts for system generation and software configuration;
2. Source code for all MMS databases, displays, and reports;
3. Source code for all Contractor-developed software including MP interface, Market Operations, Settlement, Metering, and Billing, and all other applications; and
4. Source code for any Contractor-developed firmware.

These sources shall include all changes made prior to the acceptance of the MMS by the MO.


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#### 9.12.2.2 *Software Package*

The Contractor shall provide two (2) sets of the following As-Built software packages in machine readable format on CD-ROM, DVD, or other medium as appropriate for loading that is approved by the MO:

1. The entire set of software, ready to mount and execute on the MMS;
2. Object files for all the Contractor-developed programs, suitable for generation of the entire software system;
3. The source code required in Section 9.12.2.1 above;
4. Help files for the MMS;
5. Operating System software; and
6. "Make files" to configure the operating system and build the Contractor's system software.

The loadable software shall be 100% compatible with the software sources furnished in response to Section 9.12.2.1.

## 9.13 *Master Documents Directory*

A comprehensive Master Documents Directory, covering all the DSS documents, shall be provided. It shall list all the documents by such categories as software documents, hardware documents, user and maintenance manuals, schematic diagrams, parts lists, etc. Each entry shall include document title, volume number, sequence within volume, Contractor document ID, and the latest revision number and release date as the minimum information provided. The Directory shall cover all MMS documents.


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# 10.0 QUALITY ASSURANCE AND SYSTEM TESTING

## 10.1 ISO-9000 Certification

The Contractor and the Contractor's suppliers shall have ISO-9001 2000 certification. The Contractor shall adhere to ISO-9001 rules for the preparation of all Contract deliverables, including documentation, hardware and software.

## 10.2 Configuration Control

The Contractor shall prepare documented procedures for the release of software programs and modules and for their integration into the Market Management System (MMS), for maintenance of released software and revision control, for software backup, and for the tracking and correction of variances specified below. The Contractor shall supervise conformance by all subcontractors with the system configuration procedures, and shall have the ultimate responsibility for system configuration. The Contractor shall ensure that only software of the latest released version is incorporated in the system, and that the package of final software corresponds exactly to the software that is installed in the MMS at the time of its acceptance, i.e., at the completion of Site Acceptance Test.

## 10.3 Tracking of Problems and Variances

### 10.3.1 System Problems Log

From the time of the staging of MMS equipment or the beginning of software integration and development, the Contractor shall maintain a Problems Log, and record all hardware problems, operating system problems, and any contractor and third party application software problems. The Problem Log shall continue to be maintained until the end of the warranty period. The Market Operator (MO) shall have access to this log.


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### 10.3.2 Processing of Variances

Variances are system deficiencies that prevent the MMS from meeting Contract requirements, or from properly performing any function that is included in the MMS regardless of whether or not that function is contractually required. A computerized variance reporting and handling process shall be set up by the Contractor no later than the beginning of Factory Acceptance Test (FAT), and shall be maintained until the end of the warranty period. A variance report shall be written for every problem (including documentation problems) the MMS has in meeting the requirements of the Contract, complying with the approved QA requirements, and in general when any MMS function fails to operate as intended or documented. The variance reports shall be included in the MMS Problems Log.

The variance reporting process shall be subject to the MO's approval, and shall include:

1. Methods to ensure that variances are identified, documented, reported, and corrected, and to verify the corrections.
2. Procedures and forms for the reporting of variances. The forms shall include the following:
   a. The application or subsystem responsible for the observed problem. The variances shall be organized by application/subsystem;
   b. Name of the initiator of the variance;
   c. Name of the person responsible for correcting the variance;
   d. A unique identifier for tracking the correction of the variance;
   e. Identification of the non-conforming item and specific non-conforming characteristics;
   f. Identification of the specifications and documents that provide the acceptance criteria involved with the variance;
   g. The Contractor's proposed action plan and timetable for correcting the variance;
   h. Description of the action taken to solve the problem; the results of tests to verify its successful correction; and identification of the person documenting and confirming the solution, his/her signature, and date; and
   i. Approval and sign off of resolved variances by the MO.


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A complete and up-to-date collection of all variances, including closed variances, shall always be available for inspection by the MO. A variance status summary shall be included in the monthly project progress reports.

## 10.4 Factory Acceptance Test (FAT)

The purpose of the FAT is to verify that the system is fully developed and meets all contracted configuration, functional, performance, and interface requirements for the MMS. The tests shall verify the performance and functional integrity of the individual subsystems, including active interfaces between subsystems, and shall demonstrate the operation of the MMS as an integrated system. MMS tools, including database, forms, and reports generation and maintenance functions shall be demonstrated. MMS performance and response times shall be verified through testing of User Interface responses and observation of the utilization and spare capacity of processors, memory, disks, LANs, and communications interfaces. The Contractor shall be responsible for providing the equipment and software needed to fully simulate the loading associated with the *Ultimate* configuration.

All interfaces with external equipment and systems shall either be connected to this external equipment during the FAT, or appropriate simulators shall be provided and used in the test. It is a goal of the MO to perform the FAT on a configuration that is as close as possible to the configuration of the MMS in its ultimate configuration, and under the most realistic operating conditions possible.

The FAT shall be conducted according to the Test Plan and Test Procedure documents. Each function shall be tested for correct operation and performance under all plausible and realistic conditions, including user errors, invalid data, hardware and communication failures, system overload state, and other system conditions.

The FAT shall be conducted by MO personnel under the direction of the Contractor. The Contractor shall notify the MO at least thirty (30) days in advance of the scheduled starting date for the FAT.


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The overall FAT process shall include the following.

### 10.4.1 Preliminary Factory Acceptance Test (PreFAT)

In order to ensure that it will be expeditiously and successfully completed, the FAT shall commence only after the successful completion of a Preliminary Factory Acceptance Test (PreFAT). The purpose of the PreFAT is to qualify the MMS *as well as the test plan and procedures* as ready for the test. The PreFAT shall be a complete dry-run of the FAT, strictly following the MO-approved acceptance testing plan and FAT procedures. The intent is for the Contractor to detect and correct all problems with design, integration, database, displays, and performance of the MMS before MO personnel are committed to participate in the test. The PreFAT shall be supervised by the person designated to serve later as the Contractor's FAT Director, and each test shall be formally signed off by that person.

A copy of the FAT procedure with test results fully documented and formally signed-off shall be provided to the MO for inspection in time to determine if the MMS is indeed ready for FAT and to make arrangements for its personnel to participate in the FAT. If successful completion has not been signed off for all the tests by the time that the signed off procedure is sent, then an up-to-date variance report shall be included for each incomplete test. The FAT shall not be started until all the PreFAT variances are cleared and all failed tests have been repeated and passed.

MMS documentation shall be completed, reviewed, and approved by the MO before the PreFAT starts. This documentation shall include all design documents, maintenance documents, user manuals, and the FAT Test Plan and Procedures. The Contractor shall notify the MO at least fifteen (15) days prior to the start of the PreFAT, and the MO shall have the option to witness the test and make comments.

### 10.4.2 System Generation

A complete system software generation shall be performed just prior to the FAT to ensure full compatibility with up-to-date, formally controlled, system sources. The test configuration shall


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include only code derived from the latest release of controlled sources. Computer produced system generation records shall be provided for inspection by the MO, and shall be included in the official records of the FAT. The MO shall get early notice for the system generation and have the option to witness it.

The system generation procedure that is required in the System Administrator Manual shall be followed, and only deliverable software tools shall be used in the process.

### 10.4.3 Equipment Tests

Equipment Tests shall be performed on the MMS during the FAT, including:

1. Visual Test - Verification that the MMS includes all required equipment and is properly configured;
2. Verification of Upgrade and Expansion Capabilities - Inspection and verification that provisions to upgrade and expand the MMS are furnished as required by the Contract; and
3. Hardware Diagnostic Test - The hardware diagnostic test shall consist of individual tests of all system hardware. These tests shall consist of running standard hardware diagnostic programs plus any special diagnostic programs used by the Contractor.

### 10.4.4 System Functional Test

The purpose of this test is to rigorously exercise all the system functions and applications, both individually and collectively, and to verify correct functional behavior by all hardware and software. All system functions included in the MMS shall be thoroughly tested.

### 10.4.5 Unstructured Testing

The FAT schedule shall allow time throughout the functional testing for unstructured testing by the MO. At least two hours shall be reserved for unstructured testing for each ten hours of structured testing. The MO shall be allowed to schedule unstructured testing at any time, including during structured tests.


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Unstructured testing is intended solely for use by the MO to perform additional tests, the need for which may be recognized during the formal testing, and to investigate potential problems detected during tests. *Unstructured testing shall never be called for in the test procedures as a substitute for formal test instructions.* Detailed tests procedures shall cover all aspects of system functionality, performance, and management. Variances found during unstructured testing shall be added to the formal MMS Problem Log for correction by the Contractor.

### 10.4.6 System Performance Tests

System Performance Tests shall be conducted to verify that the system performance requirements are met for the *Ultimate* configuration specified for the MMS. Simulation shall be used to create any operating conditions that are required for the test but are not supported by the test configuration or do not exist under the test conditions. Such simulation may include additional processor executions, disk accesses, and processor and disk usage (allocations) to be imposed on the MMS through the use of simulation software or hardware. The use of extrapolation of system utilization in lieu of simulation may be proposed, but shall be subject to approval by the MO, and the MO's decision shall be final. Performance testing shall include comprehensive Integrated System Stability Testing (ISST) with ultimate sizing and when fully interfaced with all other systems and applications.

The methods used for the simulation (or extrapolation) of system activities and loading shall be explained and *justified, functionally and quantitatively*, and shall be subject to approval by the MO.

Performance testing shall include the verification of:

1. Data retrieval and processing times;
2. Display response times;
3. Response time to all user requests;
4. Utilization of computing resources and memory of processors;
5. Disk memory space and time utilization;
6. Loading of the LANs;


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7. Wall-clock time for application program executions;
8. Response and processing times for interfaces with other systems; and
9. "Stress tests" in which the MMS shall be overloaded.

### 10.4.7 System 100-Hour Test

A 100-hour continuous run of the MMS shall be performed after the successful completion of the functional and performance tests, to ensure that the software is robust and that the hardware system is reliable and stable. This test will be considered successful if no critical function is lost, no restart of a critical function occurs, no automatic failover or switchover occurs, and no major hardware failure occurs within a continuous 100-hour period. Major hardware failures are defined for the purpose of this test as the loss of a major piece of hardware supplied, recommended, or approved by the Contractor (such as a processor, disk set, interface to any consoles, data link, etc.).

During the 100-hour test, the MMS shall be exercised (with simulated inputs, events, and conditions) in a manner that approximates normal operations. Unstructured user activities may be performed by the MO representatives during this test.

No ad-hoc software "fixes," modifications, or changes shall be allowed to bypass failed equipment during the 100-hour test. If a failure occurs, those portions of the functional test affected by the change shall be repeated, and the 100-hour test shall be rerun in its entirety.

### 10.4.8 Management of Variances

A variance processing process shall serve as the tool for managing the correction of all problems discovered during the FAT, including problems uncovered during unstructured testing. When a test fails, a separate variance report shall be created for each problem that prevented the successful completion of the test procedure. Tracking numbers for variance reports shall be noted in the test procedures of failed tests, and a test shall not be signed off until all the variances against it are cleared to the satisfaction of the MO.


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The presence of major discrepancies such as frequent processor failover, excessive delay in system response, major or non-recoverable database errors where wrong values are accessed or stored, incorrect operation of major functions, etc. may, at the discretion of the MO's Project Manager or a designated representative, be cause for suspension of the entire FAT pending correction of the problem. After correction of a major discrepancy, the entire sequence of tests to which the failed test belongs shall be started again (i.e., tests that had been completed before the discrepancy was found shall be repeated). The MO shall have the right to request that other hardware and/or software modules that may be impacted by the correction also be re-tested. Minor discrepancies may, at the MO's option, be corrected and re-tested without suspending or repeating the entire sequence of tests. It is the MO's intent to have all discrepancies resolved to its satisfaction before the system is shipped.

## 10.5 System Commissioning

System commissioning comprises all activities required to verify that the MMS is in an operational state, ready for operation. Specific steps are:

- Preparation of Facilities;
- System Installation;
- System Start-up;
- System Operational Test;
- Integration with MP Interface;
- Integration with Energy Management System; and
- Site Acceptance Test.

MO personnel shall be responsible for facility preparation and installation. All other activities shall be the responsibility of the Contractor with assistance from MO personnel as defined in each section. MO personnel involvement will be for purposes of on-the-job training as well as providing assistance with integration with facilities and the EMS. The Contractor shall prepare a detailed plan for all site activities including schedule and involvement of both Contractor and MO personnel. This plan will be subject to review and approval by the MO.


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Problem reports shall be generated as required during all phases of site testing, and Variance Lists maintained and referenced to the appropriate test phase.

### 10.5.1 Preparation of Facilities

The MO will be responsible for the preparation of the facilities for all MMS equipment in accordance with requirements prepared by the Contractor.

Prior to shipping the MMS, the MO will notify the Contractor that it has completed the preparation of facilities for the MMS installation. The Contractor shall inspect the facilities to verify that they conform to the requirements of the facilities and installation manuals.

### 10.5.2 System Installation

MMS equipment furnished by the Contractor, as well as any equipment that may be purchased by the MO for the MMS with the Contractor's approval, shall be installed by the MO under the technical direction of the Contractor. The MO will place the equipment on site, interconnect the equipment using Contractor-supplied cables and cables included with equipment, connect the MMS to electrical power, and connect cables to external equipment and systems.

### 10.5.3 System Startup

The Contractor shall be responsible for the startup of the MMS after its installation. The Contractor shall:

1. Inspect the MMS for proper installation;
2. Power up the MMS and run diagnostics to verify the proper operation of all system hardware;
3. Start the MMS and initialize applications; and
4. Check the on-site operation of the MMS and ensure that it is ready for the Site Acceptance Test.


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### 10.5.4 System Operational Test

The purpose of the System Operational Test is to confirm that the MMS has been properly installed and is ready for operational use. Testing shall be performed by the MO with the Contractor's assistance after the MMS has been installed in the designated facilities, and startup has successfully been completed. The tests shall consist of a subset of the functional tests, performance tests, and the failover tests from the FAT. Test procedures shall be extended, and new procedures shall be added, for functional and performance testing that was not feasible in the FAT.

Unstructured tests will be employed, as deemed necessary by the MO, to verify correct overall operation under actual operating conditions.

Any system defects or design errors discovered during the SAT shall be corrected by the Contractor. The variance reporting and processing procedures shall be used to manage the correction of problems discovered during the SAT.

### 10.5.5 Market Participant (MP) Integration

The next step after establishing that the MMS as delivered and installed operates satisfactorily will be to integrate the system with the e-commerce facility described in Section 5. This series of tests shall start with connection to the e-commerce site and verify:

1. Communications to selected locations in all three regions;
2. Market Participant entry of data on selected forms and return of data to the MO;
3. Access of MO-posted data by MPs in all regions; and
4. Measurement of performance compliance to the specification.

Testing shall be continuous over multiple days to prove both operation and performance compliance at all times of the day.


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### 10.5.6 Integration with Meter Data Collection

The ability to retrieve meter data both periodically and on demand shall be tested by replacing simulators used during factory and earlier site testing with actual connections to the communications network. This series of tests can be performed in parallel with MP integration testing as system capabilities allow. The tests shall verify that:

1. Installation data as described in Section 5 can be retrieved;
2. Metering data can be retrieved from meter data collection systems on demand;
3. Metering data is in proper format;
4. Metering data is returned per periodic requirements;
5. Meter data collection system setup data from MMS to the regions operates as expected;
6. Errors are logged; re-tries operate and all audit requirements are met; and
7. Performance requirements are met.

### 10.5.7 MMS-EMS Integration

A major step of site testing will be the integration of the EMS with the MMS. Note that the EMS will be fully operational and on-line, controlling the NPC network. Connection and testing shall be scheduled and conducted with this firmly in mind. The ability to disconnect and to return the EMS to independent operation of the network at any time must be assured.

The actual testing shall be done in discreet steps of limited size and at off-hours to minimize potential system in interruptions. The Contractor shall prepare a detailed test plan for review by both the MO and the System Operator prior to initiation of this series of tests.

1. Connect LANs and verify point-to-point communications via each LAN;
2. Test primary-reserve operation of LANs;
3. Test receipt of all data from EMS to MMS
    - Network Model
    - Load Forecast
    - Outages and Constraints
    - Generation Data
    - Etc.


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4. Test receipt of all data from MMS to EMS
    - Dispatch schedules
    - Operator messages
    - Etc.
5. Test functional operation between systems in backup EMS mode; and
6. Test functional operation for limited time in operational mode.

This series of testing will take multiple days and support from multiple Contractor and MO and SO personnel. The Contractor shall be responsible for the detailed planning of the tests, gaining the MO and SO approval for both functions and personnel responsibilities and the actual conduct of the testing.

### 10.5.8 Site Acceptance Test

The final set of tests in the commissioning sequence shall be a fully-integrated operational test of the complete Information Technology (IT) infrastructure. Note that responsibility for the operation of the EMS, Meter Data Collection Systems and Communications Network will not be the responsibility of the MMS Contractor. The Contractor shall, however, have the responsibility to define testing and test sequences, and proper operation of the interfaces. This testing shall be planned by the Contractor and reviewed and approved by the MO, SO and representative MPs. The intent of the testing shall be to demonstrate that the system meets all functional and performance requirements.

The series of tests shall comprise major subsets of factory and site functional and all performance tests, but with all systems interconnected for the first time. This testing shall be conducted over multiple days. This phase of testing shall also include time for unstructured testing by all personnel.

The successful completion of this test phase will be justification for putting the PEM into operation. At that time all problems and variances shall be reviewed, re-tested as necessary, software configuration control reviewed and all documentation updated as necessary.


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## 10.6 Availability Test

The purpose of the Availability Test is to verify the reliability of the hardware and robustness of the software of the MMS, and shall constitute the final test of the system. The Availability Test shall commence after the commissioning of the MMS is completed, at a time mutually agreed upon by the Contractor and the MO. It shall be performed under actual operating conditions.

During the Availability Test period, the following maintenance and support requirements shall apply:

1. The MO will maintain the facilities in which equipment is installed within the temperature and humidity limits specified by the Contractor for all periods that will be counted in the Availability Test;
2. The Contractor shall bear responsibility for all corrective maintenance on the system;
3. The MO will be responsible for system restarts, notification to the Contractor of problems and service requirements, and for preventive maintenance; and
4. The Contractor shall have qualified support personnel on call for emergency support at all times during the Availability Test.

During the Availability Tests, downtime and operational time will be recorded by the MO. The system's availability shall be computed as specified in Section 6, based on these records.

The Availability Test shall be run for a total operating time of 2200 hours (approximately three months). Should the guaranteed availability not be demonstrated at the end of 2200 hours, the Contractor may continue the test by moving the starting time of the test forward and continuing the test until 2200 **consecutive** hours have been accumulated and the guaranteed availability has been demonstrated. The entire 2200-hour test must be rerun when any hardware or software changes are made to the MMS to correct problems with the Contractor's software or hardware. However, database changes will be allowed without invalidating the on-going test. The MMS shall be deemed to have failed the Availability Test if more than three (3) redefinitions of starting time are required to demonstrate the guaranteed availability, or if the test is not completed within one hundred and eighty (180) days from the original starting date.


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If the MMS fails the Availability Test, the Contractor shall make all hardware and software corrections necessary to make the MMS conform to availability requirements. This effort shall be given high priority, and a weekly progress report shall be sent to the MO's Project Manager. The report shall identify the people working on the problems and the progress made. The MMS Availability Test shall then be rerun. This process of making corrections and rerunning the Availability Test shall be repeated until the MMS successfully passes the Availability Test. All Contractor costs for such corrections and test reruns shall be borne by the Contractor.


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# 11.0 PROJECT ORGANIZATION, TRAINING, AND MAINTENANCE SUPPORT

Establishment of the Philippines Electricity Market will require close coordination among a number of contractors as well as internal Department of Energy and National Power Corporation functions. The Market Management System is a key component of the required Information Technology infrastructure and meeting project requirements in functionality, performance and schedule will be necessary to ensure the success of the PEM. This includes intermediate milestones as well as final delivery. This section provides requirements for Contractor project organization and support.

## 11.1 Project Responsibilities

### 11.1.1 Responsibilities of the Contractor

#### 11.1.1.1 General Responsibilities

Except for the activities assigned to the MO in the next section, the Contractor shall assume complete responsibility for the design, assembly, delivery, installation, implementation, successful startup, and operational performance of the MMS in accordance with the Contract. The responsibilities of the Contractor(s) shall include, but not be limited to, the following:

1. System engineering, including the qualification of all hardware and software components for the functions to which they are assigned, and modification of the MMS components as necessary to achieve system performance as a single, fully integrated system;
2. Integration of the Contract deliverables with equipment and software that may be supplied by the MO. It shall be the Contractor's responsibility to meet all the specified functional and performance requirements of the Contract, with the equipment furnished by the MO included in the MMS;
3. Hardware and software development engineering, as may be required to develop MMS functions and interfaces to the external systems that are required under the Contract;


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4. Supply of all MMS equipment, including processors, servers, workstations, LANs, data storage devices, communications gateways, and related support material, except for equipment, if any, that is explicitly designated by the Contract to be furnished by the MO;
5. Supply of system software, market operations, and settlement, metering and billing applications software to satisfy all the Contract requirements;
6. Supply of hardware interfaces to the external systems and applications as required by the Contract;
7. Integration of the System with the external equipment and systems as required by the Contract;
8. Provision and maintenance of a development system for use by MO personnel;
9. Furnishing of all interconnecting cables and wiring, including power wiring, among all Contractor-furnished equipment. The Contractor shall document the manufacturer type and catalog number for the power plugs being furnished and for communication interface connectors and any other connectors to external equipment;
10. Supply of documentation on system design, testing, maintenance, upgrading, and operation, including data sheets and technical documentation for OEM equipment, and any other required documentation, according to a Documentation Plan approved by the MO;
11. Furnishing of the required software packages, including the source code specified in Section 9.12.2;
12. Provision of environmental specifications, such as air conditioning, power, grounding, containment of electro-magnetic interference, seismic protection, dust protection, etc., as necessary for the proper operation of the equipment, and/or to meet the conditions for the Contractor's compliance with the Contract's availability and warranty requirements;
13. Training of the MO's personnel on system operation, through formal courses and on-the-job training;
14. Training of the MO's personnel on database and display preparation, and provision of direction and assistance to the MO in building power system displays;
15. Training of the MO's personnel on system maintenance, expansion, and upgrading, through formal courses and on-the-job training;
16. Inclusion, at the MO's option, of the MO personnel in the MMS development team, and direction and supervision of their work;
17. Preparation of all the required displays, including the WEB-based displays for market participants and public access to data (in consultation with the MO);
18. Integration into the MMS of any databases and displays prepared by the MO;
19. Successful completion of Pre-Factory Acceptance Tests (PreFAT) according to FAT procedures approved by the MO, and submittal of detailed results for approval by the MO;


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20. Management of the Factory Acceptance Test (FAT), and ensuring its successful completion;
21. Shipment of project deliverables;
22. Technical direction for the installation of MMS equipment by the MO;
23. Commissioning and startup of the operational MMS after its installation at the MO, up to and including Site Acceptance Test;
24. Assistance (i.e., provision of labor and materials) during the Availability Test, and correction of defects discovered;
25. Provision of maintenance support, site services, spare parts, and test equipment during the Availability Tests;
26. Correction of all defects covered by the Warranty;
27. Maintenance of an up-to-date version of the Contract documents, reflecting all the agreed upon change orders;
28. Full functionality of the system/application when fully loaded and fully integrated to meet ultimate system specifications.

### *11.1.2 Responsibilities of the MO*

The MO shall be responsible for the following:

1. Preparation of facilities for MMS equipment;
2. Power supply for the MMS to receptacles according to the Contractor's specifications;
3. LAN cables to user consoles;
4. All interconnecting wiring between external communications terminals and communications interface panels supplied by the Contractor;
5. Communications channels (excluding interfaces) to the external systems and to the market participants;
6. Physical installation of the MMS equipment under direction of the Contractor;
7. Review and approval of documentation, including software and hardware design documentation, users guides, drawings, progress reports, acceptance tests plans and procedures, and as-built documentation of the System;
8. Furnishing of information required by the Contractor for preparation of Contractor-built databases, displays, and reports;
9. Consultation on, review of, and approval of Contractor-built displays and reports;
10. Furnishing, upon request by the Contractor, of necessary documentation, interface information, engineering drawings, and schematic diagrams for the MO-furnished equipment that will be directly interfaced with Contractor-furnished equipment;


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11. Coordination of project work at the MO's facilities, such as connection to external equipment, testing of MMS interaction with external systems, and integration of equipment and software into the MMS;
12. Performing the Factory Acceptance Test under Contractor's direction. Reviewing and approving of test results;
13. Conducting of the Site Acceptance Test with the Contractor's assistance; and
14. Conducting of the Availability Test with the Contractor's support.

In addition to assuming the responsibilities listed above, the MO may wish to assign personnel to participate in MMS development and integration work under the direction and supervision of the Contractor.

#### 11.1.3 The MO Development System

The Contractor shall supply the MO with a system for use in the development and integration tasks, including:

1. Consultation on the development of Web-based displays for market participants and for dissemination of information to the public;
2. Review by the MO of Contractor-furnished forms and templates; and
3. Development and testing communications interfaces for the market participants, settlement data management agents, and other parties on the Web Site.

The MO Development System shall support simultaneous independent work by at least three persons, possibly at different locations, and from the beginning shall support on-line file exchanges with the Contractor. Also, from the beginning, the MO Development System shall support the database and display work for which the MO is responsible, and shall be capable of showing displays that the Contractor provides for review by the MO. This requires the inclusion of the specified database generation and maintenance functions.

To enable development and testing work in a timely fashion, the MO Development System shall be delivered and ready for use by the MO early in the project.


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## 11.2 Project Organization

#### 11.2.1 The MMS Project Manager

All project contacts and coordination with the MO shall be through the person designated by the MO as its project manager. All correspondence shall be addressed to the project manager. Scheduling of document approval, project meetings, MO personnel participation in the project, training and system testing, as well as other project affairs, shall be coordinated through the MO project manager.

#### 11.2.2 Project Consultant

The MO may retain a Consultant for assistance with project implementation. As directed by the MO, the Consultant shall have access to all project documentation and information provided for the MO by the Contractor, including the Contractor's proprietary documents, and shall participate in project meetings, testing, and other activities.

#### 11.2.3 Contractor's Key Project Personnel

The following requirements apply to each Contractor for the MMS.

##### 11.2.3.1 Project Manager

The Contractor shall designate a Project Manager who shall be the single-point contact for coordination of all the project work and for all formal communications between the Contractor and the MO. The MO shall have approval rights on the selection of the Project Manager. The Project Manager shall not be changed or substituted by another person without the express written consent of the MO's project manager. If the MO in its sole opinion determines that the Contractor's Project Manager is not meeting the MO's requirements, the Contractor shall provide the resumes of potential Project Managers for the MO to select a new Project Manager.


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#### 11.2.3.2 Team Leaders

The Contractor shall nominate team leaders for the development and integration of the EMS functions and for each major area of applications. The MO shall have approval rights on the sclection of the Team Leaders. They shall not be changed or substituted without The MO's express written consent. If the MO determines that a team leader does not perform in a fashion that is acceptable to the MO, the Contractor shall provide the resumes of potential team leaders for the MO to select a replacement.

While on site, contractor personnel shall abide by the policies governing the employees of the MO.

## 11.3 Project Schedule

### 11.3.1 Detailed Project Schedule

A detailed project schedule showing all tasks, with task breakdown into person-week units, shall be submitted by the Contractor for review and approval by the MO within two (2) weeks after the signing of the Contract. The schedule shall be compatible with the schedule included in the Contract.

The project schedule shall be prepared using the Microsoft Project program, which shall continue to be used throughout the project. This project management program shall be used to plan and show project activities, including design, integration, testing, shipment, installation, and acceptance and availability testing, from the inception of the project until the MO accepts the MMS.

Project activities for which the MO is responsible and which impact the schedule shall be explicitly included and identified in the schedule (e.g., review and approval of documents; preparation of facilities for the Development System and the operational MMS; preparation of databases and displays; supplying of technical information to the Contractor; and assistance to


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the Contractor with the integration of the MMS with other subsystems). Activities of subcontractors who may be involved in the MMS Project, as well as MMS equipment procurement activities, shall be shown to the extent that these activities may affect the overall MMS project schedule. Payment milestones shall be shown in the schedule, linked to the prerequisite milestone tasks. The project management program shall also produce manpower requirements and identify critical path activities.

The project schedule shall be updated at least once a month by the Contractor's project manager. An up-to-date hardcopy and electronic copy of the schedule shall be included in the monthly project progress report sent to the MO.

### 11.3.2 Project Milestones

To facilitate the review of the Contractor's progress, a list of important project milestones shall be prepared and maintained as part of the schedule. Delivery dates of interim and final project deliverables shall be included in the milestones. Milestones shall be listed in chronological order, with the expected completion date shown for each milestone. Completed milestones shall be marked whenever the schedule is updated. The list shall include two sets of milestone completion dates. The original dates, entered when the list is first submitted, shall always be retained. In addition, actual completion dates shall be shown for completed tasks, and presently expected completion dates shall be shown for the remaining milestones.

## 11.4 Project Procedures

### 11.4.1 Project Progress Reports

A Project Progress Report shall be prepared by the MMS Contractor and received by the MO by the tenth calendar day of each month. The report shall include:

1. A description of work completed in the reporting period;
2. Work expected to be completed in the next reporting period;
3. Actual progress relative to the schedule;


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4. Major outstanding problems, identified by either the Contractor or the MO;
5. Procedures in place or efforts being undertaken to resolve outstanding problems;
6. The Variance Status Summary;
7. Open action items, both for the Contractor and for the MO, with the date due for their resolution;
8. Action items which have been completed since the last project meeting, with a reference for their closing (e.g., Minute 5 of Meeting #4, or a correspondence number) and date of closing;
9. Log of recent Contractor and MO correspondence, including emails and faxes; and
10. A hardcopy and electronic copy of the most recent revision of the project schedule and milestones, updated to the end of the reporting period.

### 11.4.2 Project Meetings And Minutes

Project meetings shall be held to review project status, to ensure correct interpretation of the Contract, to review new design, to coordinate project work by the Contractor and MO personnel, and to discuss other project issues. The Contractor's project manager and software team leaders shall attend all the meetings, as will the MO's project manager or an appointed substitute. Software and applications developers shall attend those meetings in which functions are reviewed for which they are responsible. The elapsed time between meetings shall be two months or less. The meetings shall take place at the MO's office or at the Contractor's facilities, with most meetings held on site after the FAT is completed in the Contractor's factory.

The Contractor's Project Manager shall prepare a proposed agenda for each meeting and deliver it to the MO's project manager by e-mail at least ten working days in advance of the meeting for review and approval by the MO (System Integrator only).

The MO will prepare minutes of the meetings, and submit them for review and comment by the Contractor. Any disagreements about the minutes of a meeting shall be resolved within thirty (30) days of submittal, and the minutes shall be approved in the next meeting. The final minutes, as approved, shall become the official minutes for the given meeting.


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### 11.4.3 Project Correspondence

Correspondence between the MO and the Contractor shall adhere to these rules:

1. All correspondence, including fax and e-mail transmittals, shall be dated and numbered in sequence;
2. For clarity, each transmittal shall be limited to one major topic;
3. The topic of each transmittal shall be described in a "subject" line that precedes the text. The description shall be specific (e.g., Project Report for October 2001); and
4. The recipient of each item of correspondence shall confirm the continuity of the sequential numbering, and in the event of a gap shall inform the sender of the discrepancy.

The Contractor shall address all project correspondence to the MO's Project Manager. The other MMS Contractors shall be copied, except on privileged correspondence. E-mail shall normally be used for correspondence, including attachments that are available in electronic formats supported by Microsoft Office applications and other formats acceptable to the MO. Courier service or other fast delivery services may be required by the MO when necessary to avoid unnecessary delays.

The Contractor shall copy project correspondence to the Consultant as directed by the MO.

## 11.5 MMS Acceptance

Conditions that must be met before the MMS is accepted by the MO include:

1. The design, manufacture, installation, integration, and commissioning of all contracted components of the System have been completed, and all the functional and performance requirements of the Contract have been met;
2. Factory acceptance testing and site acceptance testing have been successfully completed, and the results have been approved in writing by the MO;
3. The MMS has successfully passed all availability testing;
4. "As Shipped" revisions of all documentation have been received and approved by the MO;
5. "As Shipped" revisions of all software deliverables have been received and approved by the MO. The software deliverables must include any changes that resulted from the acceptance and availability tests;


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6. All required software licenses have been conveyed to the MO;
7. All software source codes specified in the Contract have been delivered to the MO;
8. All hardware deliverables, including spare parts, have been received by the MO;
9. Maintenance support arrangements have been made as required by the Contract; and
10. Training of MO personnel has been completed by the Contractor as defined in the specification, to the extent that the MO elected to take this training and scheduled it in a timely fashion.

## 11.6 Training

The may wish to take primary responsibility for the maintenance of the MMS. If so, MO will maintain the database and displays, will implement system expansions, will perform system upgrades and enhancements, and plans to develop additional functionality and applications for the MMS. The MO will perform preventive maintenance of MMS hardware; will upgrade the System's hardware by replacing units such as processors, servers, routers, etc.; and will troubleshoot and replace failed MMS equipment down to the level of plug-in boards and modules. In this event the Contractor shall provide the MO with tools and training as needed for the MO to assume this range of responsibilities. Except where this is not practical, training classes are to be held on site.

1. Training courses shall be conducted by personnel who (1) are experienced in instruction, (2) have expertise in the course subject, and (3) are familiar with the MMS being developed for the MO;
2. All necessary training materials shall be provided by the Contractor;
3. Each trainee shall receive individual copies of the technical manuals and pertinent documents. These shall be sent to the trainees at least one month before the scheduled commencement of the particular training course. Electronic files of the manuals and documents shall also be provided to the MO when available to the Contractor;
4. Class materials, including documents sent before the training classes and class handouts, shall become property of the MO. The MO shall be given the right to copy such material for in-house training and use;
5. Copies of training presentations, including electronic files of the presentations, shall be provided to the MO for in-house training by MO personnel;
6. Training shall provide a proper balance of classroom lectures and hands-on work to ensure a thorough understanding of the subject matter by the students; and


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7. The Contractor shall provide suitable tools and equipment for training such that no more than two trainees shall share the same training facilities.

The MO shall be permitted to videotape training sessions for in-house use.

### 11.6.1 Training Plan and Schedule

The training plan and schedule shall be tailored to the MO's needs. It shall be compatible with the project schedule, and shall be designed to prepare MO personnel to assume their responsibilities in a timely fashion.

The plan shall identify both standard classes, which are available on a periodic basis, and classes prepared specifically for the MO.

The following subsection describes specific training requirements, and shall be used as a guideline for the preparation of the training plan.

### 11.6.2 System Overview Class

The System Overview Class shall be the first class in the training sequence. It shall be planned to serve two purposes:

1. It shall constitute an introductory class for MO personnel who are designated to attend additional training later. It shall provide each trainee with at least a general understanding of all the aspects of the MMS, including aspects on which that trainee will not get detailed training; and
2. It shall familiarize managerial personnel who will not obtain additional training with the capabilities, configuration, and operation and maintenance of the System, and provide them with an overview of the system development process.

System overview training shall be a cooperative effort by all the MMS Contractors, coordinated by the System Integrator.


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### 11.6.3 System Level Training on MMS Equipment

The training course for the computing equipment shall give the MO's hardware personnel sufficient knowledge of the overall design, configuration, and operation of the system to be able to identify all System components, correct obvious problems, perform preventive maintenance, run diagnostic programs, and communicate with contract maintenance personnel. This course shall include training on system expansion and upgrading techniques and procedures to expand and add equipment such as loggers, consoles and monitors, and communication channels, and to replace old equipment.

### 11.6.4 Hardware Maintenance Training

Hardware training shall qualify designated personnel to maintain and troubleshoot the MMS equipment to the level of replaceable units, modules, and boards. This training shall include theory of operation, maintenance techniques and practices, diagnostic procedures, and where applicable, expansion techniques and procedures. Instruction on testing and troubleshooting of links to other utilities and interfaces to external systems shall be provided.

### 11.6.5 System Software Training

System software training courses shall provide detailed instruction on the generation, configuration, tuning, and diagnosing of the MMS software.

Engineers shall be trained in the complete generation of MMS software and in partial system regeneration. This training shall be conducted towards the end of the project, when the development and integration of the MMS have been completed, and shall be designed to meet the following goals:

1. Demonstrate that a full system build is possible using only the delivered software libraries, tools, and procedures and
2. Train engineers in System building tools and procedures, and verify that the engineers have the skills necessary for a complete System build and for partial system builds without assistance by the Contractor.


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### 11.6.6 Application Software Training

Application Software Training shall include detailed training on Security Constrained Dispatch, market operations, and settlement, metering, and billing functions, and on OTS software. Applications software training courses shall include:

1. Overview - Block diagram of the application software and data flows; programming standards and program interface conventions;
2. Application Functions - Functional capabilities, design, and major algorithms; maintenance and expansion techniques;
3. Software Development - Techniques and conventions to be used for the preparation and integration of new software functions;
4. Software Generation - Generation of the applications software from sources, and setting of performance and sizing parameters for the applications functions; and
5. Software Documentation - Orientation in the organization and use of functional and detailed design documentation, and of programmers and users manuals.

### 11.6.7 Displays and Reports Training

This course shall be suitable for people without programming skills. It shall train them in the preparation and maintenance of the displays, and reports of the MMS, and make them proficient in the use of the tools provided by the Contractor for this purpose.

This course shall be provided early in the project, in time to enable the MO to fulfill its obligation to prepare the database, displays, and reports for integration into the System by the Contractor. The course shall focus on hands-on training on the MO Development System, during which time the trainees shall start the development of databases, displays, and reports for which the MO is responsible.

### 11.6.8 Training of MMS Users

Users training shall include:

1. Market Operations: These courses shall cover on-line operations including dispatch and interface with the EMS; and


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2. Metering and Settlement Functions: These courses shall be open to personnel of the MO and of the market participants, as well as to settlement data management agents. The courses shall also prepare MO personnel to instruct market participants and settlement data management agents on the use of their MMS functions.

## 11.7 Participation in System Development

The MO may assign qualified software engineers for extended periods of time to participate in the development of the MMS under the direction and supervision of the Contractor. Under such circumstances an important goal is to provide extensive on-the-job training (OJT) to the MO personnel, in particular on the advanced applications, to qualify them for MMS maintenance and upgrading responsibilities.

During the course of OJT, the Contractor shall assign to the trainees genuine job assignments in software development and integration that are relevant to the MO. The Contractor shall not use the MO's on-the-job trainees to perform low-level, tedious, or repetitive assignments, but rather shall assign them to tasks that will expand their knowledge of MMS software, as well as the Contractor's software system, software maintenance procedures, and software tools (simulators, debuggers, drivers, etc.) that are used by the Contractor's staff. The work assigned to the MO's engineers shall be designed to make them proficient in maintaining and upgrading all aspects of MMS software.

## 11.8 Maintenance Support

The Contractor(s) shall also offer long-term maintenance support for the MMS, and shall assist the MO in reaching agreement for long-term support with third parties whose equipment or software is included in the MMS.

### 11.8.1 Maintenance Support Services

On-call maintenance assistance services shall be offered to assist MO personnel in the maintenance of the System. The following requirements apply:


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1. Assistance with maintenance problems shall be available for all the hardware and software of the System. Emergency help contacts shall be available 24 hours a day, seven days a week;
2. Emergency assistance by means of remote, dial-up diagnosis shall be available;
3. Support over the telephone shall be available. The Contractor or other supplier of maintenance services shall direct MO personnel in diagnosing problems and, for hardware problems, in replacing defective boards or modules;
4. If a problem cannot be solved by MO personnel, maintenance personnel shall be dispatched to the MO. For emergency calls, service personnel shall arrive within 24 hours;
5. The Contractor shall assign personnel to each emergency call according to the expertise required to solve the problem;
6. A module-exchange service shall be provided to replace defective components; and
7. Replacement parts shall be shipped within 24 hours of an emergency delivery request.

Quoted maintenance costs shall include travel, living expenses, and labor.

Arrangements for maintenance support shall be in place from the moment that the MMS is put into operational use. The maintenance services provided in conformance with this section do not relieve the Contractor of the warranty responsibilities.

### 11.8.2 Maintenance Tools

The Contractor shall recommend test equipment and special tools to be purchased by the MO for all parts of the System, for the level of in-house hardware maintenance planned by the MO. A list of recommended test equipment and tools, from the Contractor or other suppliers, shall be furnished to the MO with catalogs and other ordering information.

### 11.8.3 Spare Parts

The Contractor shall provide sufficient spare parts for achieving the specified system availability. Spare parts shall include both recommended maintenance parts and an initial supply of operational expendable parts such as fuses, cartridges for printers, etc.


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All spare parts used in support of warranty repairs shall be replaced by the Contractor within thirty (30) days at no additional cost to the MO. Any MMS parts or spare parts which are added or modified due to design changes made after the contract was awarded and during the warranty period, or in order to meet the specified system requirements (including system availability and performance requirements), shall be provided to the MO at no extra cost.

The Contractor shall provide a list of MMS equipment and parts with the original manufacturers' part numbers. Sufficient information shall be provided for the MO to buy the equipment directly from the manufacturers. The list shall indicate the quantities of each type of equipment and modules that are included in the delivered System.

### *11.9 Contractor and OEM Update and Information Services*

The Contractor(s) shall provide to the MO during the warranty period any system updating and other information services that are available. The Contractor shall also make arrangements to provide the MO with all the system updates and other pertinent information services offered by the original equipment manufacturers (OEM) or other third party vendors. These services, including installation of upgrades in the MMS, shall be provided at the Contractor's expense for the duration of the warranty period.

System upgrades shall be available to the MO within thirty (30) days of release. However, in order to avoid disruption of MO operations, installation of updates shall be scheduled in consultation with the MO.

At the end of the warranty period, the MO shall have the option to subscribe to update and information services offered by the Contractor. The Contractor shall also assist the MO in initiating its own subscription to information and upgrade services by OEMs after the Contractor's warranty expires.


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# Attachment F

# Technical Specification of IMMS

## Deliverable of Task A2

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APPENDIX A-Questionnaire


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## GLOSSARY

| TERM | DEFINITION |
|---|---|
| **AGC** | Automatic Generation Control (function) |
| **ANSI** | American National Standards Institute, Inc. |
| **API** | Application Program Interface |
| **A/S** | Ancillary Services |
| **ASCII** | American Standard Code for Information Interchange |
| **active energy** | A measure of electrical *energy* flow, being the time integral of the product of *voltage* and the in-phase component of current flow across a *connection point*, expressed in kilowatt-hours (kWh) and multiples thereof. |
| **administered price cap** | A price cap determined in accordance with the WESM which will apply during an *administered price period*. |
| **ancillary service** | A service of the kind necessary to support the transmission of capacity and *energy* from the sources to *loads* while maintaining reliable operation of the *transmission system* in accordance with good utility practice and the *Grid Code*, and including a reserve commodities. |
| **ancillary services charges** | Fees to be collected to pay for ancillary services in accordance with Market Rules. |
| **ancillary services agreement** | An agreement in accordance with Market Rules under which a *Participant*, registered as an *Ancillary Service Participant*, agrees to provide *ancillary services*. |
| **audit trail** | Information by which the specifics of an event or transaction can be reconstructed for auditing purposes. |
| **Availability Test** | Operational testing of the MMS after site acceptance and for a defined period of time to confirm that the system is available for MMS users as defined in this Specification. |
| **Bid** | An offer to buy electricity submitted by a *Customer* in accordance with Market Rules. |
| **billing period** | The period of one calendar month commencing on 9.00 AM on the first day of each calendar month. |
| **Black Start** | The process for a recovery from a Generating Unit shutdown without external electrical power supply. |
| **black start capability** | In relation to a *generating unit*, the ability to start and *synchronise* without using *supply* from the *power system*. |


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| TERM | DEFINITION |
|---|---|
| **CCITT** | International Consultative Committee for Telephone and Telegraph |
| **CD-R** | Compact Disc – Recordable |
| **CD-ROM** | Compact Disc – Read-Only Memory |
| **CIM** | Common Information Model |
| **CSV** | Comma Separated Values |
| **Central dispatch** | Refers to the process of issuing direct instructions to electric power industry participants by the grid operator to achieve the economic operation and maintenance of quality, reliability and security of the transmission system. |
| **Communications Network** | The infrastructure by which data is exchanged between two entities or among a group. |
| **Confidential information** | Information which is or has been provided to, or by, a *Participant* or the *Market Operator* under, or in connection with, these Rules and is stated under these Rules to be, or is classified by the *Market Operator* as, confidential information or is otherwise confidential or commercially sensitive information or is information which is derived from any such information. |
| **Connection point** | The agreed point of *supply* established between a *Network Service Provider* and a *Market Participant*. |
| **Constrained-off** | In respect of a *generating unit* the output of that *generating unit* is limited below the level to which it would otherwise have been *dispatched* by the *Market Operator* on the basis of its *dispatch offer*. |
| **Constrained-on** | In respect of a *generating unit*, the output of that *generating unit* is limited above the level to which it would otherwise have been *dispatched* by the *Market Operator* on the basis of its *dispatch offer*. |
| **Constraint** | A limitation on the capability of a *network, load, generating unit* or *ancillary service* such that it is, or is deemed by the *System Operator* to be, unacceptable to either transfer, consume, generate or produce the level of electrical power or other service that would occur if the limitation were removed. |
| **constraint violation penalties** | The penalties set by the *Market Operator* in accordance with Market Rules |


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| TERM | DEFINITION |
|---|---|
| **contingency reserve** | The ability to respond to a significant drop in system frequency such as would arise as a result of a credible contingency affecting one (or more) *Generators* within a region, or transmission flows into a region |
| **Contingency Reserve Offer** | An offer made by a Generator to provide the required contingency reserve. |
| **Contractor** | The successful bidder for the Market Management System defined by this Specification. |
| **Control Center** | The physical area used by system operators to monitor and control electric network activities. |
| **credit support** | An obligation owed to the *Market Operator* by a third party supporting the obligations of a *Market Participant*. |
| **Customer** | A person who:<br>(1) engages in the activity of purchasing electricity *supplied* through a *transmission* or *distribution system* other than where all that person's electricity requirements are purchased from a *Supplier*; and<br>(2) registers with the *Market Operator* in that capacity. |
| **Customer Pricing Zone** | A *Customer pricing zone* determined by the *Market Operator* in accordance with Market Rules. |
| **cut-off time** | Time interval prior to the commencement of the *trading interval*, according to the *timetable*, where re-bidding is invalid except for authorized reasons. |
| **DC** | Direct Current |
| **DOE** | Department of Energy |
| **DPF** | Dispatcher Power Flow (function) |
| **DVD** | Digital Video Disc |
| **day ahead projections** | The day ahead projections *published* by the *Market Operator* in accordance with market rules. |
| **Dispatch** | The act of initiating all or part of the response offered or bid by a *scheduled generating unit* or *scheduled load* in accordance with Market Rules. |
| **dispatch procedures** | The procedures of selecting and ordering resource changes as described in Market Rules |
| **Dispatch Schedule** | The order in which energy and reserve resources will be dispatched during a specific trading interval. |


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| TERM | DEFINITION |
|---|---|
| **Dispatchable load** | A *load* which is able to respond to *dispatch* instructions and so may be "scheduled" via the *dispatch* process. |
| **distribution line** | A power line, including underground cables, that this part of a *distribution network, that is a lower voltage and/or radial configuration than a transmission line.* |
| **distribution network** | An *electrical network* which is a lower voltage and/or radial configuration, rather than a *transmission network.* |
| **Distribution Utility** | An entity that engages in the activity of owning, controlling or operating a *distribution system*, including an *Electric Co-operative.* |
| **EBS** | Emergency Backup System |
| **EFT** | Electronic Funds Transfer |
| **EIA** | Electrical Industry Association |
| **EIRA** | Electricity Industry Reform Act |
| **EMS** | Energy Management System |
| **ERC** | Energy Regulatory Commission |
| **economic rental** | Means, for a constraint in the *market dispatch optimization model* where the constraint is in linear programming canonical form (that is, for a maximising optimization model: the sum of the variable terms less than or equal to the constant term), the shadow price of the constraint multiplied by the constant term of the constraint. |
| **Emergency** | An event or situation described as an Emergency in accordance with Market Rules. |
| **Emergency directions** | Directions issued by the *Market Operator* in an *emergency.* |
| **Emergency procedures** | The procedures described for he procedures to be followed in a declared emergency in accordance with Market Rules. |
| **Energy** | *Active energy* and/or *reactive energy, most commonly referring to active (real) energy MWh.* |
| **energy balance equation** | An equation determined by the *Market Operator* in accordance with Market Rules, representing the balance between *generation, load* and transmission flows at a particular node of the *market network model.* |
| **energy data** | The data that results from the measurement of the flow of electricity in a power conductor. The measurement is carried out at a *metering point.* |





| TERM | DEFINITION |
|---|---|
| **Energy Management System (EMS)** | System responsible for real-time monitoring and control of the electric network, including dispatch of generation and network security. Specifically, the GE-Harris system supplied to National Power Corporation. |
| **Energy Regulatory Commission (ERC)** | Refers to the regulatory agency created by R.A. No. 9136. |
| **Ethernet** | The physical cable used for data exchange on a local area network. |
| **ex-ante dispatch** | The *dispatch* targets set for the end of a *trading interval*, immediately preceding the beginning of that *trading interval.* |
| **Ex-Ante Real-Time Dispatch** | The dispatch targets set for a future trading interval for each trading node. |
| **ex-post energy settlement price** | The *ex-post nodal energy price* of the zonal *price* determined in accordance with Market Rules as determined after the close of the trading period. |
| **Ex-Post Real-Time Dispatch** | The dispatch for each trading node for the just-completed trading interval. |
| **FAT** | Factory Acceptance Test |
| **Final statement** | A settlement statement issued by the *Market Operator* under Market Rules. |
| **Financial year** | A period commencing on 1 July in a calendar year and terminating on 30 June in the following calendar year. |
| **force majeure event** | An event which satisfies the requirements of Market Rules for establishing a force majeure event when the event is neither anticipated, nor controllable by Participants affected by the event and the event is caused by forces of nature, governmental intervention or acts of war. |
| **Frequency** | For alternating current electricity, the number of cycles occurring in each second. The term Hertz (Hz) corresponds to cycles per second. |
| **generating plant** | A generating facility comprising of one or more generating unit within one location.. |
| **Generating units** | The actual generators of electricity and all the related equipment essential to its functioning as a single entity. |
| **Generation** | The production of electrical power by converting one form of *energy* to another in a *generating unit.* |

| TERM | DEFINITION |
|---|---|
| **Generation Output** | The amount of electrical power available from a generating unit. |
| **Generator** | A person who engages in the activity of owning, controlling, or operating a *generating system* that *supplies* electricity to, or who otherwise *supplies* electricity to a *transmission system* or *distribution system* and who is registered with the *Market Operator* in that capacity in accordance with Market Rules. |
| **Generator Pricing Zone** | A zone established by the market rules in which all Generation is of equal price. |
| **Government** | The Government of the Philippines. |
| **Grid Code** | The code of that name which regulates the *supply* of electricity, and use of, and *connection* to, a *transmission* or *distribution system* and which is certified by the *Government*. |
| **historical database** | MMS-resident data collected by system and application programs. |
| **HTML** | Hypertext Markup Language |
| **HVDC** | High-Voltage Direct Current |
| **ICCP** | Inter-Control Center Communication Protocol (IEC 60870-6 TASE.2 protocol) |
| **ICD** | Interface Control Document |
| **IEC** | International Electrotechnical Council |
| **IED** | Intelligent Electronic Device |
| **IMMS** | Interim Market Management System |
| **ISO** | International Standards Organization |
| **IT** | Information Technology |
| **Interest rate** | The ninety day bank bill swap reference rate as published in the Philippines from time to time. |
| **interruptible load** | Means a *load Customer* is able to interrupt at very short notice in response to:<br>(a) a frequency deviation; or<br>(b) a request of the *System Operator*,<br>in order to meet *reserve* requirements, subject to the requirements of the Grid *Code*. |
| **intervene/intervention** | Measures taken by the *Market Operator* where there is a threat to *system security* |
| **KV** | Kilovolt |


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| TERM | DEFINITION |
|---|---|
| **LAN** | Local Area Network |
| **License** | A license issued by the *Government* in respect of a particular activity(ies). |
| **line accounts** | Accounts established under Market Rules to be in receipt of *transmission line rentals* arising on a specific transmission lines. |
| **Load** | The amount of *active (real) energy* delivered at a defined instant to a *connection point*. |
| **load forecast** | The predicted load at connection points at defined times based on historical data, weather and system conditions. |
| **load shedding** | Reducing or *disconnecting load* from the *power system*. |
| **MDCS** | Meter Data Collection System |
| **MDOA** | Merit Dispatch Optimization Algorithm |
| **MMS** | Market Management System |
| **MO** | Market Operator |
| **MOD** | Merit Order Dispatch (function) |
| **MVAR** | Megavolt Ampere Reactive |
| **MW** | Megawatt (1,000,000 watts, 1,000 kilowatts) |
| **Margin call** | An amount which the *Market Operator* calls to be made by a *Market Participant* in accordance with Market Rules to make up any anticipated shortfall between that *Market Participant's trading limit* and the *Market Operator's* exposure in respect of that *Market Participant*. |
| **Market** | The Wholesale Electricity Market or *Spot Market* managed by the *Market Operator* as embodied in R.A. 9136. |
| **Market Administrator** | The function set up by the Market Operator to provide technical services and support for the MMS. |
| **Market Auditor** | The function established by the market rules to oversee the operation of the market. |
| **Market Fees** | The fees payable by a *Market Participant* determined in accordance with Market Rules in respect of participating in the *market*. |
| **Market information bulletin board** | A facility to be established by the *Market Operator* on the *electronic communication system* on which it may *publish* information which is then available to and may be accessed by *Participants*. |


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| TERM | DEFINITION |
|---|---|
| **Market load** | The electricity delivered to a *connection point* and purchased by a *Customer* from the *spot market*. |
| **Market network model** | A mathematical representation of the *power system* submitted by the *System Operator* to the MO for the purpose of MO system analysis, optimization, and dispatch of resources |
| **Market Operator** | The entity responsible for the operation of the *spot market* governed by the *WESM Board* in accordance with Market Rules. |
| **Market Dispatch Optimization Algorithm** | The algorithm to be used for the purpose of *central dispatch* and developed by the *Market Operator* and *System Operator* pursuant to Market Rules. |
| **Market Management System (MMS)** | System responsible for all market functions as defined by the market rules. Specifically, the system defined by this Specification. |
| **Market price** | The nodal *price, zonal energy price,* or *zonal reserve price.* |
| **Market price cap** | Means the maximum allowable *market price* at any *node*. |
| **Market price floor** | Means the minimum allowable *market price* at any *node*. |
| **Market Rules** | The rules which govern the Wholesale Electricity Spot Market of the Philippines as embodied in R.A. 9136. |
| **Market Suspension** | The process of ceasing trading in the market for a specific period of time. |
| **Market trading nodes** | Those *market network nodes* determined by the *System Operator* in accordance with Market Rules. |
| **Meter** | A device which measures and records the consumption or production of electricity; in this context, specifically referring to electronic revenue meters. |
| **Meter Data Collection System** | A system located within one of the three defined regions, Luzon, Visayas and Mindanao with the specific functions of collecting data from meters in those regions and returning data to the MMS. |
| **metering data** | The data obtained or derived from a *metering installation.* |
| **metering database** | The database kept by the *Market Operator* pursuant MO metered entities. |
| **Meter Data Processing** | The process within the MMS by which data received is validated, aggregated and stored. |
| **metering installation** | The *meter* and associated equipment and installations installed or to be installed for the collection of *metering data* required for *settlement* purposes. |


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| TERM | DEFINITION |
|---|---|
| **metering point** | The connection point where metering devices are installed to measure electrical power, energy, current and voltage. |
| **Metering Provider** | A person registered with the *Market Operator* in that capacity in accordance with Market Rules. |
| **metering register** | A register of information relating to *metering installations* kept by the *Market Operator* and forming part of the *metering database*. |
| **MMS Errors file** | The system file that collects all information regarding errors detected in operations. |
| **NA** | Network Analysis (function) |
| **NEMA** | National Electrical Manufacturers Association |
| **NPC** | National Power Corporation |
| **Network** | The apparatus, equipment, *plant* and used to convey, and control the conveyance of, electricity to *customers* (whether wholesale or retail) excluding any *connection equipment*. In relation to a *Network Service Provider*, a *network* owned, operated or controlled by the *Network Service Provider*. |
| **network lines** | Means the:<br>(a) *transmission lines*;<br>(b) *distribution lines*;<br>(c) transformer elements; and<br>(d) other *plant* associated with *transmission lines* and *distribution lines*. |
| **Nodal price** | The price at a *node* determined in accordance with Market Rules. |
| **Node** | A *connection point* on a *network*, or junction point within a *network* model, whether physical, or notional. |
| **nodal value of lost load (nodal VoLL)** | Means the *constraint violation penalty* of the *energy balance equations* for each *node* set by the *Market Operator* in accordance with Market Rules. |
| **OEM** | Original Equipment Manufacturer |
| **OJT** | On-the-Job Training |
| **Offer** | An offer to supply electricity submitted by a *Generator* in accordance with Market Rules. |
| **On-Line System** | With reference to the Market Management System, the system designated as primary, thereby interfacing to the EMS, Meter Data Collection Systems and Market Participant interface, and running market applications |
| **Orphan data** | Data that has been rejected or otherwise fails to be matched or associated with validated and accepted data |
| **Outage** | Any full or partial unavailability of equipment or *facility*. |


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| TERM | DEFINITION |
|---|---|
| **PCL** | Program Control Language |
| **PDF** | Portable Document Format |
| **P/E** | Programmer/Engineer |
| **PPT** | WESM Project Team |
| **PKI** | Public Key Infrastructure |
| **POSIX** | Portable Operating System Interface for Computing Environment |
| **PreFAT** | Preliminary Factory Acceptance Test |
| **PSM** | Power System Model |
| **Participant** | A person who is registered with the *Market Operator* in accordance with Market Rules. |
| **Payment date** | The relevant date on which a *Market Participant* must pay to the *Market Operator* the *settlement amount* in accordance with Market Rules. |
| **WESM Auditor** | The auditor appointed by the *MO Board* per Market Rules. |
| **power system** | The integrated system of *transmission* and *distribution networks* for the supply of electricity *networks* in the *Philippines*. |
| **Preferred Operating Point** | Refers to individual generating unit output goal, based on dispatch optimization. |
| **pricing zone** | A *generator pricing zone*, *customer pricing zone* or *reserve pricing zone*. |
| **Problems Log** | A running list of problems uncovered with the MMS during the project. |
| **Project Plan** | Contractor's plan for completion of the MMS in accordance with specification requirements. |
| **Project Quality Plan** | Contractor's plan to demonstrate system quality throughout the project. |
| **Prudential Assessments** | Evaluations of Market Participants' ability to meet requirements for sound financial security. |
| **Prudential requirements** | The requirements imposed on a *Market Participant* to provide and maintain sound financial security in accordance with Market Rules. |
| **R&D** | Research and Development |
| **RCS** | Revision Control System |


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| TERM | DEFINITION |
|---|---|
| **RTU** | Remote Terminal Unit |
| **ramp rate** | The rate of monotonic increase or decrease in electricity production of a generating unit. |
| **reactive energy** | A measure in megavar-hours (MVARh) of the (reactive energy) alternating exchange relating to inductance and capacitance, which is the time integral product of non-unity power factor with its impact upon *voltage*. |
| **reactive power** | The rate at which *reactive energy(MVAR)* is transferred, produced or purchased by a *Customer*. |
| **re-dispatch** | The act by the *System Operator* of issuing a new dispatch order in the occurrence of a contingency. |
| **re-schedule** | The issuance of a new dispatch schedule using the market optimization algorithm subsequent to the regularly scheduled dispatch |
| **Region** | Refers to Luzon, Visayas and Mindanao, the three regions of the market. |
| **Regulating reserve** | A market ancillary service reserve commodity that requires continuous adjustment of generator output power to respond to changes in the load. |
| **Reliability** | The probability of a system, device, *plant* or equipment performing its function adequately for the period of time intended, under the operating conditions encountered. |
| **Reserve** | Generating capacities which are allocated to respond to loss of generation or load changes within the system. |
| **reserve cost recovery charges** | The cost of providing each type of reserve allocated by the System Operator to t hose Market Participants on whose behalf the System Operator purchases each type of reserve. |
| **reserve prices** | The *ex-ante reserve prices* for a particular *market reserve zone*. |
| **reserve pricing zone** | A zone determined by the *Market Operator* to designate an area for common prices for use of reserves. |
| **reserve offer** | An offer to supply *reserves*. |
| **revised statement** | A revised settlement statement issued by the *Market Operator* in accordance with Market Rules |
| **SAT** | Site Acceptance Test (of an installed system) |
| **SCADA** | Supervisory Control and Data Acquisition |
| **SSL** | Secure Sockets Layer |
| **SO** | System Operator |
| **SQL** | Structured Query Language |


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| TERM | DEFINITION |
|---|---|
| **scheduled load** | A *load* which has been bid into the *market* using a *customer bid*. |
| **Settlement** | The MO activity of producing bills and credit notes for *Participants* in accordance with Market Rules. |
| **settlement amount** | The amount payable by or to a *Market Participant* in respect of a *billing period* as determined by the *Market Operator*. |
| **settlement system** | The system, including the computerized system, for conducting *settlements*. |
| **Settlement Fees** | Fees, to be determined by the MO, to be assessed as part of the Settlement. |
| **shadow price** | Means the marginal net benefit from a unit relaxation of the capacity limitation of a *constraint* in the *market optimization algorithm*. |
| **Spot market** | The Wholesale Electricity S pot Market of the Philippines established and operated by the Market Operators as embodied in R.A. 9136. |
| **Spot market commencement date** | The date on which the *spot market* commences operation as notified by *Government*. |
| **Standing Data** | Data required for market functions which could be termed reference as opposed to transaction data. |
| **Submittal** | The official transmittal of contract documents for review and approval. |
| **suspension notice** | A notice issued by the *Market Operator* with notification of suspension in accordance with Market Rules. |
| **system blackout** | The absence of *voltage* on all or a significant part of the *transmission system* or within a *region* following a major *supply* disruption, after one or more *generating systems* and a significant number of *customers*. |
| **System Operator** | An entity that is registered as a System Operator. |
| **System Performance Test** | The series of tests that occur during the life of the project that verify that the system meets specification performance criteria. |
| **system security** | The safe scheduling, operation and control of the *power system* on a continuous basis in accordance with the *system security and reliability guidelines*. |





| TERM | DEFINITION |
|---|---|
| **system security and reliability guidelines** | The standards governing *system security* and *reliability* of the *power system*, which may include but are not limited to standards for the *frequency* of the *power system* in operation and *ancillary services* (including guidelines for assessing requirements and utilisation), developed by the *Market Operator* and *System Operator* in accordance with Market Rules. |
| **TLS** | Transport Layer Security |
| **TP** | Trading Participant |
| **time stamp** | The means of identifying the time and date at which data is transmitted or received. |
| **Timetable** | The timetable prepared by the *Market Operator* for operation of the *market*. |
| **Total Operating Time** | Continuous time that the system is on-line and available as defined in the specification. |
| **trading amount** | The sum calculated in accordance with Market Rules. |
| **trading day** | The 24-hour period commencing according to the Timetable. |
| **trading interval** | A 1-hour period ending on the hour. |
| **trading limit** | In respect of a *Market Participant* at any time means the last *trading limit* set by the *Market Operator* for the *Market Participant*. |
| **Trading Participant** | A *Customer, Generator, or other authorized entity participating in any aspect of the WESM.* |
| **Transmission Line Flows** | Amount of energy being conducted on individual transmission lines. |
| **Trading Node** | A metered connection point for Generators and/or Customers. |
| **Transmission Company** | An entity that engages in the activity of owning or operating the electrical *transmission system*. |
| **transmission rights** | The right to financial compensation based on differences between *nodal* prices at different *nodes* in the *market network model*. |
| **transmission system** | The *transmission network* together with the *connection assets* associated with the *transmission network*, which is *connected* to another *transmission* or *distribution system*. |
| **UFE** | Unaccounted for Energy |
| **VAR** | Volt Ampere Reactive |

| TERM | DEFINITION |
|---|---|
| **VAT** | Value Added Tax |
| **Variance List** | The running list of faults/problems detected during testing of the MMS. |
| **Value of Lost Load (VoLL)** | A price cap, being the maximum, on the *market price*, as determined by the *Market Operator and Government*. |
| **WAN** | Wide Area Network |
| **WESM** | The Philippines wholesale electricity spot market established and governed by these Rules. |
| **WORM** | Write Once Read Many |
| **week ahead projections** | The projections (forecasts) performed by the *Market Operator* in accordance with Market Rules. |
| **Work Statement** | The document which shall define the contract requirements to be met by the successful bidder. |
| **zonal energy price** | The *Market Price* in a particular *generator pricing zone* and/or *customer pricing zone*., determined in accordance with Market Rules. |
| **zonal reserve price** | The *Market Price* in a particular *reserve pricing zone* determined in accordance with Market Rules |


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1.2 Market Management System (MMS) ..... 1-2
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# 1.0 INTRODUCTION

## 1.1 Background Information

The Philippines Congress has passed Republic Act No. 9136 directing the restructuring of the electricity industry and the creation of a Wholesale Electricity Spot Market (WESM). The effort to implement the WESM is being coordinated by the Department of Energy, together with the Energy Regulatory Commission, and the National Power Corporation. An Interim Market will be established in 2002 as the first step of this effort, and it will be transitioned into the final market in 2004.

The Market Rules, which govern the creation of the market infrastructure and the ongoing management of market operations, stipulate that the WESM shall be run by a Market Operator (MO) and that the necessary Information Technology (IT) infrastructure shall be put in place to facilitate market activities.

The National Transmission Company (Transco) has been formed and has been given the responsibility to establish the MO. The MO has the responsibility for market pre-commencement activities, market administration, market operations and market compliance. The Information Technology infrastructure required to enable the Market Operator (MO) to direct the WESM is comprised of the following four components:

- Market Management System (MMS)
- Energy Management System (EMS)
- Meter Data Collection Systems
- Communications Infrastructure

Figure 1-1 below illustrates the interrelationship of the four components.

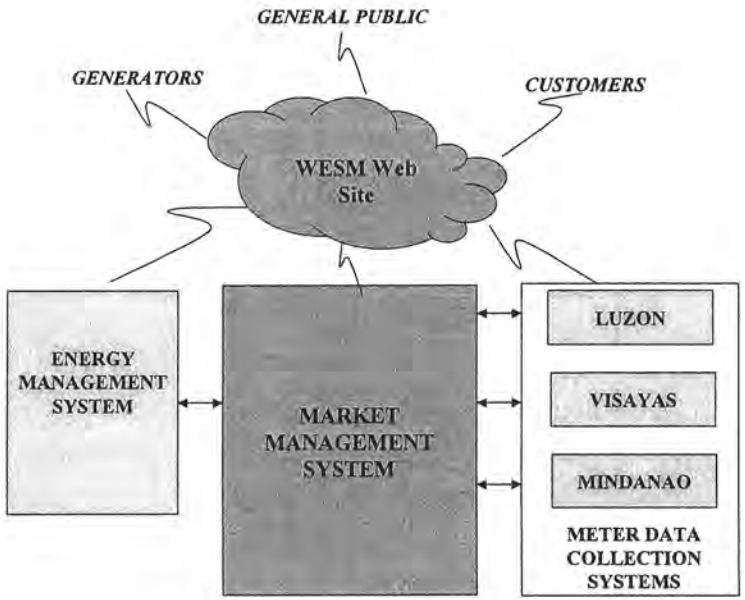


**Figure 1-1: Infrastructure Components for the WESM**

The Transco has prepared the requirements for the Market Management System and those portions of the Communications Infrastructure required for interfacing with Trading Participants as shown in Figure 1-1. Changes required to the existing Energy Management System and the Meter Data Collection Systems will be implemented under separate contracts.

## *1.2 Market Management System (MMS)*

The MMS shall include functions and capabilities required by the MO to meet all the obligations of the Market Rules. These include:





- Processing of Offers and Bids for supplying and purchasing electricity throughout the Philippines;
- Directing the dispatch of power based on a Security Constrained Dispatch Algorithm;
- Processing of metered data collected from the trading nodes;
- Calculation of final prices for all the power generated and sold in the WESM;
- Providing oversight on market activities to ensure fair and ethical operation of the WESM.

The MMS system architecture shall be based on a distributed, open-system design, in an open wide-area network, based on industry standards, and the secure use of Internet technology and capabilities.

Shown below is a representative block diagram of the MMS within the overall market operations system.

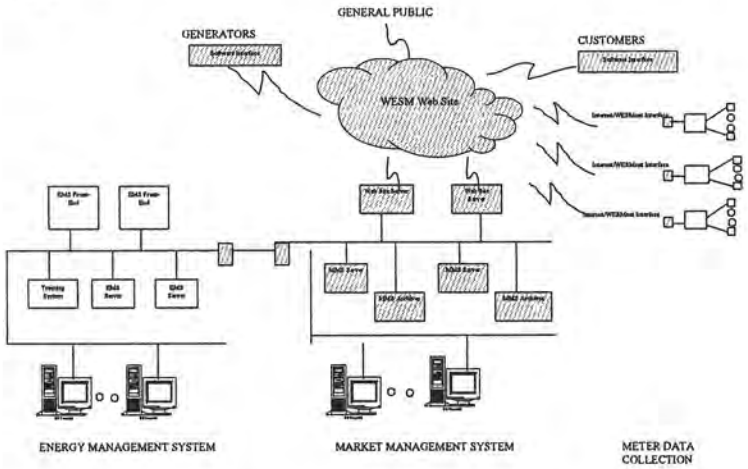


**Figure 1-2: Overall Market Operations System**

## 1.3 Interim Market

A number of project constraints such as the level of initial funding and tight schedule makes it prudent to establish an Interim Market that will include a minimal level of the required functionality of the WESM. The Interim Market will be supported by an Interim-MMS, referred to as the IMMS. The Interim Market will have the following attributes:

1. The minimal functionality required for starting the Interim electricity market shall be completed and tested by the date specified in the BDS and SCC in Volume I.
2. Audit trails shall be provided, employing a combination of automated and manual actions.
3. Trading Participants' Settlements functions shall be supported in the IMMS, with manual production of invoices. Automated links to the Market Operator accounting system can be deferred until the Final MMS is available.
4. The number of nodes for nodal pricing calculations will be minimized in order to minimize data handling to a manageable level.
5. A merit order dispatch "stack" shall be generated by the IMMS and presented to the SO via the Market Operator interface. The dispatch mechanism shall generate separate "stacks" for energy and ancillary services.
6. The trading interval of the Interim Market shall be one hour, and the dispatch interval shall also be one hour for the IMMS. However, the IMMS design shall provide the flexibility to change the dispatch interval to 5 minutes (or a user specified time interval which is a multiple of 5 minutes), as dictated by the needs of the SO.
7. The ancillary services stipulated in the Market Rules will be procured through fixed contracts.
8. The load forecasts generated by SO will be based upon the existing NPC load forecast procedures.
9. Meter data will be supplied initially by the MV-90 collection site for Luzon, Visayas, and Mindanao regions. The meter data shall be "settlement ready", although some of the underlying data may be entered manually into MV-90.
10. The SO and MO systems will be located physically at the existing NPC control center, but their market operations will be decoupled with access restrictions.
11. The IMMS will support WESM operations for Luzon, Visayas and Mindanao regions.
12. The IMMS shall be designed and structured such that it can have a smooth transition to the Final MMS. The IMMS shall be adaptable for migration to the Final MMS.
13. The IMMS shall contain a majority of the functions of the Final MMS. The intent is to utilize a majority of the IMMS software in the Final MMS.





## 1.4 Phased Implementation of MMS

As mentioned in the previous section, system implementation and commissioning of the MMS will be in two phases:

1. Interim Market Management System (IMMS) – This system, to the maximum extent possible, will be based on readily-available product offerings with modifications and extensions to meet minimal level of required functionality for market operations. The Transco will utilize this system for market start by the stipulated target date.

   A procurement contract will be awarded for the IMMS.
2. Final Market Management System (MMS) – The final delivery to the Transco will be a full-function market management system, meeting all the requirements for market operations in accordance with the market rules. The MMS will be fully integrated with EMS, Meter Data Collection Systems and Communications Systems, and will provide the Transco the functions and capabilities to efficiently support an expanding market.

   The Bidder of the IMMS is required to submit an optional bid to furnish and deliver the Final MMS. The Purchaser shall have at least eight (8) months to exercise this option. All the terms and conditions of the IMMS procurement will be also applicable in the bid procurement to the Final MMS.

This Volume II of the Bidding Document details the requirements for an IMMS. In formulating the concept of the IMMS, the Transco has elected to relax the overall system requirements in a number of areas (of the Final MMS) during the initial period of market operation, in order to meet the project deadline. This is done recognizing that the IMMS may be upgraded or replaced within a relatively short period of time. Areas where the Transco has elected to relax the requirements are:

- Extension – Sizing requirements are only for the Interim Market. Extension will have to be made for the Final MMS. There will be no provision for disaster recovery and no comprehensive archive and restore functions.
- Expansion/Scalability – The IMMS should be designed for immediate upgrade. The IMMS will preferably serve as a "stepping stone" to the final system.
- User Interface – The input-screens shall be similar to those required for the final market in the Final MMS to limit the amount of re-education. As far as the information provision to the participant is concerned, the interface shall be a subset of the final design, providing basic information and instructions
- User Accommodation – The IMMS shall support and facilitate significant manual entry of data. This can be accomplished via manual input to input-screens of the IMMS.

Hence, it is to be emphasized that all the technical requirements and functional features stipulated for the IMMS in this Volume II shall be regarded as "mandatory", since Transco has already relaxed the requirements in order to start the IMMS.

It should be noted that, for the IMMS, the requirements for system reliability and availability, the security and integrity of the data contained within the IMMS, and the accuracy of the optimization algorithms to be used for market applications, shall meet the same rigorous requirements and standards as the Final MMS. In the Interim Market, the Transco will provide the Market Audit and Market Surveillance functions manually to ensure that these requirements are met.

Table 1-1 below shows a comparison of high-level functional requirements between the IMMS and the Final MMS.

**Table 1-1: Functional Requirements of IMMS Versus the Final MMS**

| Function | IMMS | Final MMS |
|---|---|---|
| **Registration** | Manual | Electronic |
| **Bid Management** | Supply Offers<br>Limited Re-bids<br>Back up bidding | Supply Offers<br>Re-bids<br>Back up bidding<br>Demand Bids<br>Ancillary Service Bids |
| **Variable System Data** | Manual Load of Demand Forecasts<br>Manual Load of Reserve Requirements<br>Manual Load of Constraints | Auto Load of Demand Forecasts<br>Auto Load of Reserve Requirements<br>Auto Load of Constraints |
| **Standing System Data** | Fixed Regions / Nodes<br>Fixed CPs<br>Fixed Market Fees<br>Fixed VoLL<br>Fixed Inter-connectors<br>Fixed Timetables | Maintain Regions / Nodes<br>Maintain CPs<br>Maintain Market Fees<br>Maintain VoLL<br>Maintain Inter-connectors<br>Dynamic Network Model<br>Maintain Timetables<br>Report Status<br>Auto C.P. Data Update |
| **Expected Conditions** | No Expected Conditions Forecast | Expected Conditions Forecast |
| **Pre-Dispatch** | Hourly Pre-Dispatch*<br>Ancillary Service Scheduling and Coordination | Hourly Pre-Dispatch*<br>Determine Ancillary Service Requirements<br>Forecast Reserves |


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| Function | IMMS | Final MMS |
|---|---|---|
| **Dispatch** | 60 minute dispatch<br>Solve on limited Nodal Basis<br>Manual Constraints<br>Ancillary Service Scheduling and Coordination | 5 minute Dispatch*<br>Solve on full Nodal Basis<br>Dynamic Constraints<br>Co-optimized for Ancillary Services<br><br>Output regulation requirements to AGC |
| **Dispatch Monitoring** | Resource stack listings outputted to SO to be manually entered into EMS and/or dispatched with conventional methods | Record Dispatcher Instructions<br>Validate Dispatcher Instructions<br>Record Non- Conforming Units |
| **Metering** | Manual Load of Meter Data | Automatic Load of Meter Data<br>Meter data Warehouse<br>Data Reporting<br>Meter Transfers<br>Meter Administration |
| **Reports** | Limited General Reports<br>Confidential Reports | General Reports<br>Confidential Reports<br>Ad-Hoc Reports |
| **Participant Interface** | Offer Creation<br>Offer Submission<br>Price Reporting<br>Reports<br>Market Notices | Offer & Bid Creation<br>Offer & Bid Submission<br>Price Reporting<br>Reports<br>Market Notices<br>E-mail<br>Help |
| **Settlements** | Calculate Trading Amounts<br>Calculate Excess Energy Prices<br>Handle Market Fees<br>Fixed Billing Calendar<br>Generate Reports/Statements<br>Maintain Dispute Details<br>Manual Prudential Processing<br>Manual Participant/Market Suspension<br>Adjust manually for VoLL | Calculate Trading Amounts<br>Calculate Excess Energy Prices<br>Handle Market Fees<br>Maintain Billing Calendar<br>Generate Reports / Statements<br>Maintain Dispute Details<br>Automatic Prudential Processing<br>Manage Participant / Market Suspension<br>Adjust for VoLL<br>Adjust for Administered Price / Force Majeure<br>Handle Ancillary Services<br>Online Historic Re-Runs |
| **General** | Auditing | Auditing<br>Disaster Recovery<br>Archive / Restore<br>Management Reporting<br>Full Integration of SCADA / EMS and MMS<br>Full integration of MMS and Metering Systems |


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As noted, this Technical Requirement (Specification) is for the IMMS. Tables have been included at the beginning of each major section to provide the Bidders with a high-level comparison of the requirements between the IMMS and the Final MMS. The information in these Tables is intended only to assist the Bidders in understanding the differences between the IMMS and the Final MMS.


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# 2.0 MARKET ADMINISTRATION

The Wholesale Electricity Spot Market (WESM) will function under the direction of the Market Operator (MO). The MO will be responsible for Market Administration as defined by the Final Market Rules for the Interim Wholesale Electricity Market. . The Market Administration functions include the ones required to capture and maintain all the data pertaining to the market operations.

The focus of Market Administration in the Interim Market Management System (IMMS) is to provide effective tools for collecting and maintaining market data in a simple and yet secure manner. Table 2-1 below summarizes the differences in general administrative functions to be included in the IMMS and in the Final Market Management System (MMS).

| Function | IMMS | MMS |
|---|---|---|
| Participant Registration | | |
| • Data Submittal | Manual | Electronic |
| • Data Entry | Manual | Electronic |
| • Data Recall | Manual | Automated |
| Market-Structure Data Maintenance | | |
| • Regions/Nodes | Fixed | Updated as Needed |
| • Fees | Fixed | Updated as Needed |
| • Timetable | Fixed | Updated as Needed |
| Reports Preparation and Output | Pre-formatted | Tailored/Ad hoc |
| Audit | Manual | Automated |

**Table 2-1: General Administrative Functions**

## 2.1 General

The Contractor shall provide a complete set of user-friendly functions and tools to facilitate the administration of the market. The market administration functions to be supported are:

1. Participant Registration;
2. Data Management;


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3. WESM Audit;
4. WESM Surveillance; and
5. WESM Security.

The requirements are described in the following subsections.

## 2.2 Participant Registration

All Participants in the WESM must be officially registered with the MO. The specific Participants defined by the Market Rules are:

- Market Operator;
- System Operator;
- Network Service Providers;
- Ancillary Service Providers;
- Metering Providers;
- Generators; and
- Customers.

Individual companies can qualify to be Participants in more than one category as defined by the Market Rules. Each category will require a separate registration. While all of the above are classified as Participants, only the Generators and the Customers are designated as Trading Participants (TP).

### 2.2.1 Registration Process

The IMMS shall provide the capability to receive and process Participant Registration applications. Screen forms specifically designed for this purpose shall be provided to facilitate the inputting of Registration data.

In the Interim Market, the actual inputting will be done by the MO manually. Once the forms are submitted by a Participant, the MO will review the forms for completeness and prepare the Participant registry entry. The default registration status shown on the screen shall be "Applied".





The MO will be responsible for verifying all information submitted, including prudential information, and determining that the registration is in accordance with the Market Rules. Based on this review, the MO will change the status of the submittal from "Applied" to "Active".

### 2.2.2 Registration Information

The IMMS shall support the collection, maintenance, and management of basic information from all Participants, including their categories, the registration of users and their roles and access levels, together with company aliases, associations and agents. Such registry information shall include:

1. Company (Entity) Name – The identification to be used by Participants.
2. Company (Entity) Address – The mailing and legal addresses for the Participant.
3. Participant Identification Number – A separate field for each individual Participant, with number to be assigned by the MO.
4. Primary Contact Information – Participant's primary contact for all matters related to the WESM. Data shall include name, title, responsibilities, telephone numbers, fax, e-mail addresses, and mailing address.
5. Alternate Contact Information – Provision shall be made for four alternate contacts with all supporting data.
6. Participant Category: - Specific category as defined by the Market Rules. Note that individual Participants may be registered in multiple categories. The IMMS shall support user access to all information, by either Participant Category or by Participant Name.
7. Registration Status – The registry shall support the designation of the Participant's status within the WESM as either Applied, Active, Inactive, Suspended or Withdrawn.

### 2.2.3 Detailed Qualifications

The individual Participants must also submit qualification information and data specific to the categories for which they are applying to register. These data will be reviewed by the MO and if approved shall be included in the Participant registry. The data required include:

70 ***A. For the Market Operator***

| Technical: | Commercial: |
|---|---|
| – Trading zones<br>– Trading zone assignments<br>– WESM timetable and functions<br>– Registry of IMMS users<br>– Participant list by category/class | – Market fees<br>– Prudential requirements and rules<br>– Active participant list |

71 ***B. For the System Operator***

| Technical: | Commercial: |
|---|---|
| – Dispatch procedures<br>– Operating criteria<br>– Operating requirements<br>– Emergency procedures | – System operation charges<br>– System performance standards |

72 ***C. For the Network Service Provider (Transmission)***

| Technical: | Commercial: |
|---|---|
| – Substation details<br>– Transmission details<br>– Transmission constraints<br>– Connection point registry | – Transmission contract<br>– Transmission tariff<br>– Interconnection agreements |

73 ***D. For the Network Service Provider (Distribution)***

| Technical: | Commercial: |
|---|---|
| – Load substation details<br>– Embedded power plants<br>– Connection points | – Prudential details<br>– Interconnection agreement<br>– Metering arrangement |

74 ***E. For the Metering Provider***

| Technical: | Commercial: |
|---|---|
| – Meter registry<br>– Metering details | – Metering fee<br>– Metering standards |

75


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75 ***F. For the Trading Participant (Generators and Customers)***

| Technical: | Commercial: |
|---|---|
| – Load substation details<br>– Power plant details<br>– Connection point details | – Prudential details<br>– Bilateral contract<br>– Metering arrangement |

76 ### 2.2.4 Suspension/Withdrawal of Participation

77 Provision shall be made to facilitate and support changing the status of a TP from "Active" to
78 either "Suspended" or "Inactive". The MO will manually change TP status based on:

79 • Suspended – Failure to maintain a viable economic status or a violation of the
80 Market Rules;
81 • Inactive – Written notification request made by the Participant to the MO to
82 temporarily or permanently withdraw from participation in the WESM.

83 Reinstatement of the TP to the "Active" status shall only be done manually by the MO.
84 Automated means for proper checking of authority to change and proper record keeping shall be
85 provided in the IMMS.

86 #### 2.2.4.1 Market Suspension Data

87 The IMMS shall automatically maintain information on the start and end periods of each market
88 suspension and the reasons for suspension. Limited manual process will be acceptable, in which
89 certain data will be created and maintained by the MO. Data will be updated only if the market is
90 suspended. The data shall include:

91 • Unique identifier for suspension;
92 • Start date of suspension;
93 • Start of the trading interval of suspension;
94 • End date of suspension;
95 • End of the trading interval of suspension;
96 • Reason for suspension;


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- User authorizing the start;
- User authorizing the end;
- Regions affected; and
- Last date and time the record was changed.

The IMMS shall provide the means for the MO to enter the specified data.

## 2.3 Data Management Function

All data supplied to the MO as part of the registration process shall be stored and maintained in the IMMS Database as Registered Data.

### 2.3.1 Registered Data Structure

Only one data structure shall be utilized for Registered Data. The structure will be defined by the Contractor and approved by the MO.

### 2.3.2 Participant Data Tables

Registered Data shall be made up of all data types listed in Section 2.2 above for each Participant category. The Contractor shall define each type in detail as part of the data submittal to the MO for Registered Data structure.

#### 2.3.2.1 Regions

The WESM will include all three regions - Luzon, Visayas, and Mindanao. The information on the regions shall consist of:

1. Region identifiers (IDs);
2. Region names; and
3. All Market Trading Nodes within a Region.





#### 2.3.2.2 Market Trading Nodes

Market Trading Nodes or connection points are those points on the power system at which Generators supply energy to the system and customers consume energy. The IMMS shall initially allow for appropriate number of market trading nodes per region. It is anticipated that initially, Luzon region will have 250 trading nodes, Visayas region will have 150 trading nodes, and Mindanao region will have 100 trading nodes. Data regarding these nodes shall include:

1. Market Trading Node ID;
2. Market Trading Node Region
3. Node Name or reference designation;
4. Type of Trading Node;
5. Trading Participant; and
6. Meter Service Provider.

#### 2.3.2.3 Market Fees and Pricing Data

Market Fees are necessary to enable the MO to recover the expenses of operating the market. Market Fees can take various forms and the rates that are applied to organizations will be based on their market activity. Market Fees can change only after consultation with the necessary authorities, and as such will not be revised very often. Based on this, it is planned that the MO will manually enter and maintain the Market Fee rates. The IMMS shall facilitate this process via user-friendly manual entry and maintenance of the fees.

The IMMS shall initially support the following five types of fee and pricing data:

1. Registration;
2. Annual administration;
3. Transmission tariffs;
4. Ancillary services;
5. Settlements; and
6. Undefined.

The Settlements Fees that are payable by the affected TP shall be included in the invoices issued at the end of each billing period as part of the Settlements process. It is expected that an annual administration fee will be invoiced separately to all TPs and it will not be amortized over a calendar year. To support the application of different types of market fees, the IMMS shall support: the ability to record and maintain Market Fee definitions, and to record market fee values.

#### 2.3.2.4 *Generators*

The IMMS shall have provisions to allow a TP to aggregate certain physical units (scheduled generation) into single "dispatchable" unit after the MO is satisfied that the following conditions are met:

1. The units are assigned to the same Trading Node;
2. The units are owned and operated by a single TP;
3. Power System security will not be compromised in any way by aggregation;
4. Communication protocols between the MO and the units satisfy the Market Rules; and
5. Metering systems satisfy the Market Rules.

The Contractor shall provide the functions needed for the registration and storage of standing data of all dispatchable units. This includes all the physical units and all the aggregated units. There shall be a unique Dispatchable Unit identification (ID) for each of the approved dispatchable unit.

TPs must submit and maintain the unit standing data for all dispatchable generation and load within their control. Unit standing data is data that does not require frequent modification. The following information shall be maintained by the IMMS for each generating unit:

1. Identity of the organization responsible for the unit;
2. Unit type, e.g., generator or dispatchable load;
3. Registered rating capacity of each physical unit;
4. Unique identity of each physical unit;
5. Registered capacity of dispatchable unit (MW);


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6. Unique identifier of Dispatchable Unit - determined after approval of aggregation by the MO;
7. Region in which the unit is located;
8. Start type flag, e.g., fast or slow start unit;
9. Unit Data from the Energy Management System;
10. Operating limits;
11. Unit governor ramp rate;
12. Unit forbidden operating zones;
13. Unit AGC ramp rate;
14. Cold startup time;
15. Shutdown time;
16. Connection point details;
17. Date and time of submission; and
18. Unique file number for version control.

#### 2.3.2.5 *Customer Loads*

Participants applying to be classified as Customers must provide detailed information on the load(s) they represent as well as the proof of eligibility, in accordance with the Market Rules. These data shall be stored in the IMMS.

The following information shall be maintained in the IMMS for each load of each Customer:

1. Identity of the responsible organization;
2. Load Size – Minimum to Maximum;
3. Load Characteristics –load curves per connection point;
4. Connection Point Details;
5. Date and Time of submission;
6. Physical/electrical location of load; and
7. Unique file number for version control.

#### 2.3.2.6 *Bilateral Supply Contract Data*

The following data shall be maintained in the IMMS on bilateral supply contracts:


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1. Contracted capacity;
2. Load connection point;
3. Generator connection point;
4. Load characteristics;
5. Contract effectivity; and
6. Transmission service arrangements.

#### 2.3.2.7 *Metering Data*

Participants applying to be classified as Metering Services Providers must provide proof of qualification as evidenced by a current valid license from the Government, proof of responsibility for each metering point for which it is applying, and the conformity of metering installations to Grid Code requirements.

The following information shall be maintained in the IMMS for each Metering Service Provider:

1. Identify of responsible organization;
2. List of Metered Points by Market Trading Nodes;
3. For each Market Trading Node, Direct Links to the Metering Register and Installation Data contained in the Metering Database;
4. Date and time of submission; and
5. Unique identifier for version control.

The IMMS shall provide functions to allow TPs to change their metering agent at any time by notifying the MO. TPs will inform the MO about the identity of the new metering agent, and the date and time from which the appointment will be effective. In such instances, the MO will notify both the old and new Metering Agents of the change request. The system shall record the following:

1. Unique version number for this transaction;
2. Trading Participant's ID;
3. Both Metering Agents' Ids; and
4. Effective date and time of new Metering Agent's appointment.





#### 2.3.2.8 *WESM Timetable*

Successful operation of the WESM will require close coordination among all Participants, accurate forecasts of both load and generation, and the energy offers and bids. The information submitted to the MO by all Participants, the cutoff times of Offers/Bids for each Trading Interval, the times at which the Market Optimization algorithm shall be run, and the times for the publication of Settlements data will all be in accordance with the Timetable established by the Market Rules. Such time parameters shall be maintained in the IMMS.

The Timetable shall include the time-dependent definitions for all the IMMS functions:

- Registration*;
- Offers/Bid Processing;
- Information Submitted;
- Dispatch Interval;
- Metering (data transfer); and
- Settlement.

(*Registration is included since there will be times when the Participant and the MO will be bound with respect to the provision and approval of information.)

The Timetable shall contain the following item types. Note that this list is representative and will be updated based on the latest release of the Market Rules Timetable.

- Time for receiving Offers and Bids for Energy and Reserves;
- Time for receiving other data required for Dispatch;
- Day-ahead and week-ahead projections;
- Pre-dispatch and dispatch runs of the Security Constrained Dispatch Algorithm;
- Trading Intervals;
- Meter data collection intervals;
- Preparation of Settlements;
- Payments; and
- Other parameters to be defined later.

### 2.3.3 Updating Registration Information

The IMMS shall enable authorized users to update certain fields of the Participant register.

All details of the update actions shall be tracked for audit purposes, with at least the User ID of the person modifying the record, date/time stamp, location, etc. The Contractor shall provide features to update and record the updating of the following data:

1. Organization (company) details;
2. Electronic Funds Transfer (EFT) details;
3. Credit limit details;
4. Organization type details;
5. Organization status details;
6. Control details;
7. Contact type details;
8. Contact address details; and
9. Contact number details.

The updated organization register records will be entered into the IMMS database and tracked for audit purposes. Archived records for audit purposes shall record details of the user updating the entry along with a date/time stamp.

Among the tasks which must be accommodated are:

1. Change of Participant status from inactive to active*;
2. Entry of notes regarding individual Participants*;
3. Update of contact information for individual Participant;
4. Update of information regarding a specific company, a global change;
5. Change of generating capability or load; and
6. Update of standing data in the Participant data tables (Item 2.3.2).

(*Restricted to the MO.)

In all cases, the IMMS shall process the change requests in the same manner as that of the initial registration submittals, flagging any errors or omissions. In this instance, however, the MO shall


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have the ability to correct the detected errors or reject the changes made by the Participant. An audit trail of all activities shall be created and maintained.

### 2.3.4 Data Access, Reports and Publication

The Contractor shall support all reports and data publication.

#### 2.3.4.1 Data Access

The Contractor shall support the data access of Participants depending on their access level.

#### 2.3.4.2 Reports

The Contractor shall prepare recommended reports for MO approval. These shall include:

- Participant Summary;
- Generators throughout the market;
- Customers throughout the market;
- Market Trading Nodes; and
- Summary of Trading Participants.

#### 2.3.4.3 Data Publication

The MO will have the responsibility to publish information regarding the WESM and market operations, both periodically and on request. The publications will be for government agencies and for general public distribution. The Contractor shall support the preparation of these reports with user-friendly tools.

## 2.4. WESM Audit

Audit of the WESM has been mandated by the Final Market Rules for the Interim Wholesale Electricity Market, and shall be accommodated in the IMMS. All functions and processes


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executed in the IMMS shall include audit trails that are maintained automatically by the IMMS and made available to authorized users.

### 2.4.1 Market Auditor

Access to audit functions for maintenance, revision or review shall be at the appropriate level of authority depending on the functions performed.

### 2.4.2 Audit Capabilities

The Market Auditor shall be able to access all data collected in the IMMS for this purpose, utilizing the tools provided by the Contractor. The detailed requirements for audit data are included in the functional requirements for each process. The Contractor shall provide a listing of all audit information including system administration, registration, market operations, metering and settlement.

### 2.4.3 Prudential Assessment

The IMMS will not have the capability to assess the prudential position of TPs since automated metering will not be available at the start of the market (during the Interim Market). However, there shall be a requirement to verify and log prudential instruments and support the audit trail of all prudential data submitted by Participants, both current and historical. Audit shall include data regarding submittals, time-tagged, and names of individuals submitting these data.

The prudential (financial) assessment will be determined manually based upon the balance of the financial instruments lodged and unallocated so far against the calculated obligations that are based on cost of energy used, transmission fees, or ancillary service costs together with estimated projections between now and the next prudential assessment.





### 2.4.4 Audit Reports

The IMMS shall include formatted audit reports with the delivery of the system. The format and content of the reports shall be reviewed and approved by the MO. The capability to prepare additional reports and to modify the default reports based on Market Audit requirements shall be provided with the IMMS.

## 2.5 Market Surveillance

The Market Rules define the need for a Market Surveillance Committee to support the Board in overseeing the Market, specifically with regard to the activities and status of Participants. The Contractor shall ensure that all 'material' data is tracked within the system so that it can be made available to support the Committee in carrying out this work.

### 2.5.1 Data Access

The Contractor shall provide tools to support the Surveillance Committee access to all data related to Participants and their activities. These include registration, prudential, offers/bids and settlements data. The Contractor shall provide a user-friendly interface and appropriate access authorization.

### 2.5.2 Audit Data

Tools shall be provided to enable the Surveillance Committee to have equal access to all audit information, including the activities of the Audit Function.

### 2.5.3 Data Collection and Reports

The Contractor shall provide user-friendly tools that allow the Surveillance Committee to build reports incorporating the data described above, and to produce hard copies of these reports.

## 2.6 WESM Security

Security of the WESM is an overriding concern of the MO and the Government. This is reflected by the establishment of a Market Auditor and Market Surveillance functions in the Market Rules. The concern for security is with regard to protection from outside intervention, and assurance of data integrity throughout the WESM.

### 2.6.1 WESM E-Commerce

The Specification Section includes specific requirements for ensuring security of data exchanged via WESM E-Commerce.

### 2.6.2 Data Links

All data links between and among systems shall utilize full security provisions of the selected protocols. These provisions shall be specifically tested during system integration and again during factory acceptance tests.

### 2.6.3 IMMS Internal

The full security provisions of all hardware and software utilized in the IMMS shall be invoked in system implementation, and thoroughly tested and demonstrated during factory acceptance tests. Emphasis will be on integrity of the databases, from data collection to archives.


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# 3.0 MARKET OPERATIONS FUNCTIONS

Operation of the Wholesale Electricity Spot Market (WESM) in real-time will require close collaboration between the Market Operator (MO) and the System Operator (SO). The MO will administer the spot market in accordance with the Final Market Rules for the Interim Wholesale Electricity Market. The SO will dispatch energy according to the requirements of the MO, and will maintain the security and reliability of the electric network. The Interim Market Management System (IMMS) shall provide all the functions and capabilities required to carry out these operations.

The IMMS shall include functional features to enable trading participants to submit and process Offers and Bids. The following table summarizes the comparison of the Market Operations functions between the IMMS and the final Market Management System.

| Function | IMMS | MMS |
|---|---|---|
| Bid Management | | |
| • Offers & Bids | Automated (offers only, no bids) | Automated |
| • Re-submittals | Automated | Automated |
| • Demand Bids | Not Applicable | Automated |
| • Ancillary Services | Not Applicable | Automated |
| System Data | | |
| • Network Conditions and Constraints | Manual Entry | Automated |
| • Load Forecast | Manual Entry | Automated |
| • Ancillary Services Requirements | Not Applicable | Automated |
| Dispatch Runs | | |
| • Pre-dispatch | Hourly | Hourly |
| • Dispatch | Hourly | Five Minutes |

The scope of IMMS functionality for market operations depicted below, shall include:

a. Validating and processing bids, offers, and congestion data;
b. Executing market optimization analysis; and
c. Providing dispatch instructions to the SO for each trading interval.

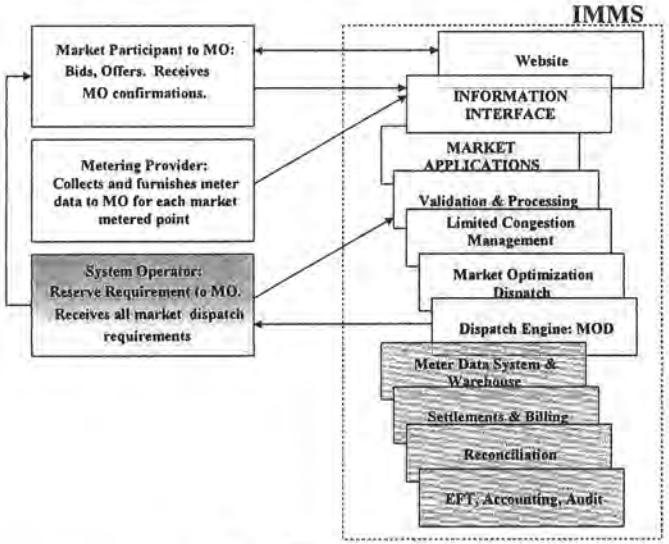


**Figure 3-1: Scope of IMMS Functionality**

Real-time SCADA data will not be transferred directly from EMS to MO during the IMMS phase since the new EMS will not be available and there will not be functional modeling to provide dynamic congestion management. There must be provision for that interface, but it is unlikely that it will be functional during the IMMS phase. Congestion data and required path data will be transferred as prescribed by IMMS supplier, probably through high priority batch mode file transfer.

## *3.1 Offers/Bids Processing*

Generators and Customers shall be able to process offers and bids for both energy and reserves entirely within the IMMS.





### *3.1.1 Offers/Bids Submittal*

The Contractor shall structure the forms to enable TPs to prepare offers and bids for energy and reserves. The TPs shall be able to submit the offers and bids to MO via the Web based interface. Ancillary service, although contracted, must still be processed by and reported through the offer process. The estimated reserve requirements must be manually entered for each region for each day.

The forms shall provide the capability to include the following information:

1. Generator Offers
   a. Must include the plant name, unit ID(s), location of the connection point and relevant network node;
   b. Must include the Generator Pricing Zone;
   c. May include up to 10 blocks of energy offer per (aggregate) unit;
   d. Must be for a minimum block size;
   e. Must have monotonically increasing prices, starting from zero generation;
   f. May include negative prices but these are limited by the market price floor and market price cap;
   g. Must include maximum up and down unit ramp rates;
   h. Must include a validity period of offers (e.g., valid for a specified period or valid until the offer is revised);
   i. May include a "forbidden operating zone" if applicable; and
   j. Must include an operating range (upper and lower limit).
2. Regulation Reserve Offers
   a. Must include the plant name, unit ID(s), location of the connection point and relevant market network node;
   b. Must include the Generator Pricing Zone;
   c. Up to 3 reserve offer blocks per aggregate unit (MW/block);
   d. Must have monotonically increasing prices from zero to the first offer block, which shall correspond to the mandatory reserve capability required from that Generator under its connection agreement;
   e. Must include up and down governor ramp rates (primary regulation);
   f. An AGC ramp rate up and down (secondary regulation);

g. Must include a validity period of offers (e.g., valid for a specified period or valid until the offer is revised);

h. May include a "forbidden operating zone" if applicable;

i. Must include an operating range (upper and lower limit);

j. A maximum response level up and down for the relevant reserve category (MW); and

k. A minimum and maximum energy dispatch level (MW) at which any regulation reserve response will be available (MW above and below preferred operating point);

3. Customer Reserve Offers (Re-dispatchable Demand)

a. Load ID and Customer Pricing Zone

b. A maximum response level for the relevant reserve category (MW);

c. A maximum proportion of the forecast load which may be interrupted;

d. Up to 10 reserve offer blocks (MW/block);

e. A minimum block size;

f. Monotonically increasing prices;

g. Must include validity period of reserve offers; and

h. Must represent a certified dispatchable load.

4. Customer Bids (Certified Demand Bids): During the interim market, demand side bidding is discretionary.

The following diagram depicts the data flow of Offers and Bids in the context of overall data exchange.





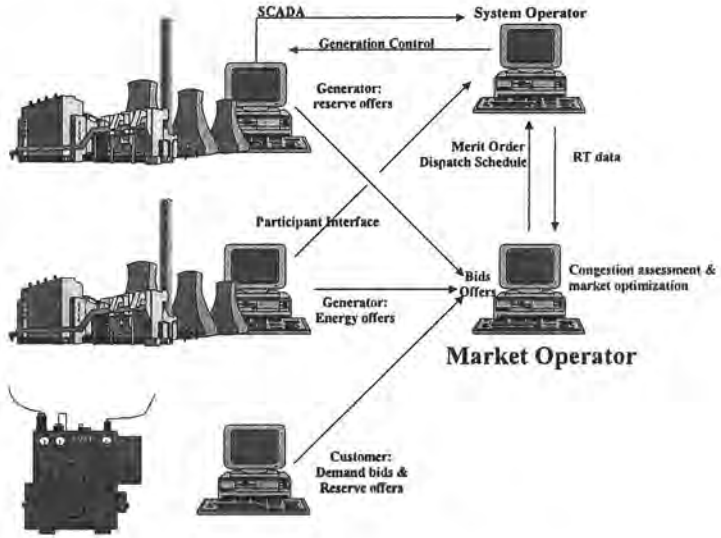


**Figure 3-2: Data Flow of Offers and Bids**

### 3.1.2 Review Process

The Contractor shall provide functions in the IMMS for the automatic validation of submitted offers/bids, in accordance with the Market Rules. The Validation shall be thorough and accurate since the dynamics of the WESM do not allow time for manual intervention in the validation process.

Validation features shall include:

1. Validity of registration/certification of the commodity that is bid or offered;
2. Validity of submittal in accordance with Timetable;
3. Reasonability of Submittal, where data falls within the parameters of Standing Data (Examples include but are not limited to: Maximum capacity, governor ramp rates, maximum dispatchable load values, physical location by pricing zone and node, status of unit or load dispatch, availability from outage scheduling data, cold start-up times, total

bids/offers in all commodity categories does not exceed total available capability, and ability of authorized MO personnel to adjust the "bandwidth" or trigger points for each data type). Detailed examples of items to be checked are included in the following Table.

| Item | Examples Of Reasonability Checks | User-enterable Trigger Points |
|---|---|---|
| 1 | Value offered/bid is greater than maximum capacity of unit or load | >1MW Δ |
| 2 | AGC or governor ramp rate offered is greater than AGC ramp rate certified | >0.1-0.5 MW/min Δ |
| 3 | Total of commodities offered/bid in all market categories (incl. reserve) exceeds the total available capacities of cited resources | >0.5-2MW Δ |
| 4 | Units, physical location, pricing zone are correct | No tolerance |
| 5 | Fields required for all submittals are completed | No tolerance |
| 6 | Fields required for commodity offered/bid are completed | No tolerance |
| 7 | Resource offered is not available per outage scheduling data [override by MO provided] | No tolerance |
| 8 | Generation availability for units off line are sooner than cold-start data timing | >5-50 minutes Δ |
| 9 | Dates and times and cited market periods submitted are within WESM Rules regarding submittal | No tolerance |

4. Consistency of Submittal (Submittal in full compliance with MO Rules);
5. Consistency with Published Market Information (MO and SO procedures and orders); and
6. Prudential processing – to be performed manually on a daily basis.

### 3.1.3 Approval/Re-submittal

The Contractor shall provide functional features to process all submittals of offers and bids, and provide acknowledgements (positive or negative) to the TP in a timely manner. IMMS shall be capable of providing an automated response to the submitting TP at the time of processing, indicating acceptance or rejection. Rejection notification to TPs shall include the reason for rejection. The IMMS shall be capable of accepting re-submittals in accordance with the Timetable.





## 3.2 Information Submittal

The Contractor shall provide features to enable the SO to forward to MO additional information beyond the offers and bids, in accordance with the market Timetable. The types of additional information required by the MO from the SO shall include the following.

### 3.2.1 Network Status

The network model for the electrical system will be created and maintained in the EMS. The EMS shall transmit the initial network model in an industry-accepted format, and thereafter shall transmit each major change to the network.

### 3.2.2 Outage Schedules

The SO will have responsibility for maintaining all system outage schedules in the EMS, and submitting them to the MO. Outage schedules requested by MO shall be submitted daily to the MO for review. The schedules shall be forwarded to the MO in accordance with the Timetable.

### 3.2.3 Transmission Constraints Considerations in the Interim Market

The SO has the responsibility for monitoring and ensuring the security of the electric system through compliance with Market Rules. The SO will periodically run network security programs off-line, and the results (for each trading interval) will be input to IMMS. The Merit Order Dispatch stack (dispatch instructions) that originates from the IMMS will make use of this constraint data. The Contractor shall provide functions to enable the SO to forward a list of all transmission constraints to the MO for each trading interval.

Limited congestion management shall be accommodated in the IMMS, but the entry of congestion data shall be from tables that are calculated every four hours, and manual input of "real time" constraints. The systems shall include features to automatically process this congestion data in order to provide a limited level of co-optimization of demand and congestion.

### 3.2.4 Preferred Operating (Targets) Points

The SO will have the responsibility for executing dispatch in accordance with the MO Security Constrained Dispatch (SCD) instructions. Hence, the IMMS shall have the capability to enable the SO to implement the MO instructions as actual operating points for each generation unit.

### 3.2.5 Load Forecast

The load forecast data required by the IMMS will be furnished by the SO to MO. The function shall provide forecasts at a regional level, and at each market trading node of the regions. The data, on an hourly basis for a rolling window of 168 hours, shall be made available to the MO. It must come from the SO, perhaps from an off-line SDLF. IMMS cannot be used for forecasting as it has no model and no real-time SCADA data input from SO.

### 3.2.6 Initial Conditions

In solving for dispatch requirements, the dispatch algorithm will normally make use of the results from the previous dispatch interval as its initial parameters. The IMMS shall be capable of supporting the manual entry of initial system conditions, as determined by the SO and the MO.

## 3.3 The Dispatch Process

The Contractor shall deliver a market scheduling and pricing software that is capable of providing a Day Ahead Projection and a Week Ahead Projection to meet the Pre-Dispatch requirement, and the price and schedule for a Real-Time Dispatch market.

The pre-dispatch process and the real-time dispatch process shall have the following features:

- The pre-dispatch process shall have a Day Ahead Projection which represents 24 individual periods (23 or 25 for daylight savings changes as applicable), each of a duration of 1 hour. The Week Ahead schedule produced shall represent the state of the system at the end of each 1-hour period;


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- The pre-dispatch projections shall have starting conditions given by the current state of the plant, with the ending state for each subsequent hour representing the starting state for the following hour;
- The Real-Time Ex Ante Dispatch represents an individual period of 1 hour. The schedule produced shall represent the projected state of the system at the end of the 1-hour period; projection for the end of trading interval is made at the beginning of trading interval; and
- The Real-Time Ex Post Dispatch represents an individual period of 1 hour. The schedule produced shall represent the state of the system at the last system dispatch during the 1-hour period and with metered load at the end of the hour for that period.

In all modes, the schedule process shall take into account the actual generation and demand applied to the initial conditions in the previous trading interval as well as the forecast or target for the end of that trading interval, as estimated by the dispatch optimization performed prior to the beginning of that trading interval.

Tables 3-1, High Level Data Input Requirements for IMMS, and Table 3-2, High Level Data Output Requirements for IMMS, summarize the data required to run the market optimization dispatch and the results required for market operations. General data flow of the data exchanges for input and output are depicted in Flow Diagrams 3-3 and 3-4, respectively. Descriptions of the data exchange and interface requirements for the IMMS are contained in Section 5.

### 3.3.1 Inputs

The Contractor shall structure the forms and templates to accommodate the data input requirements included in Table 3-1, and the output results requirements described in Table 3-2.

All forms and templates shall be subject to approval by the MO. The IMMS shall also have the capability to support the manual entry of all data as a backup.


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**Table 3-1: High Level Data Input Requirement For IMMS**

*IMMS= interim market management system; TP= Trading Participant; SO= System Operator; EMS= energy management system (operated by SO)*

| Item | IMMS Data Input Description | Data Type |
|---|---|---|
| | **Offers & Bids, Required Data** | |
| 1 | Participant Identification | TBD |
| 2 | Validated offers from each valid Trading Participant for each trading period submitted: Each offer and bid shall be submitted using an approved MO template; Each template shall provide for the data field identified by this Data Input Table as defined by the following data field descriptions | All |
| 3 | Offers shall be date and time stamped received by MO: This will be the time used to determine validity with respect to allowed period for submittal | Date |
| 4 | Each Offer shall designate: Commodity type Identifier to include initial provision for: (1) energy, generation offer; (2) energy, customer demand bid (corresponding with dispatchable load) | Codes TBD |
| 5 | Commodity type offered/bid: Each template shall allow initially for up to twenty different commodity types, with provision to accommodate 24 trading periods in each 24-hour calendar day | Text & times |
| 6 | Commodity trading period to which submittal applies: Beginning and ending times for each commodity type in the specified trading period(s); default will use first entered submittal date for each time segment, unless flagged as standing bid | Times |
| 7 | Contractor shall provide for commodity trading period "standing offer" flag as allowed by WESM, with beginning date and time, and ending date and time for each commodity type | Code TBD |





| Item | IMMS Data Input Description | Data Type |
|---|---|---|
| 8 | **Fixed Contracts** Fixed Contract Data shall be submitted as contract tables in MO defined format including, but not limited to: TP name, registration number, contract type (code to be determined by MO), contract number or identifier, commodity type, contract effective date, contract expiration date, values and prices table, physical location of each plant/unit/load, connection point and associated node and pricing zone, limits/conditions restrictions; this input will be received and flagged; MO authorization and approval is required for implementation. Initially all ancillary services may be provided by Contract. | Various |
| | **Market Commodity Submittals** – All submittals for market commodities shall be based on Contractor-provided, MO-approved Forms and Templates; and processed in accordance with the following. | |
| 9 | Date and time submitted | Date |
| 10 | Energy, generation offer, unit specific: MW specified in each of 1-10 blocks, each block size must equal or exceed specified MW minimum value (user enterable), must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation, may include negative prices as allowed by WESM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable), must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal or less than that in the standing data, must include governor ramp rates up and down (each in MW/minute) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data | Various |
| 11 | Outage schedule requests by location/plant, equipment ID, time scheduled out/in, dates, related de-ratings or other impacts, with trailer information [process to be determined] | Text |
| 12 | SO changes or updates for Nonscheduled demand, pricing node specific (if applicable, time, MW values, all data per WESM ) | MW |

| Item | IMMS Data Input Description | Data Type |
|---|---|---|
| | **IMMS Data from the SO** | |
| 13 | Actual unit MVAR 4 digit field + 3 decimal places all | MVAR |
| 14 | Actual unit Status (on-off) & flag change | Status |
| 15 | All grid related data that may be updated by TPs (see first part of this table) and provided by a defined process to the SO, for SO to report to MO | Various |
| 16 | Interchange MW total by each Region tie + sum including any dynamic scheduling across ties | MW |
| 17 | Network model, including all parameters, constraints, logical definitions | All |
| 18 | Nonscheduled generation projection (time, MW, values, all data per WESM) | MW |
| 19 | Outage schedules, approved and rejected by location/plant, equipment ID, time scheduled out/in, dates, related de-ratings or other impacts, with trailer information [process to be determined] | Text |
| 20 | Requests for re-dispatch based upon grid security reasons | Various |
| 21 | Reserve minimum and target requirements, non-unit specific by trading period, (input source to Market Optimizer output by Region) | MW |
| 22 | Transmission path over operating limit (.9-1.1) x 100 by path name & MW Δ (User enterable) | MW |
| 23 | Unit specific, SO changes or updates for High/low MVAR limits (Q max-min) | MVAR |
| 24 | Unit specific, SO changes or updates for High/low operating limits | MW |
| 25 | Unit specific, SO changes or updates for High/low regulating limits | MW |
| 26 | Unit specific, SO changes or updates for Unit reserve monitor MVAR, unused – MVAR | MVAR |
| 27 | Unit specific, SO changes or updates for Unit reserve monitor MVAR, unused + MVAR | MVAR |
| 28 | Unit specific, SO changes or updates for Unit reserve monitor MW, unused capacity (if applicable) | MW |
| 29 | Violations and trigger events, data, and updates as may be required incremental to normally scheduled data output to IMMS | Various |

**High Level IMMS Input Information**





TP's offers and bids each include the data as required by WESM with all details. MW/Hr refers to MW value for an interval; by default the interval is an hour period. Supplier is responsible for the design and WESM compliance. Supplier shall supplement this listing as required. Content, as applicable, will include: Trading Participant approved name or acronym, registration code, plant or location ID, unit or equipment ID, commodity type, contract ID when applicable, commodity type, trading interval to be applied, including beginning and ending times HHMM (24-hour military time format), time submitted, value of commodity per block, operating limits, forbidden zones, loading ramps as applicable, dead-bands/bandwidths/deviation as applicable, flags/identifiers and trailer information required by WESM.

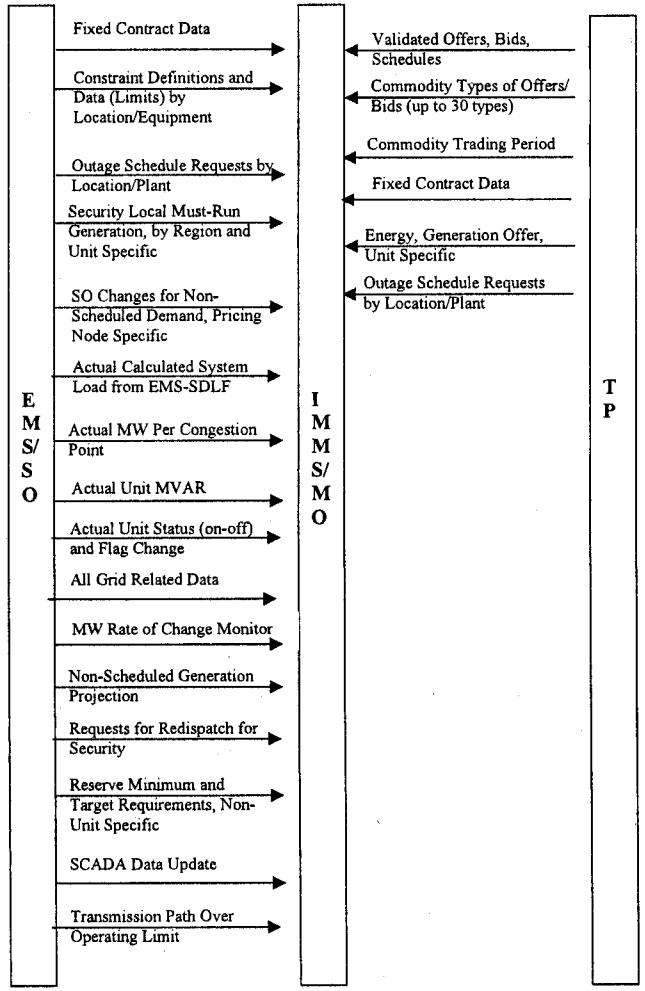


**Figure 3-3: Data Flows from TP and EMS/SO to IMMS/MO**





### 3.3.2 Outputs

Table 3-2 provides the requirements for Output Data, content, form and periodicity of transfer.

**Table 3-2: High Level Data Output Requirement For IMMS**

*IMMS= interim market management system; TP= Trading Participant; SO= System Operator; EMS= energy management system (operated by SO)*

| Item | IMMS Output Information, Description | Data Type |
|---|---|---|
| 1 | Actual load as determined by real data inputs from IMMS-Similar Day Load Forecast (SDLF) (if applicable) | MW |
| 2 | Actual reserve capacity available per Region (area if applicable) as feed-back, originates with SO) | MW |
| 3 | Area load scheduled MW per Region | MW |
| 4 | Black start resource stack with values, limits, ramps and pricing thereof | All |
| 5 | Energy & reserve pricing data for resources selected in the stack in Pesos per MWh and Pesos per MW, respectively as required by WESM | Pesos |
| 6 | For Settlement related output, refer to Settlements specifications | Various |
| 7 | Load, non-spinning reserve max interruptible MW (dispatchable load) | MW |
| 8 | MOD (resource stacks: energy gen/load, reserve capacity) requirements, MW by HE, each trading interval, prices*, multiple trading intervals as required by WESM | MW |
| 9 | MW rate of change monitor MW/min change 5 sec interval each for A/S providing units | MW |
| 10 | MW scheduled per each congestion point | MW |
| 11 | Net area scheduled MW interchange [check sign convention] between Regions as applicable | MW |
| 12 | Offers: Confirmation and rejection notification with associated data including TP/GEN ID, trading commodity, blocks/values, trading period start/end, offer/bid price*, acceptance or rejection (reason if rejected) | Various |
| 13 | Projected load flow summaries, including key lines and all congestion paths, grid losses, etc. | MW |
| 14 | Projected market cost of each dispatch solution | All |

| Item | IMMS Output Information, Description | Data Type |
|---|---|---|
| 15 | Region (and area if applicable) non-unit specific: Minimum required reserve and available reserve totals (as well as unit specific reserve data listed herein) | MW |
| 16 | Scheduled total MW for each Regional tie point | MW |
| 17 | Unit high/low non-spin limit schedules Δ MW [include for future- no current provision in WESM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch | MW |
| 18 | Unit MW non-spinning reserve contribution [include for future- no current provision in WESM]: This shall be provided at user enterable intervals as prescribed for full dispatch an re-dispatch | MW |

### High Level IMMS Output

MO's offer and bid acceptance/rejection to TPs include the data as required by WESM with all details. MW/Hr refers to MW value for an interval; by default the interval is an hour period. Supplier is responsible for the design and WESM compliance. Supplier shall supplement this listing as required. See Settlements for other. All data, as applicable, will include: Trading Participant approved name or acronym, registration code, plant or location ID, unit or equipment ID, commodity type, contract ID when applicable, commodity type, trading interval to be applied including beginning and ending times HHMM on 24-hour military time format, time submitted, value of commodity per block, operating limits, forbidden zones, loading ramps as applicable, prices, dead-bands/bandwidths/deviation as applicable, flags/identifiers and trailer information as may be required by WESM. Information to be posted will be in compliance with WESM. See Trading Participant interface data for web data and other public information.


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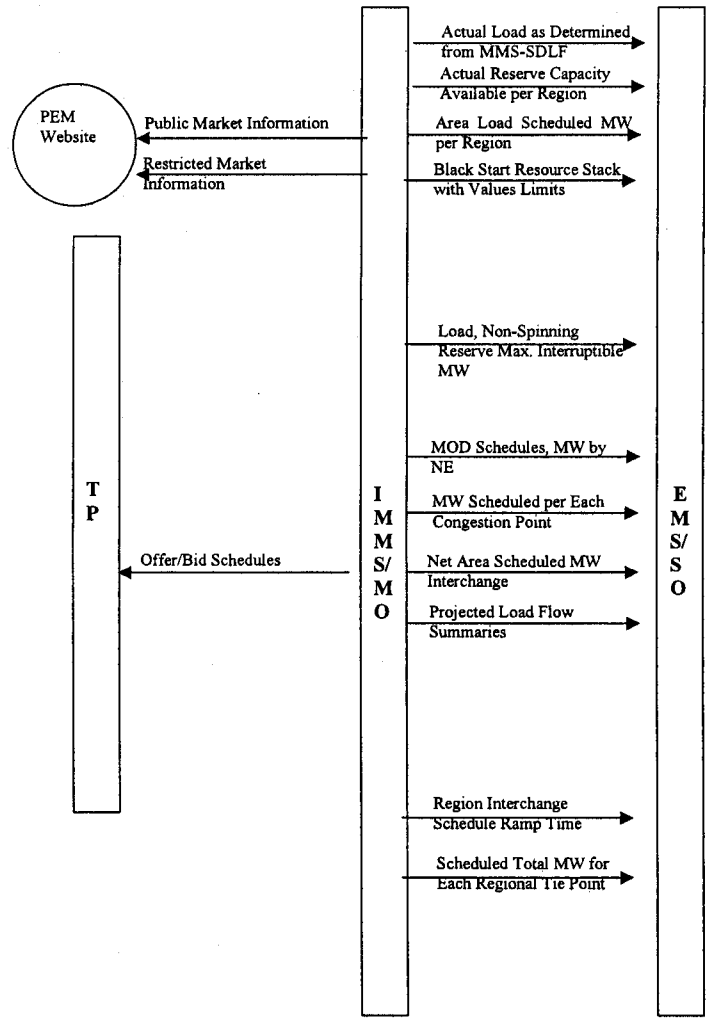


**Flow Diagram 3-4: Output Flows from IMMS to EMS, MP and PEM Website**


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1. Market Operator (MO)

   The Contractor shall provide user-friendly tools to assist the MO in a manual check and review of all IMMS processes, including Settlements. These tools shall include the following:

   (a) screen summaries, organized reports, and alarm flags for errors, rejections, missing data, process failure, time-out, non-convergence of network applications (if applicable), and other anomalies along with adequate descriptive text explanations for each, and

   (b) user friendly tools for authorized access to data.

2. System Operator (SO)

   The Contractor shall provide the capability for the SO to receive from the MO the dispatch requirements (stacks) for system operation and dispatch for each trading interval. The data shall comprise:

   - Generation Output target Levels (preferred operating points) for each Generator;
   - Operating Reserves, unit and value specific;
   - Scheduled Loads per Trading Node;
   - Projected line flows from the IMMS "primitive" congestion management;
   - Interruptible Loads; and
   - Re-dispatchable capacities.

3. Trading Participants (TP)

   The Contractor shall provide the TP with the following capabilities with regard to dispatch:

   - Market cost data for each market trading node and for each trading interval, for which dispatch was run; and.
   - The data, in Item 2 above, shall be made available in accordance with the WESM Timetable, and with access as described under WESM E-Commerce.

## *3.4 Dispatch Engine*

The dispatch scheduling and pricing process requires a mathematical optimization algorithm, which will determine the optimal schedules for each individual time period (dispatch interval), given the offers and the non-dynamic constraints.

The Contractor shall ensure that the "dispatch engine" includes the following functionalities

1. Process validated offers accepted by the IMMS;





2. Process system model data;
3. Execute a system analysis process to evaluate grid congestion, system security, and provide a market optimization result;
4. Prepare pricing for each pricing zone and for each node, as required by WESM, and prepare separate Merit Order Dispatch (MOD) stacks for energy and reserve resources, based upon least cost, considering all market commodities and system projected requirements; and
5. Upon the occurrence of significant changes in system conditions and if deemed necessary by SO or MO, execute a re-run of the optimization and MOD with subsequent notifications and re-scheduling, in accordance with WESM.

Overall Data Requirements and Data Flow are depicted in the following diagram.

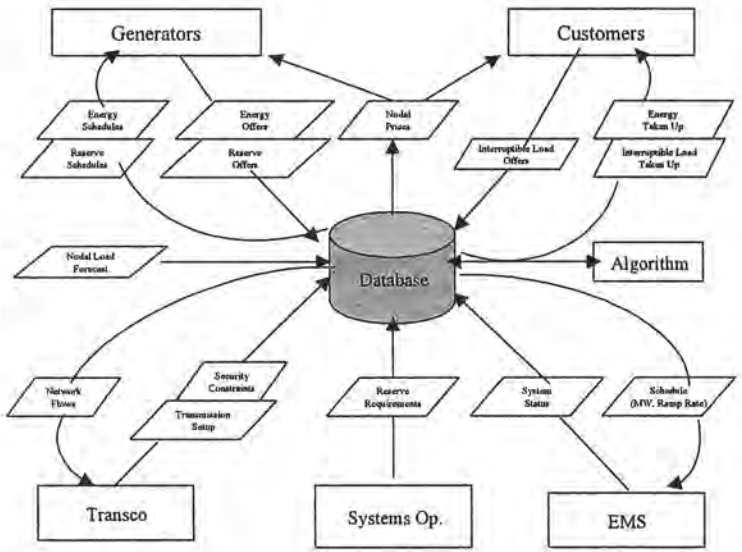


**Figure 3-5: Data Requirements and Flow**

### 3.4.1 Dispatch Algorithm

The dispatch algorithm in the dispatch engine shall have the following features:

The dispatch "stack" or the Merit Order Dispatch (MOD) shall provide dispatch targets or Preferred Operating Points for the end of the respective trading interval.

This process shall calculate prices in accordance with the Market Rules.

Separate "stacks" shall be developed for energy and reserves, based upon spot pricing at all trading nodes (zones as applicable) and reserve regions.

The optimization shall maximize the value of the dispatched load by optimizing the energy and reserve selection subject to constraints and associated violation penalties.

The MOD or resource requirement shall be furnished to the SO/EMS for implementing energy requirements, reserve allocation, and AGC dispatch control, in accordance with the WESM Rules.

The dispatch (allocation) of energy and reserve resources shall be based upon the following specific considerations:

1. Generation energy offer;
2. Generation reserve offer (regulation and contingency classes);
3. All limits, constraints, de-ratings, and projected values (unit, resource, and grid related);
4. All validated rates of change: governor ramps (up & down), AGC ramps (up & down);
5. Start-up times;
6. Load interruption times;
7. Forecasted or calculated non-scheduled load;
8. Scheduled load;
9. Reserve requirement constraints (minimum requirements) for each reserve region;
10. Status of resources and facilities, availability, scheduled outages, commitment;


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11. Grid constraints within or between Regions (by path and MW Δ);
12. Electric network (grid) configuration and status of lines, units, and equipment impacting kV, MVAR, Impedance/Admittance, stability, power transfer or ability to serve loads;
13. HVDC link constraints and capabilities;
14. Energy balance equations for each node in the market network model;
15. Power flow analysis completed by approved methodology (AC or DC model);
16. Constraints applied by either the System Operator or the Market Operator;
17. System security or reliability constraints in addition to those noted above;
18. Actual loads, power flows, and voltages from real-time grid data supplied by the SO;
19. Updates of load forecasts or change in the conditions of grid and resources; and
20. Loss of SO or MO systems, or declared Emergency.

### 3.4.2 Security Constrained Dispatch Algorithm

The Security Constrained Dispatch Algorithm is central to the integrity and success of the WESM. The algorithm has been defined in the Market Rules and will be given to potential Contractors separately. Strict conformance to the algorithm is mandatory. For the IMMS, the Market Rules permit a Basic algorithm that utilizes a Linear Programming solver to produce a least cost schedule based on energy and reserve offers and bids from Trading Participants. It produces energy and reserve schedules for Generators and Customers and nodal spot prices.


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# 4.0 FINANCIAL RECONCILIATION FUNCTIONS

The Contractor shall provide the financial reconciliation functions, from metering to settlements to billing, with the accuracy and security required for the purchase and sale of energy and services in the WESM.

Financial Reconciliation functions will make use of the existing and planned WESM infrastructure. This specifically includes the metering devices and meter data collection systems located throughout the Philippines.

The Interim Market Management System (IMMS) shall be designed to augment the current systems and functions, as needed, to have a full complement of financial reconciliation functions. It is encouraged to have separate nodes for individual functions such as meter data collection, and the interface of the meter data collection system to the IMMS.

The following table provides the comparison of the Metering and Settlement functions between the IMMS and the Final MMS.

| Function | IMMS | MMS |
|---|---|---|
| Metering | | |
| • Data collection | Manual | Automated |
| • Data validation | Limited | Automated |
| • Data warehouse | Limited | Full |
| Settlements | | |
| • Market Fees | Limited | Full |
| • Settlement Steps | Limited | Automated |
| • Calculations | Automated | Automated |
| • Ancillary Services | For Consideration | Included |
| • Transmission Tariffs | For Consideration | Included |
| • Statements | Automated | Automated |
| Payments | | |
| • Electronic Funds Transfer | Included | Included |


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The Contractor shall implement all data collection and processing for Metering, Settlements and Payments, in accordance with the Timetable established by the MO. The IMMS shall reference the Timetable for all functions to ensure consistency among applications.

Data security shall have high priority in all IMMS applications. The Contractor shall ensure that data access is limited to specific portions of data for which a specific party has been authorized and to isolate Metering and Settlement data from other applications and accesses.

## 4.1 Metering Process

The Contractor shall provide functions and capabilities to receive data from Itron MV-90 Data Collection Systems in each region.

The Metering Process refers to all system functions starting from metering at energy transfer points, to meter data collection and processing, to storage and archiving of meter values. The overall Meter Data Management System, Figure 4-1, includes metering devices at each market trading node..

The installation of physical meters and MV-90 data collection systems is part of another project. The Contractor shall focus on the collection and use of data within the MV-90. Hence, the IMMS specification does not address the responsibility for the metering devices, the base meter data collection systems and communications.

The specific functions to be supported by the IMMS are:

1. Data Collection and Validation – Validation is limited to ensure that a data file from MV-90 is not corrupt. This could be achieved using a simple horizontal and vertical parity checks and a CRC.
2. Settlements Data – A Settlements database, which shall include all data calculated and used in financial statements.
3. User Interface – Provisions shall be made to allow manual entries to the meter registry, and control of data changes.

These are shown in Figure 4-2 and discussed in the following sections.





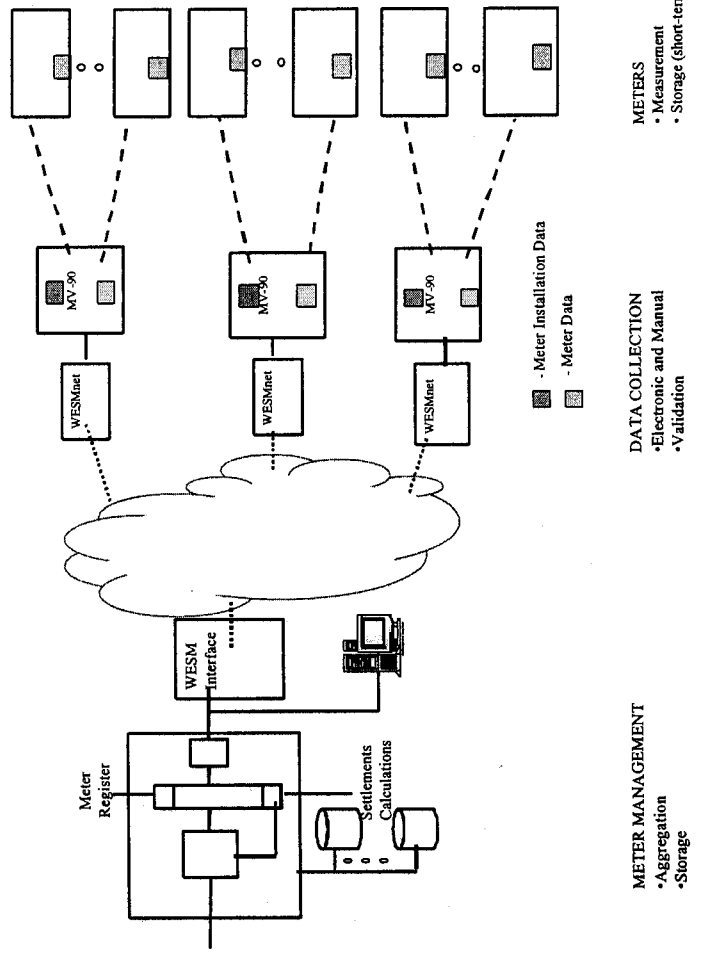


**Figure 4-1: Metering Process**

### 4.1.1 *Meter Register*

It is important to note that each Metering Provider data collection system will contain data on the installation of metering devices that are being monitored in accordance with the WESM. The data will include:

1. Metering point reference details, including:
   a. locations and reference details (e.g., drawing numbers);
   b. site identification names;
   c. standard equipment identification numbering (SEIN) in accordance with the WESM and MO procedures;
   d. details of affected Participants associated with the Metering point; and
   e. the Metering Provider.
2. The identity and characteristics of metering equipment including:
   a. serial numbers;
   b. metering installation identification name;
   c. metering manufacture types and models;
   d. current test and calibration program details, test results and references to test certificates, as required under the Grid Code;
   e. calibration tables, where applicable to achieve metering installation accuracy;
   f. data register coding details; and
   g. correction factors and multipliers.
3. Data communication details, including:
   a. telephone number(s) (or frequency details in the case of telemetric equipment) for access to data;
   b. communication equipment type and serial numbers;
   c. communication protocol details or references;
   d. data conversion details;
   e. user identifications and access rights; and
   f. "write" password (to be contained in a hidden or protected field).

The IMMS shall support a central registry of unique meter identifiers and shall be able to correlate these unique identifiers to the physical meters.


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**Figure 4-2: Metering Functions**

Meter readings will primarily be stored in the MV-90 data collection system but for audit purposes any data used for settlement purposes must also be retained in the IMMS database. The Contractor shall ensure that the manual entry of data (or substituted data) at the MV-90 data collection point shall be flagged as such. The IMMS database in its initial version shall be capable of recording:

1. Unique Metering Identifier.
2. Specific meter data by metered point, value(s), time period (interval) for which the data applies, and version number of meter data for audit purposes.
3. The following meter data categories shall be identified:
   a. Kilowatt (kW) demand, Kilovolt Ampere Reactive Demand (kVAR), kVAR Hour, kW Hour;
   b. Meter reading-beginning actual/ending actual; and
   c. Pulse width.

All data will be validated and made "settlement ready" at the MV-90 data collection point and will record the following significant statuses:

1. Actual normal passed validation;
2. Estimated automatically (not derived from actual meter readings);
3. Estimated manually (not derived from actual meter readings);
4. Validated with no detected error; and
5. Adjusted (trailer information to reflect specificity).
6. Time polled (if received or not) and received.
7. Transaction set identifier code (or unique equivalent).
8. Transaction set control number (or unique equivalent).
9. Transaction set purpose code(s) (identifies purpose of transaction set).
10. Report type, authorization data, and/or security code associated with transaction set.

### *4.1.2 Data Collection and Validation*

The Contractor shall provide the data collection and validation functions that enable the data from the regional meter data collection sites to be retrieved on a user-selectable periodicity or on demand. The collection and validation process shall be on a non-interference basis with all other


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IMMS processes, preferably with a dedicated set of Servers. The Contractor shall ensure that data can be retrieved utilizing the standard Itron MV-90 communications protocol.

Collection of Metering Data shall also include the transfer of metering values from the EMS as listed in Section 3.

The meter data provider will coordinate the resolution of issues arising from the non-performance of metering systems, and liaison with associated retailers, network service provider and metering provider(s). It will be necessary to respond promptly to all requests for remedial action when the metering systems malfunction or fail, and to provide data from the Meter itself if remote data collection is prevented. The timeliness of the detection of data errors and the response to data acquisition malfunctions is an important element in minimizing the risk to TPs.

The Contractor shall ensure in providing the Financial reconciliation function that the validation of data at the MV-90 level shall include:

1. Reasonability check based upon metered point maximum capacity or alternate parameter.
2. Completeness check for required data format with valid characters or numbers.
3. Validity of association check that the received data is authorized by submission.
4. Verification that data has been received by the MO for all metering points, for each required period.
5. Identification of data received without valid corresponding identifier (termed "Orphan Data").
6. Orphan data processed, tracked, and logged; to be reported for each calendar day and archived for access by day, location, type, meter or server, and hour.
7. Detection of incomplete or missing data.
8. Logging, flagging, and report generation for all incomplete, missing, or invalid data.

Error logs shall contain, at a minimum, trading node identifier, data requested, time period, re-tries, and flagged data from validity checks.

Validation of data at the IMMS level shall include simple checks to ensure that meter data was received as sent.


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### 4.1.3 Meter Data Processing

The Contractor shall provide the following Meter Data Processing functions:

1. The meter data shall be processed by the settlement application by referencing the unique meter identifier thereby allocating energy uses by charge type category (use category). The following data could be derived:
   a. Metering Provider;
   b. meter owner;
   c. metered entity;
   d. settlement charge type (use category);
   e. date;
   f. settlement period(s) by single or multiple periods;
   g. metered class (generator class, user class, or other);
   h. location or group of locations;
   i. metered value range (enterable by user);
   j. region or pricing zone; and
   k. node or multiple nodes.
2. The IMMS shall have the functionality and databases that accommodate multiple and simultaneous data transfer requests without any degradation of performance.

   The IMMS shall be able to support the capability of data transfers, including, but not limited to, the following:
   a. Settlement-ready data (send only) to the settlement applications; and
   b. Access (read only) to market surveillance or audit applications within the IMMS.

### 4.1.4 User Interface

The Contractor shall provide user-friendly tools for the entry and maintenance of all metering data described in the previous sections.


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## 4.2 Settlements Process

### 4.2.1 General

The WESM will settle participant accounts based mainly on energy supplied and purchased during a settlement period. The Contractor shall provide the IMMS capabilities to obtain measurements for the volume of energy generated or consumed by a Trading Participant at each metered point in each trading period and a specified settlement period. Measured amounts for each trading period shall be priced using the Spot Market Price for the node. Participants are paid for generation, and pay for usage based on metered energy volumes. Adjustments and spot market trading charges shall be added to determine the final amount due from or to each participant. The overall process is shown in Figure 4-3 below:

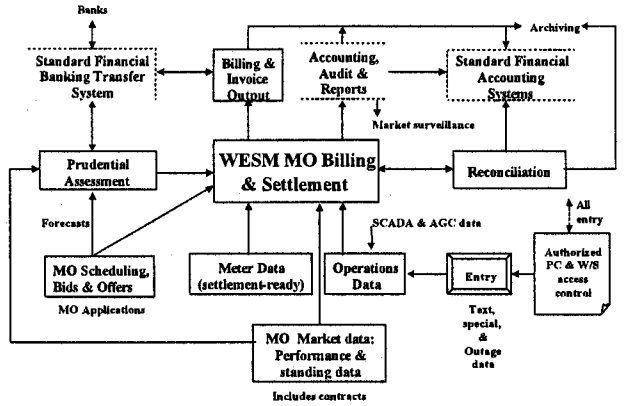


**Figure 4-3: Settlements Process**

The Contractor shall provide functions in the Settlements Process to run preliminary and final settlements on predefined dates. The preliminary settlement runs allow Participants to check against their own numbers before a final settlement run is done. Energy volumes may change between the preliminary and final runs, as meter and interchange readings get finalized.


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Settlement processing and timing of statements shall be based on the Timetable of the IMMS set in the Market Rules.

Preliminary statements are issued within seven business days (as presently defined) after the end of the payment period. Final statements will be issued eighteen business days (again, as presently defined) after the payment period has ended. There may be a number of revisions throughout and after these time periods. There may also be interim statements issued based on results of new meter readings or prudential processes. The Contractor shall ensure that the applications within the Settlements module keep track of all versions of data. In addition, the statement issue procedures and payment receipt timetables shall be strictly adhered to and be fully auditable.

The Contractor shall ensure that Settlement summary information and the results of these checks shall be available for review by the MO prior to approving the settlement run. The IMMS shall be able to send preliminary statements to Participants only after the MO has approved the run. Payment will not be required against these statements. Their purpose is to provide an opportunity for the participant to examine the statement content and to resolve any questions prior to the final statement being issued. Once the final settlement statements are authorized and issued, payment is required against these statements regardless of any disputes.

The Contractor shall provide functions in the Settlements Process to ensure that Participants are able to register disputes once a settlement run is released. If successful, resolution may result in settlement adjustments being made for a prior trading period. As a consequence, multiple settlement runs may be made for any settlement period over time, and each time all of the affected participant accounts shall be adjusted and sent to affected TPs.

### 4.2.2 *Settlements Data*

Data associated with the Settlements process consists of:

- Meter data;
- Charges and Fees; and
- Settlements Results.





The Contractor shall provide capabilities to store and maintain the above data in the IMMS Database, and make them available to applications programs and for retrieval by authorized users.

1. Meter Data – The data resulting from the Metering Process will be used by the Settlements module. The data will consist of market trading node meter readings for each trading interval, validated, processed and aggregated as required to be Settlements-ready. These data are described in the Metering section.
2. Charges and Fees – The Market Rules will impose specific charges to Trading Participants for operation of the electric system and for the administration of the WESM. The IMMS shall support the input of these charges and fees by the MO using templates and forms. The IMMS shall support multiple charge types, with each type having up to 20 subordinate sub-charge types.

   Table 4.2-1 is a list of charge types.

**Table 4.2-1 Market Charges and Fees**

| Item | Charge Type | Sub-set | Comment |
|---|---|---|---|
| 1 | Energy, Spot Market price | Allow initially for 3 market zones (zones for averaging nodal prices) | Price calculated and provided per MO, Settlements multiplies price by the metered quantity. |
| 2 | Energy, Out-of-market occurrence | | Used only in declared emergency or other allowed by WESM; Price origin is IMMS application |
| 3 | Reserve, Out-of-market occurrence | | Used only in declared emergency or other allowed by WESM; Price origin is IMMS application |
| 4 | Market fees | Subsets: include Registration, power system operation, metering, billing & settlement, administration and up to 50 others | Not defined at this time |
| 5 | Special assessments or taxes | Subsets: Allow up to 25 | Not defined at this time |
| 6 | Penalties, interest for late payments, or fines | Subsets: Allow up to 25 | Not defined at this time |

3. Settlements Results – The results of the Settlements process are the data required to prepare individual statements for each TP for each trading interval and at each market trading node.

The statement structure shall be by Participant type for a billing period and shall be for a given version of data, all of which shall be clearly identified. The net position of settlement category shall be shown and an overall net position shall be identified. If a Participant requires supporting data, they will make a formal request to view the appropriate Settlement data. The statements will include:

a. Energy consumed/generated in each Settlement Period;
b. Energy prices in each Settlement Period;
c. Fees for the Settlement Period;
d. Energy Losses allocated in each Settlement Period (if applicable);
e. Other Charges and adjustments in each Settlement Period (if applicable); and
f. Net amount payable/receivable for the Settlement Period for each Trading Participant.

Statement data line items shall include but not be limited to:

a. Identity of the organization to receive statement;
b. Statement identifier;
c. Version control ID;
d. Version Type Description - Preliminary/Final/Revised/Prudential;
e. Billing Period Week Number (1-52);
f. Statement Issue Date;
g. Charge type(s);
h. Settlements Summary;
i. Settlements Statement Total - Financial amount for total settlement statement for the organization;
j. Market Fee identifier e.g. Registration, Metering, Administration and Billing and Settlements;
k. Billing Period Price (amount for each market fee);
l. Billing Period Volume (MWhs for each market fee);
m. Billing Period Total (amount for each market fee);
n. Total Energy Payments;
o. Region identifier;
p. Connection Point ID;
q. Unique Metering ID;
r. Metered Energy - Metered Energy flow at each metering installation for billing period in MWh;
s. Aggregated Gross Energy - Metered Energy at Connection Point;


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t. Metered Energy - aggregate of the adjusted gross energy amounts for that trading interval for each connection point assigned to that transmission network connection point;
u. Settlement Energy - Adjusted Gross Energy;
v. Adjustments, corrections, authorized changes with trailer information; and
w. Daily Interest % applied to Settlement Values. (Only used when a Revision Statement is issued).

In addition, summary information regarding WESM operations for the period shall be calculated and stored.

If the settlement for a particular billing period is using revised data, historical data shall also be a line item. Processing the line items involves the following steps:

1. Obtain the total settlement data for each settlement area from previous settlement's processes;
2. Apply line items;
3. Determine net payment/ receipt based on line item totals, if the line items require adjustment;
4. Pass the line item for further processing; and
5. If the line items do not require adjustment send the line items to the next process step, i.e., for authorization and statement issue.

This shall be done for each Participant.

The data that needs to be accommodated shall include but not be limited to:

1. Spot market settlement values;
2. Excess generation settlement values;
3. Compensation payment settlement values;
4. Bilateral settlement values;
5. Market fee settlement values per billing period; and
6. Organization details.

These data shall be posted for retrieval by authorized TPs and users in accordance with the Timetable.


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### 4.2.3 *Settlements Processing*

The Contractor shall provide a Settlements module that supports the calculation of settlement amounts, billing and clearance of all Market transactions. The module shall:

1. Be fully auditable;
2. Calculate transactions and provide data on an hourly basis;
3. Accommodate flexible settlement periods;
4. Support dispute resolution with clear audit trails; and
5. Be capable of archiving results and inputs in accordance with the requirements of Market Rules.

The settlements module shall provide the flexibility with respect to:

1. The duration of the billing period;
2. The rules that apply to different types of settlement runs; and
3. The charges that are applied to participant accounts at the time of settlement, including adjustments, trading charges and applicable taxes.

Revisions to standing data and algorithms may occur, and the Settlements function shall be capable of maintaining multiple versions, such that, in the event of a settlement revision, the appropriate version of software can be run to accurately calculate the revised amount.

The Contractor shall provide Settlements application that shall accommodate:

1. Weekly calculation of daily settlement values;
2. Production of settlement statements;
3. Settlement payment processing;
4. Maintenance of settlement data; and
5. Provision of settlement data to trading participants.
6. Standard time;
7 Daylight savings time; and
8 Leap year.

The following diagram depicts the Settlements processes, showing major interfaces and data flows.


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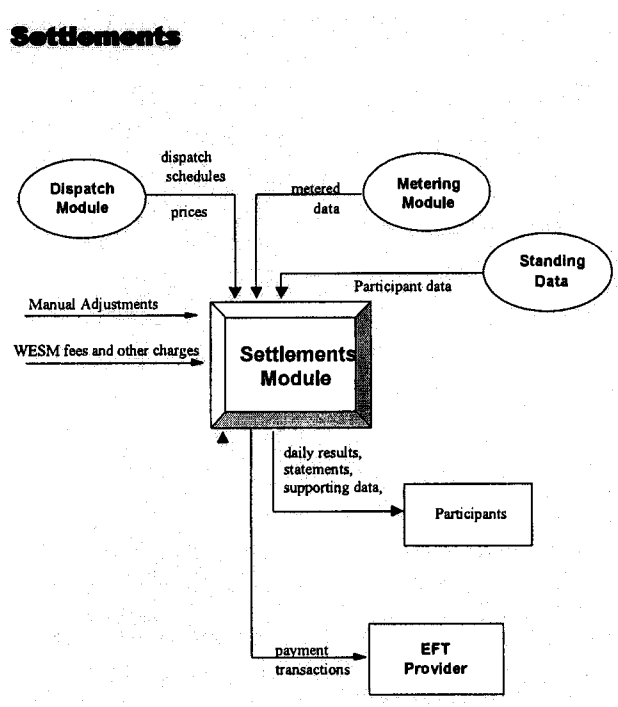


**Figure 4-4: Interfaces and Data Flows of Settlements Process**

Settlements data will be prepared based on the results of the Constrained Security Dispatch runs for Real-Time Ex Ante and Real-Time Ex Post Dispatch. An example of an algorithm that may be used is defined in the Market Rules and referenced in Section 3 of this specification.

Settlement processing involves:

1. Input of accepted (processed) bids, offers, and scheduled loads that are validated and processed by settlements application;
2. The aggregation of daily settlement data for a full billing period;


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3. The calculation of financial credits and debits based upon the MO established price and product quantity for each trading interval, each charge type, and each trading participant;
4. Determination of adjustments and the application of interest if applicable;
5. Preparation of statements and determination of line items;
6. Authorization and electronic issuance of statement to each participant;
7. Acceptance of EFT relating to market transactions and accounting for each; and
8. Taking into consideration all energy and financial transactions, summarizing them, and providing a market accounting balance sheet for each final statement period.

Trading interval settlement values shall be calculated first. These shall be calculated for each relevant participant. Each charge type (category of settlement) shall have its own calculation. Main data inputs include:

1. Regional parameters and congested path data;
2. Meter data for each required market metering point;
3. Participant details;
4. Reserve requirement details;
5. MO calculated energy price details; and
6. Standing data.

Market fees shall then be applied. Meter fee type may be dependent on the metered energy directional flow. Once flow is determined, a simple Peso value per meter shall be calculated.

The Contractor shall provide the capability to calculate Settlement values per trading interval for the following items:

1. Hour Ahead settlement values using metering data, loss factors and Regional spot prices; and
2. Excess Generation settlement values using an excess generation price and relevant metered energy.

The contractor shall provide a Settlements process function that includes the following Participant Involvement features:

1. Trading Participant:
   a. Submits offers to the MO; and


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   b. Receives from MO an ex-ante nodal energy price prior to the commencement of each trading interval.
2. Metering Provider:
   a. Submits meter data for each meter point to MO
3. Network Service Provider:
   a. Submits real-time SCADA data to SO that is shared with MO for market applications, including congestion management and load forecasting
4. Market Operator:
   a. Validates and processes bids, offers, and meter data;
   b. For each trading interval and each node, calculates an ex-ante (before) nodal energy price and an ex-post nodal energy price;
   c. Applies caps to ex-post (after) unrestrained energy nodal price if applicable;
   d. Determines ex-ante zonal reserve price for each market reserve zone;
   e. Applies caps to ex-post unrestrained reserve price if applicable;
   f. Calculates ex-ante energy settlement quantity for each trading interval as a net flow into the grid, through the trading node; and
   g. Determines ex-post settlement quantities for each trading node from actual metered flow through that node during the trading period.

The Contractor shall ensure that Settlements shall be governed by a defined set of processing steps based on the Market Rules, and ensuring that Statements conform to those rules. These rules shall be maintained in the IMMS under the responsibility of the MO. The following requirements provide a summary of expected rules and processing steps:

1. The IMMS shall maintain rules or processing steps executed as part of settlement runs. The rules/steps will be updated by the MO.
2. The IMMS shall maintain definitions of processing rules associated with effectivity dates.
3. Run control and information for a settlement run shall be supported. The data shall be updated by the system, except for the actual message, which may be input by the MO. There shall be one entry for each settlement run. The data handled shall include:
   - Settlement date;
   - Settlement run number;
   - Settlement Period identifier;
   - Type of settlement run (preliminary, final, reconciliation, etc.);
   - Date and time that the settlement run was initiated;
   - Effective Date and Time used for the settlement run;


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- A code indicating processing status of this settlement run, (e.g. 'In Progress', 'Suspended due to Error, 'Completed Ok', 'Cancelled' 'Authorized');
- The general message for the settlement run;
- The date and time that settlement details were published (if absent, indicates details have not yet been published); and
- A flag indicating if data has been archived.

4. The system shall record hourly spot market prices as they relate to settlements. The data shall be updated weekly as part of the billing run. This data is updated every trading interval. The data handled shall include:
   - Settlement Date that this data applies to;
   - Run Number;
   - Region Identifier;
   - Trading Interval Period Number;
   - Regional reference price for this dispatch period; and
   - Last date and time record changed.
5. The system shall support the definitions of different settlement types (preliminary, final, reconciliation etc). The data shall be updated by the MO. The data handled shall include:
   - Code for type of settlement;
   - Description of code for settlement type;
   - Default message to be displayed on settlement reports and statements for all settlement runs of this type;
   - A flag indicating if this is a 'Reconciliation' settlement run;
   - A value that drives the calculation of accrued liabilities ensuring that a Final Monthly settlement liability takes precedence over a Draft Monthly settlement liability; and
   - A flag indicating if a settlement run of this type may be approved automatically.
6. The system shall identify the actual settlement run used for each settlement day. The data shall be updated daily with each day's settlement run. There shall be one entry per settlement run. The data handled shall include:
   - Settlement Date that this data applies to;
   - Region identifier;
   - Ex Post Settlement Run Number;
   - Settlement run status such as posted;
   - Ex Ante Settlement Run No.;





   - Settlement run status such as posted; and
   - Last date and time the record changed.

   The system shall maintain a record of EFT payment by a participant. The data shall be updated by the Market Operation Accounts department. It is assumed that there will be one entry per Participant. The data handled shall include: Unique Identifier of a Business Associate, Net Peso amount of a payment made by a Participant, and Date and Time payment was made.
7. The system shall maintain the settlement data for each generation connection point. A regional summary is also to be provided. The data shall be updated with each Settlement run. There shall be one entry per Settlement Run. The data handled shall include:
   - Settlement date;
   - Settlement run number;
   - Settlement Period identifier;
   - Unique station identifier;
   - Dispatchable Unit identifier;
   - Physical unit identifier;
   - Region identifier;
   - Unique participant identifier;
   - Generated energy;
   - Purchased Energy;
   - Regional Market Price;
   - Excess Energy Price;
   - Connection Point Price = Regional Reference Price (RRP) * Energy consumed;
   - Net energy MW/hours;
   - Cost of net energy in Pesos;
   - Cost of excess energy in Pesos;
   - Administered Price Cap Compensation (where applicable);
   - Last date and time record changed;
   - Purchased Energy (Generator Purchases) MW;
   - Purchased Energy Cost in Pesos;
   - Meter Run Number of MDA file used; and
   - Metering Data Agent (where applicable).

8. The system shall maintain summary settlement data for generation within the specified region. The data shall be updated with each Settlement run. There shall be one entry per Settlement Run. The data handled shall include:
    - Calendar Settlement date;
    - Settlement run number;
    - Settlement Period identifier;
    - Region identifier;
    - Generated energy;
    - Purchased Energy;
    - Net energy Mwhours;
    - Cost of net energy (Pesos);
    - Cost of excess energy (Pesos);
    - Purchased Energy (Generator Purchases) MW; and
    - Purchased Energy Cost (Pesos).
9. The system shall maintain and record the adjusted amounts for each bill run, on a participant-by-participant basis, showing the bill run adjusted and the adjusted amounts. The data shall be updated weekly as part of the billing run. It is assumed there will be one entry per Billing Run. The data handled shall include:
    - WESM Financial year;
    - Week number within the financial year;
    - Unique run number within a given financial year and week number;
    - Unique participant identifier;
    - Participant type (Generator/Customer);
    - Financial year for which the adjustment is applied;
    - Week number for which the adjustment is applied;
    - Bill run number for which the adjustment is applied;
    - Previous amount billed (Pesos);
    - Adjusted amount billed (Pesos); and
    - Last changed date and time.
10. The system shall maintain the settlement liabilities in Peso amounts that are due to or from a Participant as a result of a settlement that is still outstanding. The data shall be updated by the Settlements Process. There shall be one entry per Participant per Settlement run. The data handled shall include:


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- Calendar Settlement date;
- Settlement run number;
- Settlement Period identifier;
- Unique Identifier of a Business Associate; and
- Net Peso amount due from or to (if negative) a Participant as a result of a settlement run.

11. The system shall maintain payments for market fees for each settlement date. The data shall be updated with each settlement run. There shall be one entry per settlement run. The data handled shall include:
    - Settlement date;
    - Settlement run number;
    - Unique participant identifier;
    - Period identifier;
    - Market fee identifier;
    - Fee charge;
    - Energy amount for variable fees; and
    - Last date and time the record changed.
12. The system shall maintain an audit trail of all billing runs that have been posted. The data shall be updated when the authorizing person approves a settlement run. This data is updated for each billing run posted. The data handled shall include:
    - Report identifier;
    - Settlement date;
    - Date and time report posted;
    - Settlement run number;
    - Unique participant identifier; and
    - Last date and time the record changed.

### 4.2.4 Management of Settlement Runs

The Contractor shall provide the functionality to ensure that the following types of settlement can be performed in the WESM as data becomes available and changes over time:

1. Daily;
2. Preliminary monthly;


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3. Final monthly; and
4. Reconciliation.

Each type of settlement has specific steps to gather data and perform calculations. Hence, the Contractor shall ensure that when a settlement process is initiated, it shall be monitored to completion, or reviewed after completion. If errors occur in a settlement, it may be cancelled. Some types of settlement require processing to include adjustments from prior periods. In all cases, a successful settlement run records participants' settlement liabilities.

The Contractor shall provide functions to tightly control the initiation of settlement runs so that they occur in the correct order and for the appropriate production period. When a settlement allows adjustments to be included, the system shall allow these to be specified before the run is initiated. During a settlement run the user shall be able to monitor and cancel it. After a settlement run ends, the user shall be able to review the details of its execution and if necessary, cancel it. The system shall be able to perform the steps in a settlement process in a precise order, based on user defined settlement rules.

The Contractor shall ensure that the following functions related to Settlements Runs are provided at a minimum.

#### 4.2.4.1 *Initiation of Settlement Runs*

The Settlements processes shall be user initiated. At a predefined time of day on a given day of the month, settlement processing shall be initiated and data from external sources shall be available for processing. Regardless of the source of the trigger (automatic or manual), processing shall be identical. Processing for reruns shall not be dependent upon retrieval of real-time Standing Data because the data relative to each historical market interval must be retained without alteration.

All input source data shall have been checked previously for completeness and validity. This is to ensure that all the relevant data is ready for processing and that the processing in the trading interval runs smoothly. If input source data has not passed validation, then the responsible


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application is informed by way of a "Status" message. The Settlements module produces this Status message, and the resolution of the problem is manual. The source applications may have to resubmit data before the Settlements processes can be reinitiated.

The system shall determine if a settlement run is already in progress. If one is, then a new run shall not be initiated, and progress on the current run shall be reported. If there is no run currently in progress, the user shall be able to choose the settlement type that they wish to run, the settlement period and an effective date/time for the run.

Assuming this is not a reconciliation run (see the following paragraph), the IMMS shall validate that the settlement period follows immediately from the last settlement run of the same settlement type that was completed satisfactorily, or no such settlement run exists. If no such settlement run exists, an error shall be issued and the processing shall stop.

If the chosen settlement type is a reconciliation run, the system shall invoke the required process and validate that at least one settlement run was processed correctly for the same settlement period. If not, an error shall be issued and processing shall stop. If one is available, the settlement run with the highest version number shall be used and its settlement run number updated.

Based on the settlement type and settlement period chosen, the effective date and time specified and the derived settlement comparison run number (when appropriate), a settlement run shall be created with processing status 'in progress' after creating a new settlement run number.

Settlement shall be performed in accordance with the specified process steps and the settlement run shall be monitored. Security access shall be permitted to MO staff only. All changes shall be tracked and recorded in the audit log.

#### 4.2.4.2 *Settlement Reconciliations*

The Contractor shall provide functions to support the calculation of reconciliation amounts. The system shall create an adjustments table using details from settlement runs that were completed correctly and whose type implies adjustment and whose authorization status is null (implying


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that the adjustment has not yet been included in a final settlement run). If there are no entries in this table, a message shall be displayed to the user.

If the table has entries, they shall be displayed and the user shall be able to check off one or more entries in the list. The process shall include the following features:

1. For those entries specified, he net Generation Volumes and Values are summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
2. For those entries specified, the net Purchase Volumes and Values shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
3. For those entries specified, the net Market Fees shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
4. For those entries specified, the value of Generation Balance before Value Added Tax (VAT) shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
5. For those entries specified, the value of Purchase Balance before VAT shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
6. For those entries specified, as a consideration, the VAT on Generation Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
7. For those entries specified, as a consideration, the VAT on Purchase Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
8. For those entries specified, as a consideration, the Generation Balance after VAT Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
9. For those entries specified, the Purchase Balance after VAT Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
10. For those entries specified, the Participant Fee Adjustment Values shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
11. For those entries specified, the Other Charges Balance before VAT Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.


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12. For those entries specified, the VAT on Other Charges Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
13. For those entries specified, the Other Charges Balance after VAT Adjustment shall be summed up for each Participant in question. The resulting values for each Participant shall be stored against the specific run number.
14. For each entry generated, the respective settlement run is updated with a "Reconciliation Inclusion Number", and processing is then returned to initiate settlement runs.

The Contractor shall provide the feature to calculate the interest, if any, based on the total adjusted settlement values per organization. The interest to be charged shall be at the daily interest rate allowed under the Market Rules and is referenced from the Settlements Module standing data. This function is only necessary for reconciliations since it is assumed that all participants will make the required payments by the due date via EFT.

#### *4.2.4.3 Monitoring / Canceling Settlement Runs*

The MO shall be able to monitor all Settlement runs, and cancel a run as required.

The Contractor shall provide functions to support MO with a menu of Settlement runs, and enable the selection of the present or past runs. Once selected, the IMMS shall provide all messages related to the run as they occur, or in a chronological order for past runs.

If the settlement run is still 'In Progress', this shall be reported to the user and the message redisplayed every 5 seconds to indicate that it is being updated (e.g. by the use of a timestamp).

The user shall be able to request the cancellation of a Settlement Run whose status is reported as 'In Progress' or 'Suspended due to Error'. If such a cancellation is requested and confirmed, the processing status of the run shall be set to 'Cancelled'. Cancellation of a settlement run shall be tracked and recorded in the audit log.


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### 4.2.5 Market Suspension

The Contractor shall provide functional features to support the MO's decision to suspend the market operation in one or more Regions by issuing a declaration to all TPs. The declaration of Market Suspension will be issued by the MO, which can be picked up via the Web interface by using E-Mail facilities. The IMMS shall have functions to provide the facility for an authorized user to create and maintain the Market Suspension status in selected region(s).

The Market shall be suspended from the beginning of the Trading Interval that the MO specifies as the Market Suspension time. The MO can suspend the operation of the market in a Region when one of the following conditions applies:

1. The power system has collapsed to a black system or the System Operator has declared that a threat to system security exists and it cannot be remedied by maintaining the market operations;
2. The Market Operator has been directed by a governmental order to suspend the operation of the Market in that Region or operate the Power System in a manner not consistent with the Electricity Market Rules;
3. The Market Operator has concluded that it is impossible to operate the Market in the Region in accordance with the Market Rules.

To re-establish the operation of the Market within a suspended Region, the MO must issue a notice to all TPs stating that the Market will recommence its operation in the Region on a specified date and time. The market re-activation date & time must be provided to TPs at a time specified in the market rules. This notice period is required in order for TPs to submit a day-ahead bid for the first period of Market Operation. The system shall accommodate the following:

1. Region Identifier;
2. Date and Time Suspension issued;
3. Market Status (1 = Suspended, 0 = Active);
4. Effective Date and Time Market Status to Change;
5. Reason for Suspension; and
6. Origin of Suspension order.


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The Contractor shall provide functions to complete settlement calculations for the Billing Period in which the market was suspended. After the market suspension, data within the IMMS relating to trading intervals will be ignored.

Settlement trading amounts will not be calculated for the duration of the Market Suspension in the affected Region(s), and an administered price will be enforced.

### 4.2.6 Disputes

In the course of market operation, disputes can arise over settlement payments. The Contractor shall provide functions within the IMMS to record the details of any disputes and clearance of such disputes. Disputes can arise at two levels. Stage one involves the disputing participants attempting to resolve the matter themselves. Escalation to stage two invokes a formal process that appoints a Dispute Resolution Administrator and Dispute Resolution Panel if required.

A new dispute file shall be created and saved in the system. Dispute details shall be recorded identifying the settlement date, run number, parties involved, and the specific issues. The raising of a dispute shall be recorded in the audit log and the Dispute file.

The Contractor shall provide the facility to modify the status of a dispute. Modification of dispute details will be recorded in the audit log.

Facility shall be provided to authorize the details of a dispute as correct. Authorization of dispute details is recorded in the audit log.

Facility shall be provided to update a dispute status (examples include 'level 1', 'level 2' 'resolved' etc.). Update of the status of a dispute shall be recorded in the audit log.

Where a dispute has been resolved, it will sometimes be necessary to prepare a reconciliation transfer statement. The Statement will be issued to the MO accounts department who will calculate the appropriate interest charges for the disputed payments and arrange for the reconciliation payments to be made between participants.


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The following reports shall be provided by the system:

1. Record outstanding disputes over a given period; and
2. Record dispute details.

### 4.2.7 User Interface

The Contractor shall provide user-friendly tools to support all aspects of the Settlements process, from data entry to reports.

## 4.3 Processing Payments

Payments processing will be executed external to the Settlement system using Electronic Funds Transfer (EFT) and a standard accounting package. The Contractor shall provide a Settlement system that is capable of depositing all required data. Reports shall be generated by the Settlements system in a user-defined format detailing the payments and receipts.

The Settlement system shall provide a balance sheet for determining the balance/imbalance of electrical and financial quantities for each settlement period, for designated contiguous settlement periods, and for cumulative contiguous periods.

### 4.3.1 Statements Process

The Contractor shall provide the following functions related to Statements Process.

After statements have been prepared, examined and authorized by settlements personnel, they are sent electronically to appropriate organizations. The details relating to authorization shall be recorded in the audit log. The authorization and issuance of statements shall strictly follow the time frame defined by the Timetable. Billing statements shall be allowed in mid-month and end of month only. Therefore, even if there are outstanding queries or data errors, the statement shall be issued. Any disputes or queries with the data shall be processed manually.


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The following diagram provides a summary of the Statements process, as presently defined in the Market Rules:

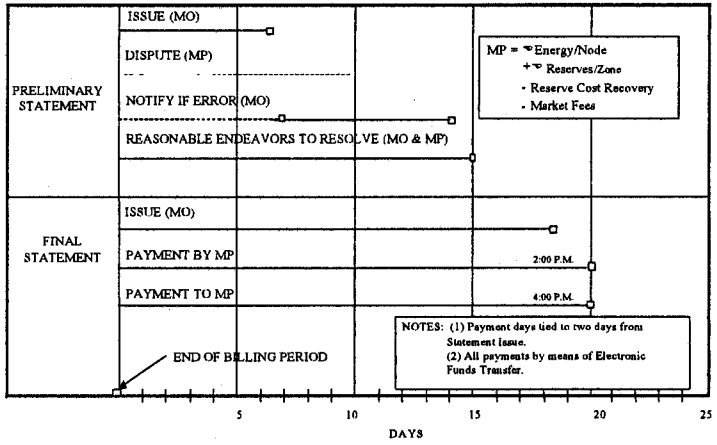


**Figure 4-5: Statements Process**

The payments must be made based on final statements, regardless of pending disputes.

### 4.3.2 Electronic Funds Transfer (EFT)

The MO will establish an Electronic Funds Transfer (EFT) capability for use by all Trading Participants. The Contractor shall provide an EFT function that ensures that the MO has the capability to electronically transfer funds between the MO and the Generators and Customers based on calculated Settlements.

The Contractor shall provide the following capabilities for interfacing with the EFT.

1. Secure data transfer and storage of all EFT account information;
2. Protected access to all EFT account information: limited to MO, TP and audit personnel;
3. Correlation between all Settlement statements and EFT data;


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4. Summaries of all EFT transactions by trading interval and daily activity;
5. Summaries, on request, of account information by TP, trading interval and statement;
6. Historical information and archived information as described for Settlements data;
7. Full audit capabilities for all EFT transactions.

The specific EFT function to be used will be selected by the MO during the system development phase. It shall be fully operational with the IMMS.

As far as the EFT provider is concerned, there will not be any requirement to calculate trading amounts, issue statements, perform billing runs or issue invoices; all these functions shall be handled by the MO Settlements and the MO Accounts department. The EFT provider will however, need to establish a reliable and secure communications link with the MO to electronically receive settlement trading amounts at designated times. The receipt of final statements from the MO will be done in two separate transactions to ensure that any shortfalls encountered during the debit of customer accounts is "smeared" across supplier accounts. The process is described in the simplified diagram below.





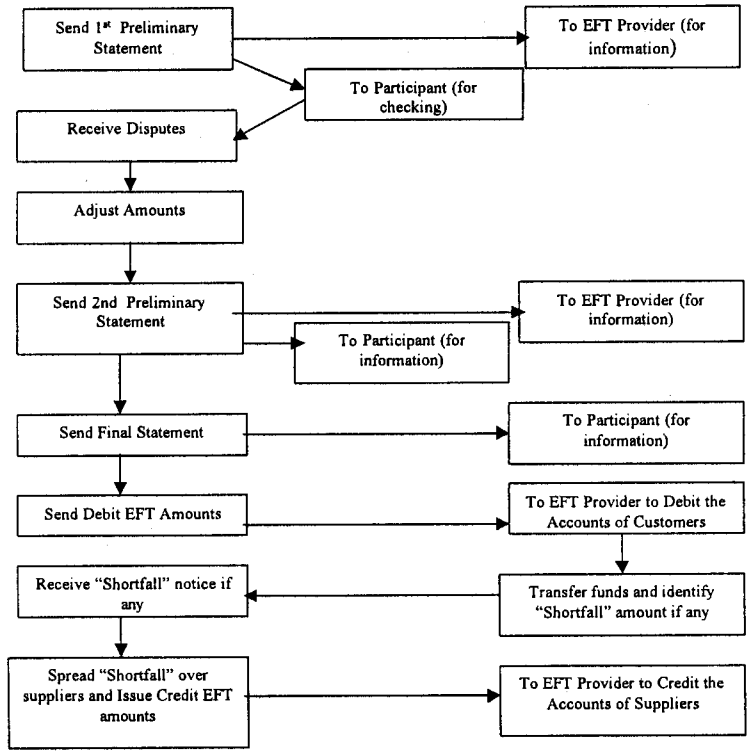


**Figure 4-6: Electronic Funds Transfer Process**

### 4.3.3 *Interface with the Accounting Department*

The Contractor shall include functions to provide direct reports on settlement transactions to the accounting department to facilitate financial accounting. The following Data shall be provided:

1. Statements and statement summaries;
2. Payment confirmations and summaries; and
3. Receipt confirmations and summaries.

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# 5.0 DATA EXCHANGE AND INTERFACE REQUIREMENTS

Data exchange and interface will be required for the Interim Market Management System (IMMS) to ensure a timely provision of data for market operations. The scope of such required data exchange is reduced when comparing with the Final MMS, as given in the following table:

| Function | IMMS | MMS |
|---|---|---|
| • MMS-EMS Interface | Manual | Automated |
| • Participant Interface | | |
| - Registration | Manual | Electronic |
| - Offers/Bids | Electronic (offers only) | Electronic |
| - Market Notices | Available | Available |
| • Metering Systems | | |
| - Data Collection | Partially Manual | Automated |
| - Re-tries | Not Applicable | Automated |
| • Settlements | | |
| - Statements | Automated | Automated |
| - Invoicing | Manual | Automated |
| - Funds Transfer | Electronic | Electronic |

A summary of the external data requirements, functions and users is given in the following table.

| ITEM | DATA USER | TYPES OF DATA | SOURCE OF DATA |
|---|---|---|---|
| **System** | | | |
| 1 | EMS-SO | Dispatch data: Generation schedules and scheduled loads [electronic transfer, initially for (a) print-out and manual process by SO; and capability for (b) electronic transfer directly into the EMS] | IMMS-MO |
| 2 | EMS-SO | Exchange of load forecast data [electronic exchange; initially for (a) manually executed input by SO automatic input/output in IMMS; and capability for (b) electronic transfer between EMS and IMMS within the interim market period] | IMMS-MO |


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| ITEM | DATA USER | TYPES OF DATA | SOURCE OF DATA |
|---|---|---|---|
| 3 | EMS-SO | Processed offers data [electronic transfer, initially for (a) print-out and manual process by SO; and capability for (b) electronic transfer directly to the EMS for bids and offers] | IMMS-MO |
| 4 | IMMS-MO | Outage request data, system status, changed conditions, special actions, etc. [electronic transfer, initially (a) by e-mail template and manual process by MO; and (b) capability for electronic transfer directly into the IMMS for use in market operation, optimization, and forecasting] | EMS-SO |
| 5 | IMMS-MO | Update of modeling data from system to Market Operator (MO) [electronic transfer, initially (a) as summary tables for projected load flows and congestion by major paths; and (b) capability for electronic transfer of selected SCADA data directly between applications in EMS and IMMS] | EMS-SO |
| 6 | IMMS-MO | Submission of and receipt of confirmation for bids and offers [electronic transfer, automated processing by IMMS] | Trading Participants |
| 7 | IMMS-MO | Grid metering data corrections (if any) or adjustments [electronic transfer, initially (a) from data processed and made settlement ready by the NPC central meter collection site (and stored there); and with provision **to expand** in the MMS phase to a full-scale meter processing and warehouse for market related meter data] | Metering Provider |
| **Function** | | | |
| 8 | Settlements | Electronic transfer, Settlement-ready meter data | Metered Data Collection System (MDCS) |
| 9 | Settlements | Electronic transfer, Raw offer data from TPs (provide option) | IMMS-MO |
| 10 | Settlements | Electronic transfer, Processed offer data | IMMS-MO |
| 11 | Settlements | Electronic transfer, Grid metering data including any corrections (if any) or adjustments with flags and trailer information [automated, electronic transfer] | EMS-SO |
| 12 | Settlements | Electronic transfer, Standing data such as TP, metering provider, and all relevant names, addresses, electronic transfer routings, maximum and minimum ratings (for reasonability checks), etc. | Master standing database [bi-directional] |


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| ITEM | DATA USER | TYPES OF DATA | SOURCE OF DATA |
|---|---|---|---|
| 13 | Settlements | Electronic transfer, Constraint data, curtailment data, congestion data (MO data includes data submittals from SO) | IMMS-MO |
| 14 | Archive System | Archiving of all input data and results, to allow manually executed reconstruction and comparison during interim market processes, electronic transfer | Settlements External archive MO MDCS |
| 15 | Electronic Funds Transfer | Necessary data, audit trail, and prudential assessment required to evaluate, request, and execute valid payment drafts (electronic or paper) directly and, by user selection, secure electronic request to a third party contractor. | Settlements & prudential assessments |
| 16 | Accounting System and Corporate Ledger | All financial related output and associated electrical values and service types, charge types, and final settlement data, electronic transfer | Settlements and Electronic Banking Transfers |
| **User** | | | |
| 17 | User workstations - monitoring audit, and surveillance, engineering support staff | Authorized users who (read only) review, evaluate, and recommend actions. | Settlements IMMS-MO MDCS |
| 18 | User workstations - IMMS high level authorization | Limited few individuals who are authorized to make database changes, execute any overrides or input any allowed adjustments, with audit trail. | Settlements IMMS-MO MDCS Reconciliation |
| 19 | User workstations - IMMS system support | Read only access for real-time data, as well as technology maintenance support of platforms and systems, without authority to make data changes on primary system. | Settlements IMMS-MO MDS |
| 20 | User workstations - audit and security office | Read only, for audit review and security. | Settlements IMMS-MO MDCS |
| 21 | User workstations - dispute and reconciliation | Read only for dispute analysis and reconciliation. | Settlements IMMS-MO MDCS Accounting |


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| ITEM | DATA USER | TYPES OF DATA | SOURCE OF DATA |
|---|---|---|---|
| 22 | User workstations - application maintenance monitoring applications | Maintenance Engineering access (no authority to change or add data). | Settlements<br>IMMS-MO<br>MDCS<br>Communications |
| 23 | User workstations - Prudential Assessment | Load and market forecast data and historical data | IMMS and Settlements |

## 5.1 Energy Management System (EMS)

The GE-Harris EMS is a key component of the Information Technology (IT) infrastructure required to support WESM operations. The SO has full responsibility for monitoring and ensuring electric network system security and will use and retain the EMS to execute generation dispatch in accordance with the generation requirements developed by the IMMS. The EMS will also provide information to the IMMS for the Market Dispatch Optimization Algorithm, including the network model, system status and analog data, planned outages, security constraints, load forecast data and ancillary services requirements.

To produce the generation schedules (requirements) for ancillary and non-ancillary products, the market data input is a part of the IMMS requirement. The basic data is bids and offers from participants. Data such as load forecast, compliance monitoring, and constraint data are generated in the EMS. The IMMS shall support the input of all data from the EMS, which may be input manually.

The IMMS shall provide the SO with generation dispatch schedules and other data required for system control. These data shall be provided as required by the WESM Timetable in a format compatible with the GE-Harris system and with all necessary security.


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### 5.1.1 Process Diagrams

The two main processes requiring data exchange between the EMS and IMMS are shown in the process diagrams of Figures 5-1 and 5-2.

#### 5.1.1.1 Dispatch

The IMMS shall produce for SO use the Dispatch Schedule (Stack), based on the final Offers and Bids received from Trading Participants, using a Security Constrained Dispatch Algorithm.

Input data required from the SO are:

- Network Status (transmitted only on change)
- Schedule of Outages
- Transmission Constraints
- Generator Preferred Operating Points by Unit
- Load Forecast by Trading Node


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## *Market Operations - Dispatch*

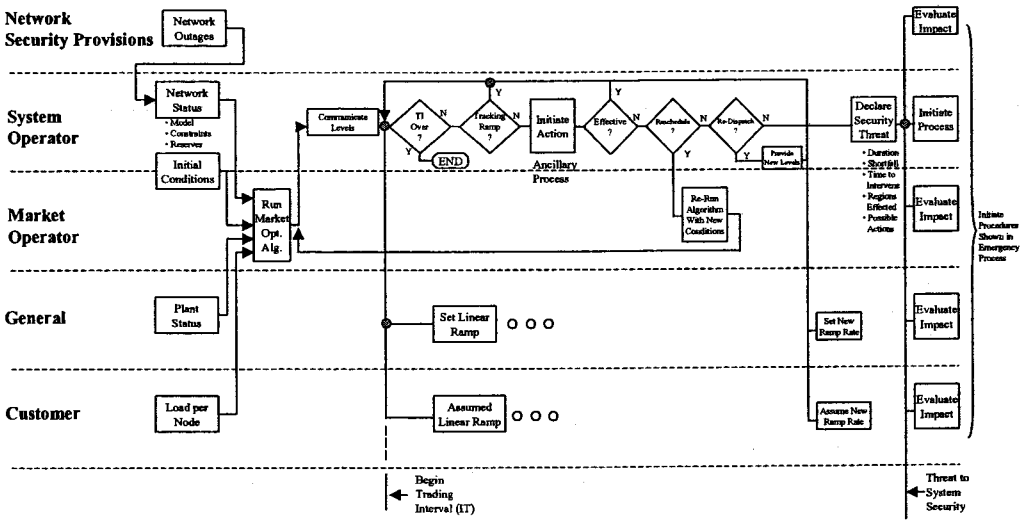


**Figure 5-1: Market Operations-Dispatch**





## *Market Operations - Emergency*

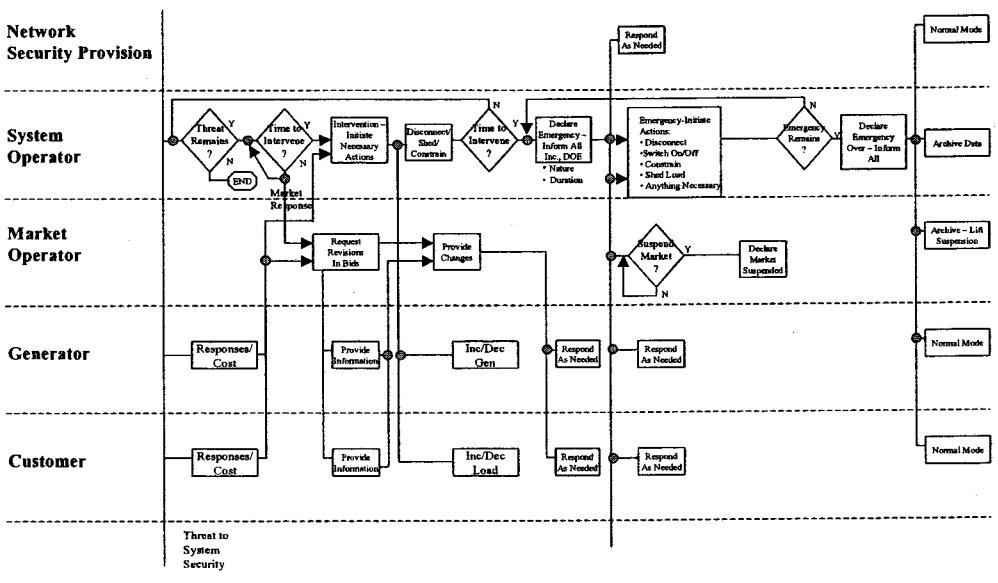


**Figure 5-2: Market Operations-Emergency**

The results of the Dispatch run (i.e., the Dispatch Schedule, the Stack) shall be transmitted to the SO for use in the next Trading Interval unless an Emergency condition is declared, and the market operation in any region is suspended.

#### 5.1.1.2 *Emergency Operations*

The declaration of an Emergency condition and the corresponding response are defined in the Market Rules. Further details regarding system operation during Emergency conditions will be based on procedures developed jointly by the SO and the MO.

## 5.2 *WESM E-Commerce for Trading Participants*

The Trading Participants (TP) shall be able to access and provide data to the IMMS using WESM E-Commerce.

The IMMS Contractor shall provide all functions and capabilities required for the WESM E-Commerce. It is possible that major portions of the WESM E-Commerce capability can be satisfied by using commercially available components; however, the IMMS Contractor shall retain full responsibility for the overall functionality, including the availability and performance requirements.

The WESM E-Commerce capability shall support:

1. Communications between the Market Operator and the Trading Participants throughout the Philippines, specifically the Generators, in Luzon and Visayas. The Trading Participants will be located throughout the regions, but all must have local and immediate access.
2. Oversight of the WESM by the Market Surveillance Committee and by Government agencies. The integrity of the WESM must be ensured.


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### 5.2.1 ***Functions***

The web site is an integral part of market operations. The functions to be included in the web site are:

1. Offers and Bids – The main use of the WESM web site is for the submittal of Offers, including reserves, by Generators, and Bids and Offers by Customers, for each trading interval in accordance with the requirements of the Market Rules. The web site shall be designed to handle the maximum number of offers and bids, and re-submissions, as defined in the Performance portion of the specification;
2. Acceptances and Rejections – MO transmits the acceptance or rejection of the submitted offers and bids;
3. Day-ahead Projections – Day-ahead projections for each trading interval shall be published in accordance with the Timetable;
4. Market Information – The MO will use the site to publish all required information regarding the market, including the details of previous day dispatched generation or dispatched load, and dispatched reserves for each scheduled generating unit and scheduled load in each trading interval; and
5. General Information – The WESM web site shall have the capability of publishing general information as required by the MO or the Government.

### 5.2.2 ***Access***

The WESM web site will be used for competitive buying and selling of power on a real-time basis. As such a great deal of information on the site is sensitive and proprietary. Access to specific portions of the site shall be controlled and subject to the security provisions detailed below. The site shall have at least the following levels of access:

1. Market Administrator – Highest level of access. No limitations. Control of passwords and security controls;
2. Market Auditor – Unlimited access to all data on the site including archived and current data;
3. Market Operator – Unlimited access to all information submitted and published on the site;
4. Network Service Provider – Access only to the details of the network; no "sensitive" market information;
5. Meter Service Providers – Access to Participants' Register, the Metering information database and general market information;


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6. Generators – Access to those data directly affecting them such as day-ahead and week-ahead projections and Market Information;
7. Customers – Same as for Generators;
8. Government Agencies – General market information; and
9. General Public – Will be restricted to specific information as designated by the Market Rules.

#### 5.2.2.1 User Log-in

Log-in shall be facilitated by a web component. The Contractor shall provide a secure log-in function that restricts user access to specific functionality. The access table shall provide various levels as defined above, in 5.2.2.

### 5.2.3 Forms and Templates

All of the information to be exchanged and/or posted on the WESM Site shall be enterable via forms and templates created for this purpose by the MO.

Default forms shall be built using a standard template editor. These forms shall be designed in consultation with the MO and shall be approved by the MO. Some of the specific requirements are:

1. Creation and modification of templates shall be possible using simple data entry procedures;
2. Templates shall be implemented using standard technologies, preferably XML or spreadsheet tables with Comma Separated Values (CSV);
3. All templates shall contain an identification number, the version number and the effective date of implementation;
4. Descriptions of all templates shall be posted on the web site;
5. Transition to new or updated templates/forms shall be under the control of the MO;
6. Ease of use by the TPs shall be a high priority; and
7. All changes to templates and installation activities shall be logged and archived.





### 5.2.4 Trading Participant Operation

A major responsibility of the MO will be to provide information to TPs. Acceptance of the web site and interface with the TPs is of vital importance to the ultimate success of the market. Participants need detailed information to help them make informed business decisions, and to participate in a manner consistent with the objectives of the market. Hence, the web site shall be designed to:

1. Enable all participants to access the market system without a heavy investment in specialized computer technology;
2. Provide all participants equal access to market information;
3. Enable participants to make effective trading decisions by providing market information at the right time and in an appropriate format; and
4. Encourage the development of efficient markets.

Information dissemination shall share a common set of general characteristics. It is essential that the information be accurate and consistent between display presentations, and be made available in a timely fashion. Titles and headings shall be clearly defined and easily understood. Participants shall control the selection of data and be able to customize the parameters that control the information presentation formats.

All information provision functions and web components shall share a standard set of characteristics in order to ensure consistent display and operation.

The market web site shall provide Participants with one-stop access to information about the markets.

The trading page shall provide the following:

1. Real-time market display panels; and
2. Data entry facilities.

The trading page will be defined during the project implementation process.

#### 5.2.4.1 Operations Functions

The Web server shall support:

1. Secure login of Participants with varying security levels of access to data.;
2. Standard web browsing and navigation among web pages, using the latest web browser capabilities;
3. XML-supported displays of data;
4. Entry of form data;
5. Download and upload of data according to the formats defined by the Market Rules;
6. "Notification" of events and messages to individual Participants;
7. Broadcast of messages to all Participants;
8. Periodic/on-event updates of the changed data on user's screens;
9. Time-stamped Web log that can be queried for basic site statistics and each Participant's usage and access statistics; and
10. Time-stamped Web archive of critical data as posted to Participants.

### 5.2.5 Security

The security of the WESM web site is of foremost importance. With the sole exception of the web pages designed for use by the general public, security shall be assured as described below:

1. A Public Key Infrastructure (PKI) using standard 1024 bit digital certificates shall be used to verify the identity of participants. The WESM web site shall ensure that:
   a. The certificates used are registered in the Certificate Registry;
   b. Certificates are current and valid, by verifying the Certificate Authorities signature and checking the validity period;
   c. The participant has initiated communications from the specified IP address or host; and
   d. The certificate has not been revoked.
2. Secure Sockets Layer version 3 (SSLv3) and/or Transport Layer Security (TLS) Version 1 or above, IP Security or equivalent shall be used for authentication. The following SSL selections or alternatives with equivalent performance characteristics shall be provided:
   a. Asymmetric Algorithm: RSA
   b. Symmetric Algorithm: RC4 (128-bit)


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   c. Digest Algorithm: SHA-1
   d. Record Size: Largest size feasible.
3. Strong encryption with a minimum 128-bit key.
4. The web site shall provide for lockout of individual participants in the event of authentication failures, automatic logout on loss of connection, and automatic closing of all files and applications in the event of logout.

#### 5.2.5.1 Site Monitor

The Site Monitor function shall process all requests to access the WESM system from all users by ensuring that requests are routed correctly, security rules are applied, and access constraints are handled correctly.

All activities occurring on the WESM web site shall be monitored and the following events recorded for review by authorized access levels:

1. Logons to the site;
2. Unsuccessful logon attempts;
3. Logoff and loss of connection;
4. Updates of information shown on the web pages;
5. Downloads of files or results of queries;
6. Upload of files;
7. Submitted forms;
8. Acceptance and Rejection Notices;
9. Attempts by individuals to access restricted data;
10. Web site application failures;
11. Web site communications failures;
12. Failed attempts for access from unauthorized ports; and
13. Any other security breaches.

The log of these events shall include the following information at a minimum:

1. Time to the millisecond, and date of the event;
2. Logon name of the individual and certificate number;
3. Targeted URL address;


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4. Success or failure of interaction;
5. Type of Event;
6. Archive of the associated data, if applicable; and
7. Security Alarm flag to indicate an unusual aspect of the event.

Access to the security log shall be limited to authorized security engineers, the Market Auditor and the WESM Web Site administrator.

### 5.2.6 General Web Site Operation

When a user first opens the Market Web site, the general public view shall be displayed. This view shall provide the user with a standard set of fields and links to other pages. It shall also provide Participants with a log in function.

Trading Participants (as opposed to those interested only in observing the market) shall be able to access the trading functions as defined by their service level. Each Trading Participant's connection shall be monitored and if a specified time out interval is reached, access to the trading functions shall be suspended until the Participant logs back in.

Navigation panels to other pages shall enable the user to move between pages, for example reports and messages.

Hyperlinks to public web pages shall still be available from within the trading pages. They will be used to display general information about the electric energy markets and operation of the WESM. They will also be used to display public bid/offer information and other market related data entered by the participants. In addition to pre-formatted public reports, Participants shall be able to select data using an ad-hoc query function.

The Trading Pages shall support the following functions:

1. Allowing users to log in;
2. Displaying connection status;
3. Monitoring user connections;





4. Navigating between pages;
5. Reporting Energy Usage;
6. Reporting Spot prices;
7. Reporting spot market histories;
8. Reporting News; and
9. Viewing Static reports.

#### 5.2.6.1 Displaying Connection Status

The Connection status shall be presented in a field on all web pages in the same location on the screen. Its purpose is to provide feedback about the status of a user's connection to the WESM system. It shall be triggered by a user request to view any WESM web page (public or trading), and shall be updated periodically by a background process.

#### 5.2.6.2 Monitoring User Connections

A background task shall be included such that the users may leave their workstation at any time without logging off. Connections made with the system shall be monitored so that they can be cleaned up, or at least 'timed' out, after a default or user defined period of time. The purpose of monitoring user connections is:

1. To protect against unauthorized trading activity; and
2. To clean up user connections that are no longer in use.

#### 5.2.6.3 Navigating Between Pages

Navigating between pages shall be facilitated by a web panel in each trading web page. The purpose is to enable users to navigate to market web pages from within the trading web site by preparing 'menus'.

### 5.2.7 Trading Participant Data Input

The data to be transmitted from the Trading Participant to the IMMS will utilize WESM E-Commerce forms that would be developed for each of the following sets of data.

1. Offers and Bids
2. Fixed Contracts

#### 5.2.7.1 Offers and Bids

Validated offers and bids will be submitted by each valid TP for each trading period using the approved MO template. Each template shall provide the data fields identified by this Data Input Table. Offers and bids shall be date and time stamped when received by the IMMS in order to determine the validity with respect to time allowed for submitting and processing offers and bids.

Each Offer/Bid will designate commodity type Identifiers. The IMMS shall support:

1. energy, generation offer; and
2. energy, customer demand bid (corresponding to dispatchable load).

Each template shall allow for different commodity types, with provision to accommodate 24 trading periods in a 24-hour calendar day. Templates shall also include beginning and ending times for each commodity type in the specified trading period(s); it shall default to first entered submittal date for each time segment, unless flagged as a standing bid.

The Contractor shall provide for commodity trading period "standing bid" flag as allowed by WESM, with beginning date and time and ending date and time for each commodity type.

#### 5.2.7.3 Fixed Contracts

The IMMS shall support the submittal of Fixed Contract Data. Fixed Contract Data will be submitted as contract tables in MO-defined format, including but not limited to:

1. TP name;


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2. registration number;
3. contract type (code to be determined by MO);
4. contract number or identifier;
5. commodity type;
6. contract effective date;
7. contract expiration date;
8. values and prices table;
9. physical location of each plant/unit/load;
10. connection point and associated node and pricing zone; and
11. limits/conditions/restrictions.

This input shall be received by the IMMS and flagged to the MO. The Contractor shall submit to MO for approval all the forms utilized for data submittal and review.

#### 5.2.7.4 Market Commodity Submittals

All submittals for market commodities shall utilize Contractor-provided, MO-approved forms and templates. These shall be designed for ease of entry, navigation and transfer of data electronically via WESM E-Commerce. In addition, the Contractor shall facilitate the manual entry of these data by the MO. Processing of forms, both electronic and manually-entered, shall include the validation and reasonability checks in the submittal descriptions as well as all security checks.

The market commodity submittal types and the data requirements for each type are.

1. Energy, Customer demand bid, load specific: Must correspond with certified dispatchable load.
   a. MW per each of 1-10 blocks per take-off point, must equal or exceed minimum block size (user enterable);
   b. submittal must include monotonically decreasing prices (Pesos), must begin from a zero takeoff, may have negative prices, all prices must fall between the market price floor (user enterable) and the market price cap (user enterable); and
   c. submittal must specify validity period or specify "valid until offer is revised or revoked," must not exceed the maximum rated loads for the respective seasonal period specified for each take-off point in standing data.


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2. Energy, generation offer, dispatchable unit specific:
   a. MW specified in each of 1-10 blocks, each block size must equal or exceed specified MW minimum value (user enterable);
   b. submittal must consist of monotonically increasing prices (in Pesos) beginning with zero MW generation, may include negative prices as allowed by WESM, prices must fall between the market price floor (user enterable) and the market price cap (user enterable);
   c. submittal must specify validity period or specify "valid until offer is revised or revoked," must include operating range equal to or less than that in the standing data; and
   d. must include governor ramp rates up and down (each in MW/minute) not to exceed those in standing data, and maximum MW may not exceed maximum rating in standing data.


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ADITIONAL PROJECT REQUIREMENTS

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11.0 Project Management ..... 11-1





# 6.0 SYSTEM PERFORMANCE AND SIZING REQUIREMENTS

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|---|---|---|---|---|---|
| **6** | **SYSTEM PERFORMANCE AND SIZING REQUIREMENTS** | Same as MMS described in Volume III | Section 6 | Except that | Requirements are for the initial System Only |
| **6.1** | **Critical and Non-Critical Functions** | Same as MMS described in Volume III | Section 6.1 | | |
| **6.1.1** | **Critical Functions** | Same as MMS described in Volume III | Section 6.1.1 | | |
| **6.1.2** | **Non-Critical Functions** | Same as MMS described in Volume III | Section 6.1.2 | | |
| **6.2** | **System Utilization** | Same as MMS described in Volume III | Section 6.2 | Except that | Requirements are for the initial System only |
| **6.2.1** | **System Activity Levels** | Same as MMS described in Volume III | Section 6.2.1 | | |
| **6.2.2** | **Utilization Requirements** | Same as MMS described in Volume III | Section 6.2.2 | | |
| **6.3** | **User Response Time Requirements** | Same as MMS described in Volume III | Section 6.3 | | |
| **6.3.1** | **Display Call-up Response Time** | Same as MMS described in Volume III | Section 6.3.1 | | |
| **6.4** | **Market Applications Functions Completion Time** | Same as MMS described in Volume III | Section 6.4 | | |
| **6.4.1** | **Market Applications Functions Completion Time** | Same as MMS described in Volume III | Section 6.4.1 | | |
| **6.5** | **Market Activity Estimated Volume** | Same as MMS described in Volume III | Section 6.5 | | |
| **6.5.1** | **Business Information** | Same as MMS described in Volume III | Section 6.5.1 | Except that | Initial sizing requirements only apply. |
| **6.5.2** | **Participant Interfaces** | Same as MMS described in Volume III | Section 6.5.2 | Except that | Initial sizing requirements only apply. |
| **6.5.3** | **Offers and Bids** | Same as MMS described in Volume III | Section 6.5.3 | Except that | Initial sizing requirements only apply. |
| **6.5.4** | **Market Operation Data Transfer** | Same as MMS described in Volume III | Section 6.5.4 | Except that | Initial sizing requirements only apply. |

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|---|---|---|---|---|---|---|
| 6.5.5 | Prudential Assessment | Same as MMS described in Volume III | Section | 6.5.5 | Except that | Initial sizing requirements only apply. |
| 6.5.6 | Settlements | Same as MMS described in Volume III | Section | 6.5.6 | Except that | Initial sizing requirements only apply. |
| 6.6 | MMS Sizing | Same as MMS described in Volume III | Section | 6.6 | Except that | Initial sizing requirements only apply. |
| 6.7 | System Availability | Same as MMS described in Volume III | Section | 6.7 | | |
| 6.7.1 | Calculation of Availability | Same as MMS described in Volume III | Section | 6.7.1 | | |
| 6.7.2 | Downtime Accumulation | Same as MMS described in Volume III | Section | 6.7.2 | | |
| 6.7.3 | End of Downtime Accumulation | Same as MMS described in Volume III | Section | 6.7.3 | | |
| 6.8 | System Security | Same as MMS described in Volume III | Section | 6.8 | | |
| 6.8.1 | General | Same as MMS described in Volume III | Section | 6.8.1 | | |
| 6.8.2 | Data Links and E-Commerce | Same as MMS described in Volume III | Section | 6.8.2 | | |
| 6.8.3 | Monitor and Audit | Same as MMS described in Volume III | Section | 6.8.3 | | |
| 6.9 | Applicable Standards | Same as MMS described in Volume III | Section | 6.9 | | |


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# 7. HARDWARE AND SOFTWARE PLATFORMS

| | | | | |
|---|---|---|---|---|
| 7 | HARDWARE AND SOFTWARE PLATFORMS | Same as MMS described in Volume III | Section | 7 |
| 7.1 | General | Same as MMS described in Volume III | Section | 7.1 |
| 7.2 | MMS Configuration | Same as MMS described in Volume III | Section | 7.2 |
| 7.3 | Distributed Open Systems Requirements | Same as MMS described in Volume III | Section | 7.3 |
| 7.4 | Redundant System Design Requirements | Same as MMS described in Volume III | Section | 7.4 |
| 7.4.1 | Redundancy Requirements | Same as MMS described in Volume III | Section | 7.4.1 |
| 7.4.2 | Design Options | Same as MMS described in Volume III | Section | 7.4.2 |
| 7.4.3 | Failover/Switchover | Same as MMS described in Volume III | Section | 7.4.3 |
| 7.4.4 | System Restarts | Same as MMS described in Volume III | Section | 7.4.4 |
| 7.4.5 | Manual Failover/Switchover and Restart | Same as MMS described in Volume III | Section | 7.4.5 |
| 7.5 | Hardware Requirements | Same as MMS described in Volume III | Section | 7.5 |
| 7.5.1 | Processors | Same as MMS described in Volume III | Section | 7.5.1 |
| 7.5.2 | Compact Disk-Recordable (CD-R) Units | Same as MMS described in Volume III | Section | 7.5.2 |
| 7.5.3 | System LAN Connectivity | Same as MMS described in Volume III | Section | 7.5.3 |
| 7.5.4 | MMS User Consoles | Same as MMS described in Volume III | Section | 7.5.4 |
| 7.5.5 | Expansion Capabilities | Same as MMS described in Volume III | Section | 7.5.5 |
| 7.5.6 | Upgrade Capabilities | Same as MMS described in Volume III | Section | 7.5.6 |
| 7.6 | System Software Requirements | Same as MMS described in Volume III | Section | 7.6 |
| 7.6.1 | Software Development and Integration | Same as MMS described in Volume III | Section | 7.6.1 |
| 7.6.2 | Version-Control Software | Same as MMS described in Volume III | Section | 7.6.2 |
| 7.6.3 | Operating System Software | Same as MMS described in Volume III | Section | 7.6.3 |
| 7.6.4 | Diagnostics | Same as MMS described in Volume III | Section | 7.6.4 |


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| | | | | | | |
|---|---|---|---|---|---|---|
| 7.6.5 | Virus Detection | Same as MMS described in Volume III | Section | 7.6.5 | | |
| 7.6.6 | Programming Tools | Same as MMS described in Volume III | Section | 7.6.6 | | |
| 7.6.7 | System Generation | Same as MMS described in Volume III | Section | 7.6.7 | | |
| 7.6.8 | Third Party Software Interfacing Requirements | Same as MMS described in Volume III | Section | 7.6.8 | | |
| 7.6.9 | System Resource Monitoring | Same as MMS described in Volume III | Section | 7.6.9 | | |
| 7.7 | Emergency Backup System (EBS) | Same as MMS described in Volume III | Section | 7.7 | Except that | Requirements are for information only; later addition. |
| 7.7.1 | EBS Design Philosophy | Same as MMS described in Volume III | Section | 7.7.1 | Except that | Requirements are for information only; later addition. |
| 7.7.2 | EBS Functions | Same as MMS described in Volume III | Section | 7.7.2 | Except that | Requirements are for information only; later addition. |
| 7.7.3 | Database Maintenance | Same as MMS described in Volume III | Section | 7.7.3 | Except that | Requirements are for information only; later addition. |
| 7.7.4 | Support for User Consoles | Same as MMS described in Volume III | Section | 7.7.4 | Except that | Requirements are for information only; later addition. |
| 7.7.5 | Transferring of Operations Between the Main System and EBS | Same as MMS described in Volume III | Section | 7.7.5 | Except that | Requirements are for information only; later addition. |
| 7.7.6 | EBS Integrity Testing | Same as MMS described in Volume III | Section | 7.7.6 | Except that | Requirements are for information only; later addition. |


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# 8. DATABASE REQUIREMENTS

| | | | | |
|---|---|---|---|---|
| 8 | DATABASE REQUIREMENTS | Same as MMS described in Volume III | Section | 8 |
| 8.1 | Database Design Requirements | Same as MMS described in Volume III | Section | 8.1 |
| 8.1.1 | Design Concepts | Same as MMS described in Volume III | Section | 8.1.1 |
| 8.1.2 | Design Conventions | Same as MMS described in Volume III | Section | 8.1.2 |
| 8.1.3 | Database Model | Same as MMS described in Volume III | Section | 8.1.3 |
| 8.1.4 | Common Information Model (CIM) Data Objects | Same as MMS described in Volume III | Section | 8.1.4 |
| 8.1.5 | Relational Database Requirements | Same as MMS described in Volume III | Section | 8.1.5 |
| 8.1.6 | Database Backup and Security | Same as MMS described in Volume III | Section | 8.1.6 |
| 8.2 | Market Operations Database Management | Same as MMS described in Volume III | Section | 8.2 |
| 8.2.1 | Multiple Database Instances | Same as MMS described in Volume III | Section | 8.2.1 |
| 8.2.2 | System Rollback | Same as MMS described in Volume III | Section | 8.2.2 |
| 8.2.3 | Referential Integrity | Same as MMS described in Volume III | Section | 8.2.3 |
| 8.2.4 | Synchronization with Template Modifications | Same as MMS described in Volume III | Section | 8.2.4 |
| 8.3 | Historical and Archival Databases | Same as MMS described in Volume III | Section | 8.3 |
| 8.3.1 | Capabilities of the Historical and Archival Databases | Same as MMS described in Volume III | Section | 8.3.1 |
| 8.3.2. | On-Line Market Operations Records | Same as MMS described in Volume III | Section | 8.3.2. |
| 8.3.3 | Off-Line Archiving and Transfer of Data | Same as MMS described in Volume III | Section | 8.3.3 |
| 8.4 | Report Generation and Maintenance | Same as MMS described in Volume III | Section | 8.4 |
| 8.4.1 | Creation of Reports | Same as MMS described in Volume III | Section | 8.4.1 |


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| | | | |
|---|---|---|---|
| 8.4.2 | Printing of Reports | Same as MMS described in Volume III | Section 8.4.2 |
| 8.4.3 | Viewing and Editing of Reports | Same as MMS described in Volume III | Section 8.4.3 |
| 8.5 | Database Generation and Maintenance Requirements | Same as MMS described in Volume III | Section 8.5 |
| 8.5.1 | Database Generation | Same as MMS described in Volume III | Section 8.5.1 |
| 8.5.2 | Database Generation Tasks | Same as MMS described in Volume III | Section 8.5.2 |
| 8.5.3 | Database Update | Same as MMS described in Volume III | Section 8.5.3 |
| 8.5.4 | Input Validation | Same as MMS described in Volume III | Section 8.5.4 |
| 8.5.5 | Database Maintenance Functions | Same as MMS described in Volume III | Section 8.5.5 |
| 8.5.6 | Interactive Database Updating | Same as MMS described in Volume III | Section 8.5.6 |
| 8.5.7 | Database Redundancy and System Reliability | Same as MMS described in Volume III | Section 8.5.7 |

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9 # 9. DOCUMENTATION REQUIREMENTS

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| | | | |
|---|---|---|---|
| 9 | DOCUMENTATION REQUIREMENTS | Same as MMS described in Volume III | Section 9 |
| 9.1 | Categories of Documentation Required | Same as MMS described in Volume III | Section 9.1 |
| 9.2 | Documentation Plan | Same as MMS described in Volume III | Section 9.2 |
| 9.3 | Documentation Preparation Requirements | Same as MMS described in Volume III | Section 9.3 |
| 9.3.1 | Documents | Same as MMS described in Volume III | Section 9.3.1 |
| 9.3.2 | Contractor's Drawings | Same as MMS described in Volume III | Section 9.3.2 |
| 9.4 | Documentation Review and Approval Rights | Same as MMS described in Volume III | Section 9.4 |
| 9.4.1 | General | Same as MMS described in Volume III | Section 9.4.1 |
| 9.4.2 | Approval of Documents | Same as MMS described in Volume III | Section 9.4.2 |
| 9.4.3 | Approval of Drawings | Same as MMS described in Volume III | Section 9.4.3 |
| 9.4.4 | Contractor's Responsibility | Same as MMS described in Volume III | Section 9.4.4 |
| 9.5 | Functional Design Documentation | Same as MMS described in Volume III | Section 9.5 |
| 9.5.1 | Hardware Functional Design Documentation | Same as MMS described in Volume III | Section 9.5.1 |
| 9.5.2 | Software Functional Design Documentation | Same as MMS described in Volume III | Section 9.5.2 |
| 9.6 | Detailed Design Documentation | Same as MMS described in Volume III | Section 9.6 |
| 9.6.1 | Detailed Hardware Design Documentation | Same as MMS described in Volume III | Section 9.6.1 |
| 9.6.2 | Detailed Software Design Documentation | Same as MMS described in Volume III | Section 9.6.2 |
| 9.6.3 | System Software | Same as MMS described in Volume III | Section 9.6.3 |
| 9.6.4 | Database Manual | Same as MMS described in Volume III | Section 9.6.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9.6.5 | Interface Control Document | Same as MMS described in Volume III | Section | 9.6.5 | | |
| 9.7 | Hardware Maintenance Manuals | Same as MMS described in Volume III | Section | 9.7 | | |
| 9.8 | Software Maintenance Manuals | Same as MMS described in Volume III | Section | 9.8 | | |
| 9.8.1 | Standard Software Manuals | Same as MMS described in Volume III | Section | 9.8.1 | | |
| 9.8.2 | Custom Software Manuals | Same as MMS described in Volume III | Section | 9.8.2 | | |
| 9.8.3 | System Administrator Manual | Same as MMS described in Volume III | Section | 9.8.3 | | |
| 9.8.4 | Manuals for Development and Debugging Tools | Same as MMS described in Volume III | Section | 9.8.4 | | |
| 9.9 | Facilities and Installation Manuals | Same as MMS described in Volume III | Section | 9.9 | | |
| 9.1 | Users Manuals | Same as MMS described in Volume III | Section | 9.1 | | |
| 9.10.1 | Information Presentation Requirements | Same as MMS described in Volume III | Section | 9.10.1 | | |
| 9.10.2 | Contents and Structure | Same as MMS described in Volume III | Section | 9.10.2 | | |
| 9.10.3 | Viewing of the User Manuals on MMS Consoles | Same as MMS described in Volume III | Section | 9.10.3 | | |
| 9.11 | Test Documentation | Same as MMS described in Volume III | Section | 9.11 | | |
| 9.11.1 | Acceptance Testing Plan | Same as MMS described in Volume III | Section | 9.11.1 | | |
| 9.11.2 | Factory Acceptance Test (FAT) Procedures | Same as MMS described in Volume III | Section | 9.11.2 | Except that | Requirements are for the Initial System |
| 9.11.3 | Site Acceptance Test Procedures | Same as MMS described in Volume III | Section | 9.11.3 | | |
| 9.11.4 | Availability Test Procedures | Same as MMS described in Volume III | Section | 9.11.4 | | |
| 9.12 | As-Built Documentation and Software | Same as MMS described in Volume III | Section | 9.12 | | |
| 9.12.1 | Final System Documentation | Same as MMS described in Volume III | Section | 9.12.1 | | |
| 9.12.2 | Final Software | Same as MMS described in Volume III | Section | 9.12.2 | | |
| 9.13 | Master Documents Directory | Same as MMS described in Volume III | Section | 9.13 | | |


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# 10. QUALITY ASSURANCE AND SYSTEM TESTING

| | | | | | | |
|---|---|---|---|---|---|---|
| 10 | QUALITY ASSURANCE AND SYSTEM TESTING | Same as MMS described in Volume III | Section | 10 | | |
| 10.1 | ISO-9000 Certification | Same as MMS described in Volume III | Section | 10.1 | | |
| 10.2 | Configuration Control | Same as MMS described in Volume III | Section | 10.2 | | |
| 10.3 | Tracking of Problems and Variances | Same as MMS described in Volume III | Section | 10.3 | | |
| 10.3.1 | System Problems Log | Same as MMS described in Volume III | Section | 10.3.1 | | |
| 10.3.2 | Processing of Variances | Same as MMS described in Volume III | Section | 10.3.2 | | |
| 10.4 | Factory Acceptance Test (FAT) | Same as MMS described in Volume III | Section | 10.4 | Except that | Requirements are for the Initial System |
| 10.4.1 | Preliminary Factory Acceptance Test (PreFAT) | Same as MMS described in Volume III | Section | 10.4.1 | | |
| 10.4.2 | System Generation | Same as MMS described in Volume III | Section | 10.4.2 | | |
| 10.4.3 | Equipment Tests | Same as MMS described in Volume III | Section | 10.4.3 | | |
| 10.4.4 | System Functional Test | Same as MMS described in Volume III | Section | 10.4.4 | | |
| 10.4.5 | Unstructured Testing | Same as MMS described in Volume III | Section | 10.4.5 | | |
| 10.4.6 | System Performance Tests | Same as MMS described in Volume III | Section | 10.4.6 | Except that | Requirements are for the Initial System |
| 10.4.7 | System 100-Hour Test | Same as MMS described in Volume III | Section | 10.4.7 | | |
| 10.4.8 | Management of Variances | Same as MMS described in Volume III | Section | 10.4.8 | | |
| 10.5 | System Commissioning | Same as MMS described in Volume III | Section | 10.5 | | |
| 10.5.1 | Preparation of Facilities | Same as MMS described in Volume III | Section | 10.5.1 | | |
| 10.5.2 | System Installation | Same as MMS described in Volume III | Section | 10.5.2 | | |
| 10.5.3 | System Startup | Same as MMS described in Volume III | Section | 10.5.3 | | |
| 10.5.4 | System Operational Test | Same as MMS described in Volume III | Section | 10.5.4 | | |
| 10.5.5 | Trading Participant (TP) Integration | Same as MMS described in Volume III | Section | 10.5.5 | | |
| 10.5.6 | Integration with Meter Data Collection | Same as MMS described in Volume III | Section | 10.5.6 | | |


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| 10.5.7 | MMS-EMS Integration | Same as MMS described in Volume III | Section | 10.5.7 | Except that | Testing limited to file transfers for each function |
| 10.5.8 | Site Acceptance Test | Same as MMS described in Volume III | Section | 10.5.8 | | |
| 10.5.9 | Market Dry-run Test | Same as MMS described in Volume III | Section | 10.5.9 | | |
| 10.6 | Availability Test | Same as MMS described in Volume III | Section | 10.6 | | |

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14 # 11. PROJECT ORGANIZATION, TRAINING, AND MAINTENANCE SUPPORT

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|---|---|---|---|---|---|---|
| 11 | PROJECT ORGANIZATION, TRAINING, AND MAINTENANCE SUPPORT | Same as MMS described in Volume III | Section | 11 | | |
| 11.1 | Project Responsibilities | Same as MMS described in Volume III | Section | 11.1 | | |
| 11.1.1 | Responsibilities of the Contractor | Same as MMS described in Volume III | Section | 11.1.1 | | |
| 11.1.2 | Responsibilities of the MO | Same as MMS described in Volume III | Section | 11.1.2 | | |
| 11.1.3 | The MO Development System | Same as MMS described in Volume III | Section | 11.1.3 | Except that | Requirements are information only; later addition |
| 11.2 | Project Organization | Same as MMS described in Volume III | Section | 11.2 | | |
| 11.2.1 | The MO Project Manager | Same as MMS described in Volume III | Section | 11.2.1 | | |
| 11.2.2 | Project Consultant | Same as MMS described in Volume III | Section | 11.2.2 | | |
| 11.2.3 | Contractor's Key Project Personnel | Same as MMS described in Volume III | Section | 11.2.3 | | |
| 11.3 | Project Schedule | Same as MMS described in Volume III | Section | 11.3 | | |
| 11.3.1 | Detailed Project Schedule | Same as MMS described in Volume III | Section | 11.3.1 | | |
| 11.3.2 | Project Milestones | Same as MMS described in Volume III | Section | 11.3.2 | | |
| 11.4 | Project Procedures | Same as MMS described in Volume III | Section | 11.4 | | |
| 11.4.1 | Project Progress Reports | Same as MMS described in Volume III | Section | 11.4.1 | | |
| 11.4.2 | Project Meetings And Minutes | Same as MMS described in Volume III | Section | 11.4.2 | | |
| 11.4.3 | Project Correspondence | Same as MMS described in Volume III | Section | 11.4.3 | | |
| 11.5 | MMS Acceptance | Same as MMS described in Volume III | Section | 11.5 | | |
| 11.6 | Training | Same as MMS described in Volume III | Section | 11.6 | | |
| 11.6.1 | Training Plan and Schedule | Same as MMS described in Volume III | Section | 11.6.1 | | |
| 11.6.2 | System Overview Class | Same as MMS described in Volume III | Section | 11.6.2 | | |
| 11.6.3 | System Level Training on MMS Equipment | Same as MMS described in Volume III | Section | 11.6.3 | | |
| 11.6.4 | Hardware Maintenance Training | Same as MMS described in Volume III | Section | 11.6.4 | | |
| 11.6.5 | System Software Training | Same as MMS described in Volume III | Section | 11.6.5 | | |

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|---|---|---|---|---|
| 11.6.6 | Application Software Training | Same as MMS described in Volume III | Section | 11.6.6 |
| 11.6.7 | Displays and Reports Training | Same as MMS described in Volume III | Section | 11.6.7 |
| 11.6.8 | Training of MMS Users | Same as MMS described in Volume III | Section | 11.6.8 |
| 11.7 | Participation in System Development | Same as MMS described in Volume III | Section | 11.7 |
| 11.8 | Maintenance Support | Same as MMS described in Volume III | Section | 11.8 |
| 11.8.1 | Maintenance Support Services | Same as MMS described in Volume III | Section | 11.8.1 |
| 11.8.2 | Maintenance Tools | Same as MMS described in Volume III | Section | 11.8.2 |
| 11.8.3 | Spare Parts | Same as MMS described in Volume III | Section | 11.8.3 |
| 11.9 | Contractor and OEM Update and Information Services | Same as MMS described in Volume III | Section | 11.9 |

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# APPENDIX A





## QUESTIONNAIRE

The answers to the Questionnaire will serve, together with the table of compliance (see Section 1 below), as an important source of information for the bid evaluation; supplementary information included in the proposal will not be exhaustively reviewed. Responses to the Questionnaire will be considered as bidder commitments. For these reasons complete and accurate responses are requested. The Questionnaire, along with the Technical Requirements (Specification) of Systems and Services included in Chapters 1 through 6, serves as the Technical Requirements of the bid procurement document.

The bidders are requested to repeat each question before the answer. Where practical, related documentation shall be included with the answers to the questions. References to other parts of the proposal shall be minimized and, where necessary, shall include information needed to quickly locate the referenced material (volume, partition, chapter, page, etc.).

An electronic file of these questions will be supplied to the bidders on request.

### 1. Table of Compliance

Each Table of Compliance shall indicate the specific compliance proposed for each individual section and subsection in a table format, referencing the appropriate line number or numbers and spelling out the degree of compliance as follows:

> **C - Compliant:** The Bidder understands and the Bid complies with all requirements in the cited sections or subsections. No explanations, interpretations, or comments have been added.
>
> When a section or subsection is indicated as "compliant", it will be understood that full compliance exists regardless of what may be stated elsewhere in the Bidder's Bid.
>
> **N – Noted:** The Bidder accepts the definitions, descriptions, etc. given in the cited section or subsection, which may not be an explicit requirement but which may be an implicit requirement or which may be related to other requirements. An "N" shall be considered as Bidder's compliance to the implicit or related requirements.

A – **Alternate:** The Bid is functionally compliant to the requirements cited, subject to a specific explanation, interpretation, or comment, or an alternate approach is offered. The Alternate should include comments to indicate clearly which specified requirement is addressed and clearly state in what way the proposed system offers an alternative to the requirement. An Alternate which reduces the functionality of the specified requirements should be bid as an Exception, and will nevertheless be considered by the Purchaser as an Exception.

X – **Exception:** The Bid is not compliant to the requirements in the cited line(s) and no functional alternative is proposed. The Exception should indicate clearly which specified requirement is addressed.

Only the symbols above shall be used, and one symbol shall be assigned to a line.

Bidders shall also indicate in the Table of Compliance when each function will be provided.

## 2. *Update of Request for Information (RFI)*

This section repeats specific quotes asked as part of the Request for Information (RFI) process. Please provide updated answers, as applicable, based on the more detailed information in the Specification and the evolution of your business. If there are no changes to individual questions, please state NO CHANGE, and repeat the RFI answer.

P-1. What major subcontractors do you anticipate would be used on this Contract?

P-2. Please comment on your ability to supply the necessary resources to the IMMS project to meet the proposed schedule, considering your existing workload.

P-3. Describe those aspects of your system architecture that would qualify it as an open, distributed architecture.

P-4. Are there any portions of your architecture of system design that would require significant extensions for the IMMS?

P-5. Please provide any analyses made of the general cost of ownership of your system, including maintenance, support and upgrade activities.

P-6. Please comment on the proposed schedule for implementation, and the measures necessary to ensure that it is met.

## 3. *Market Administration*

1. Provide an overall description of the Participant registration process, including data flows.
2. Describe the forms/templates to be used by Participants to register for the WESM.


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3. Describe the structure of the database and means for maintaining that portion of the database used for Standing Data.
4. Describe special handling, if any, of Prudential Assessment information.
5. Describe how all functions/programs, which base their running on Timetable requirements, will access the Timetable at one maintained location.
6. Provide a summary of capabilities built into the system to ensure adequate audits.
7. Describe all security provisions included in the system especially those concerning:
   a. WESM E-Commerce,
   b. External Data Links, and
   c. Database Access
8. Provide Contractor recommendations for improved security within the system, i.e., beyond what has been specified.

## 4. *Market Operations*

1. Provide an overall data flow diagram depicting submission, processing and approval of Offers and Bids from Trading Participants.
2. Describe the database structure for storage of Offers and Bids, both pre-Dispatch and post-Dispatch, and the means available for manual entry/revision of data.
3. Describe the format to be used for network status information. Describe any capabilities available to the MO to make changes to these data.
4. Provide a Table summarizing all input data required for your Security-constrained dispatch algorithm, data formats and data sources.
5. Comment on the use of Load Forecast data transmitted by the EMS.
6. Provide a description of your Security-constrained dispatch algorithm and define all changes and/or extensions that you see will be necessary to use that program for market optimization in accordance with the Market Rules.
7. Provide your recommendations for the algorithm to be used for market optimization, considering the importance of initiating market operations as scheduled.
8. Provide a Table summarizing the output data of the dispatch program, data formats and uses.

## 5. *Financial Reconciliation*

1. Provide an overall data flow diagram for meter data collection, giving data formats for meter data at each location.


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2. Describe the database structure for all meter data, including raw and aggregated values, installation data, standing data regarding the meter providers and provisions for transmission errors.
3. Provide a description of the Data Warehouse, its functions and capabilities and its use in this application.
4. Provide an overall data flow diagram for the Settlements process.
5. Is the Settlements process algorithm a third-part product? Designed specifically for this application?
6. Provide a list of Settlements Functions which will be available in the program supplied.
7. Describe provisions for ensuring that retrieved archived Settlements data will be successfully recreated to original conditions.
8. Describe the interfaces of Settlements to Electronic Funds Transfer and Accounting systems.
9. Describe provisions within the system for handling:
   a. Disputes
   b. Market Suspension

## 6. Data Exchange and Interface

1. Provide a data flow diagram for the interface with the EMS should such interface be activated. Comment on bandwidth requirements for the interface during normal and emergency conditions.
2. Describe your recommended use of the second LAN as a backup to the main LAN-detection of failure, assurance that no data is lost, seamless transfer, etc.
3. Describe your plans to implement WESM E-Commerce. List subcontractors, if any, and specific responsibilities.
4. Comment on performance of the proposed function, from Market Participant entering data to receipt at the IMMS.
5. Provide a Table listing the forms which will be required for market operations. Include:
   a. Name;
   b. User;
   c. Recipient;
   d. Data Fields; and
   e. Variations
6. Provide a description of the tools available to the MO to create new forms and to modify existing forms.


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## 7. System Performance and Sizing

1. Please provide the following estimates, and explain how they were derived:
   a. Estimated loading of the processors, disk systems and LANs during "Steady State"; and
   b. Estimated loading of the processors, disk systems and LANs during "High Activity State".
2. With reference to Initial Requirements for system sizing parameters, identify any specific parameters that dictate significant changes to your standard offering.

## 8. Hardware and Software Platforms

1. System Configuration:
   a. Provide configuration drawings for the IMMS, with enough detail to identify the major units and to demonstrate system architectural features such as redundancy and expansion capabilities.
   b. Explain the configuration shown in the drawings. Highlight its merits, and specifically features that make it suitable for this application.
   c. Referring to the configuration drawing provided, explain the redundancy scheme, and the modes of failover that are possible at various levels of the system.
2. To what extent are processors of the same product line and with the same operating system used throughout the IMMS?
   a. Identify the model and configuration of the processors and servers used for each subsystem.
   b. Which operating system will be used (except for the user consoles)? How much experience do you have with it?
   c. Will the same revision of the same operating system be installed in the processors?
3. List all the programming languages that will be used for the IMMS and their revision. For each language, please list the applications or programs for which it will be employed.
4. Describe the software, hardware, and configuration features of your system that qualify it as a distributed computing system based on an open systems architecture.
5. List the programming language(s) that have or will be used by you, by subcontractors, or by third parties, for the development of the functions and applications of the SCC System. If more than one language is used for the various functions and applications, please identify the language that is used fore ach.
6. Identify the tools that will be employed to manage the development and integration of the software, software configuration control, and software backup.


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7. Describe the security features of the operating system, and any additional security features that may be included in your software to protect the integrity of the system and to prevent unauthorized access to data. If you cite standards that are observed, then please include relevant documentation or at least references to the documentation.
8. Virus Detection:
   a. Which virus detection software will be included in the System? What does it check?
   b. What arrangements will be provided to update the virus detection software in order to cope with new viruses?
9. Describe the tools that will be provided to monitor and tune the performance of the System.
10. Do you use project-wide maintenance tools (such as IBM's Tivoli and ORACLE's enterprise manager) for the administration of the software and databases? Please describe the tools and procedures that will be used.
11. Explain how your offering complies with the system life and support requirements:
    a. How does your selection of equipment and software promote long-term availability of technical support, replacement parts, and upgrade services for the IMMS?
    b. Describe *long-term* support commitments that you are offering.
12. List the hardware, software, interface, and quality control standards that will be followed in the development of the IMMS, including standards that may not have been explicitly listed in the Specification. Explain where each standard is employed.
13. Describe the software standards that will be followed for the IMMS software. Have these standards also been followed in the existing software that will be included in the System?

## 9. Database Requirements

1. Please describe how the system will ensure and confirm the consistency of data across all modes of the network under circumstances where users may make changes at the IMMS as well as at external systems.
2. Describe the structure of the IMMS database. Enumerate the various elements. Explain how they are distributed among the on-line and backup servers and workstations. Please address the following issues: (a) identify databases where there is a single (redundant) copy of a data item, contrasted with databases where data is distributed among many copies; (b) describe how the system prevents users and programs from making conflicting database entries; and (c) explain the process by which an updated database is distributed to all users.
3. Which relational database products will be used in the IMMS, including the data repository? If more than one is used, please explain the reason, and the purpose for which each product is used.


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4. Describe the philosophy adopted in the design, data storage architecture, and data flows of the repository. A detailed description, with block and data flow diagrams, is requested. Subjects to be covered in your response should include:
   a. The database products used in the repository, and the type of data for which each is used;
   b. The architecture of data storage and its merits (e.g., efficient storage, fast access, standard interfaces, access control and security considerations, data consistency, redundancy and protection against loss of data, etc.);
   c. Information models (such as CIM) employed and supported for the various types of data;
   d. Methods for the selection of data to be stored in the repository;
   e. Control of access to repository data;
   f Redundancy and protection against loss of data;
   g. Tools for archiving and restoration of data;
   h. Interfaces with rest of the System; and
   i. Interfaces available for external users and applications.

   The descriptions should include the database products that are used, and the format in which the various types of data are stored.
5. What happens if the database is restructured between the time some historical data is archived in the data repository and the time it is restored for viewing, assuming that points that were saved in the data repository were deleted from the database?
6. If the report generation program of a third party has been proposed, please identify the software and provide documentation about its capabilities.
7. Please describe the process by which a user can produce a report with the data sorted according to his or her chosen key; for example, a report of the alarms that were generated over the previous month, first sorted by substation name, then (alternatively) sorted by alarm category.

## 10. Documentation Requirements

1. Please provide a list of documentation deliverables, arranged as a preliminary Documentation Plan. For each document or set of documentation, indicate when it will be delivered for review. Please correlate the document delivery schedule with the proposed project schedule.
2. Clear and detailed presentation, from a user's standpoint, should be used in the functional design documents, which describe the capabilities and user interfaces of functions and applications, in order to facilitate review of the Contractor's functional design. Therefore, please provide examples of functional design documents that have recently


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been prepared by you, which demonstrate the scope and format of presentation that will be provided for the IMMS.

3. How can duplication of effort in the preparation and maintenance of the user's manual and the Help screens be avoided, and how can consistency of information between them be achieved: Please describe your experience with the proposed method, explain how it works, and provide examples.
4. The Market Operator is open to innovative approaches to improving the documentation process for system implementation and the final documentation delivered on the project. Innovative approaches to ensure the usefulness of deliverable documentation and the means to keep it current are solicited and will be well received.

## 11. *Quality Assurance and System Testing*

1. Describe the quality assurance program that will be used for the development of the IMMS. Explain how it fits, or will be adapted to, the unique circumstances of the project.
2. Please provide a description of the tools, both hardware and software, to be used for conducting Performance testing in the factory. Include both simulators and measurement tools.
3. Please provide descriptions of hardware and software to be used in the factory for simulation of:
   a. Trading Participant interface
   b. Metering Systems
4. Please provide preliminary time estimates for the on-site Operational Testing:
   a. Market Participant
   b. Meter Data Collection Systems
   c. Energy Managements

   and expected assistance from the MO. Include plan for Contractor on-site representation.

## 12. *Project Organization, Training, and Maintenance Support*

1. Please provide a preliminary project schedule with a list of milestones. (If the schedule is presented elsewhere in this proposal, please provide a reference to it.)
2. Please describe the tools available in support of remote maintenance support.
3. Describe the scope and terms for updates and information services that are offered for the IMMS:
   a. By the Contractor
   b. By OEMs


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3. Provide a comprehensive training program, including a training schedule, that covers all the training that is required by the specification and is quoted in your proposal. Please include class descriptions:
   a. Class name
   b. Brief summary of class contents
   c. Class duration
   d. Location of class
   e. Instructor (Contractor, OEM, etc.) and his/her qualifications
   f. Class prerequisites

   Please identify standard classes, which are available on a periodic basis, and classes prepared specifically for the MO. The training schedule shall be compatible with the project schedule. Please include a brief explanation of how the schedule will prepare MO personnel in time to carry out their project responsibilities.
4. Suggest a plan for the participation, for the purpose of on-the-job training, by MO personnel in the development and integration of the MMS.

   In your discussion please include:
   a. Development tasks that you recommend for assignment to MO personnel;
   b. The number of MO personnel that you recommend to assign to each task, and required qualifications;
   c. Activities which require full-time participation, and activities which could be performed by people who are available on a part-time basis; and
   d. A schedule for the work assigned to MO personnel, when they will be needed and for what duration.


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# Attachment G

# Bidding Document

# Commercial Requirement IBRD

# Bidding Documents for Supply and Installation

of

The Interim Market Management System

and

The Market Management System

for the

***Philippines***
***Wholesale Electricity Spot Market***
***(WESM)***

VOLUME I Of III

January 2002

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# INVITATION FOR BIDS (IFB)





## INVITATION FOR BIDS (IFB)

***INTERIM MARKET MANAGEMENT SYSTEM (IMMS)***
***And***
***MARKET MANAGEMENT SYSTEM (MMS)***
***For The***
***PHILIPPINES WHOLESALE ELECTRICITY SPOT MARKET***

An Interim Market Management System (IMMS) and a Market Management System (MMS) for the Philippines Wholesale Electricity Spot Market (WESM), each of which includes the following functions: Market Administration, Market Operations, and Financial Reconciliation, will be procured with World Bank financing, Loan No. IBRD 3996/3997.

1. This Invitation for Bids (IFB) follows the issuance of a Request for Information (RFI) sent to nine companies on October 29, 2001.
2. The National Power Corporation (NPC) has an existing loan agreement with the World Bank/International Bank for Reconstruction and Development (the Bank), and would like to utilize the loan savings for the acquisition of the Interim Market Management System (IMMS) for the Wholesale Electricity Spot Market (WESM), and it intends to apply part of the proceeds of this loan to payments under the agreement(s) resulting from this IFB.
3. The National Power Corporation now invites sealed bids from eligible Bidders for the supply and installation of an Interim Market Management System (IMMS). The scope of the system includes an IMMS along with interface to the Energy Management System (EMS), via file transfers, meter data collection system, and related communications infrastructures. The scope of services includes testing, commissioning, documentation and training. An Optional Bid for the full and final Market Management System (MMS) must also be submitted. One of the key factors in the evaluation of IMMS will be its adaptability and provision for migration to the Final MMS. NPC shall have the right to exercise or decline such Optional Bid within eight (8) months after the award and execution of a contract for the procurement of the IMMS. The term Information Systems has also been used in referring to the IMMS or the Final MMS, or both.
4. Bidding will be conducted using the Limited International Competitive Bidding (LIB) procedures specified in the World Bank's Guidelines: Procurement under IBRD Loans and IDA Credits. Bidders from eligible source countries as defined in the Guidelines must meet the minimum qualification criteria given in the Bid Data Sheet (BDS) corresponding to the Instruction To Bidders (ITB) Section 6.1(a), in this Volume I of the Bidding Documents.
5. As indicated in the Bid Data Sheet (BDS) corresponding to the Invitation To Bid (ITB) Section 6.1(a), the Bidder must demonstrate the experience in providing systems of functional scope similar and comparable to the Final MMS, and demonstrate the readily available and fully functioning software system and hardware platform design, as prerequisites to the Bidder's ability to make delivery of an Interim

Market Management System (IMMS) within a very short time period without any delay. Specifically, Bidder must be able to demonstrate, at its own cost, in Manila within two (2) weeks after the Bid Opening date, such a complete and working software system which is capable of complying with the Market Rules of the Interim Wholesale Electricity Market (WESM) within the required delivery schedule.

Failing to successfully demonstrate the above software or failing to comply with any of the above-referenced qualification requirements shall render the Bid non-responsive and shall be grounds for immediate elimination from further evaluation of the Bid.

6. Interested eligible Bidders may obtain further information from National Power Corporation, and inspect the Bidding Documents from 0900 to 1700 hours at:

   Mr. Romeo V. Alejandro
   Manager
   Bid and Contracts Management Department
   National Power Corporation
   Quezon Avenue, Corner Aghan Road
   Diliman, Quezon City 1104
   Philippines
   Tel. No. (632) 921-3449
   Fax No. (632) 921-3328

7. A complete set of Bidding Documents in English may be purchased by interested Bidders on the submission of a written application to Mr. Romeo V. Alejandro at the address above, and upon payment of a nonrefundable fee of USD $200.00. The method of payment will be made in cash for local purchase or by a demand draft payable through a commercial bank in Philippines in favor of National Power Corporation. The Bidding Documents shall be obtained by the interested Bidder from the Contracts and Awards Committee of the National Power Corporation, either personally or through their local representative.

8. Bids must be delivered to National Power Corporation at the address above at or before **10:00 AM, local Manila time, February 19, 2002.** All bids must be accompanied by a bid security of not less than Five Hundred Thousand U.S. dollars (US$500,000.00). Late bids will be rejected. Bids will be opened in the presence of the Bidders' representatives who choose to attend at the address of bid submittal shown above, immediately after 10:00 A.M. on the bid due date specified above.

9. The attention of prospective Bidders is drawn to (i) the fact that they will be required to certify in their bids that all software is either covered by a valid license or was produced by the Bidder and (ii) that violations are considered fraud, which is, among other remedies, punishable by potential blacklisting from participation in future World Bank-financed procurement.

10. A pre-bid conference will be held at the address above, starting at **10:00 AM on Tuesday, January 22, 2002**. The Bidder is requested to submit any questions at least





3 working days prior to the pre-bid conference (i.e., **by January 17, 2002**). All questions must be in writing.

# SECTION I. INSTRUCTIONS TO BIDDERS (ITB)





This section of the Bidding Documents, the Instructions to Bidders (ITB), provides the information necessary for Bidders to prepare and submit responsive bids that meet the Purchaser's requirements. The ITB describe the critical steps of bid submission, opening and evaluation, and the award of contract.

Section II, which consists of the Bid Data Sheet (BDS), includes provisions that supplement or specify additional information beyond that included in this ITB.

Matters governing the performance of the Supplier, payments under the Contract, and the risks, rights, and obligations of the parties under the Contract during actual performance are not included in the ITB, but rather are covered in the General Conditions of Contract (Section IV) and/or the Special Conditions of Contract (Section V).

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# Instructions to Bidders

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## A. General

**1. Scope of Bid**

1.1 The Purchaser named in the BDS and the SCC, or the Purchasing Agent, if specified in the BDS and the SCC, duly authorized by the Purchaser (interchangeably referred to as "the Purchaser" in these Bidding Documents), invites bids for the supply and installation of the Information System (IS), as briefly described in the BDS and specified in greater detail in these Bidding Documents.

1.2 The title and identification number of the Invitation for Bids (IFB) and resulting Contract(s) are provided in the BDS.

**2. Source of Funds**

2.1 The Borrower named in the BDS has applied for or received a loan or credit (as identified in the BDS, and called a "loan" in these Bidding Documents) from the International Bank for Reconstruction and Development or the International Development Association (called "the Bank" in these Bidding Documents) equivalent to the amount indicated in the BDS toward the cost of the Project specified in the BDS. The Borrower intends to apply a portion of the proceeds of this loan to eligible payments under the Contract for which these Bidding Documents are issued.

2.2 Payment by the Bank will be made only at the request of the Borrower, or the Borrower's executing agency, and upon approval by the Bank in accordance with the terms and conditions of the Loan Agreement, and will be subject in all respects to the terms and conditions of that agreement. The Loan Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, to the knowledge of the Bank, is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan Agreement or have any claim to the loan proceeds.

**3. Fraud and Corruption**

3.1 It is the Bank's policy to require that Borrowers (including beneficiaries of Bank loans), as well as Bidders, Suppliers, Contractors, and Consultants under Bank-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuit of this policy, the Bank:





(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution; and

(ii) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practices among Bidders (prior to or after bid submission) designed to establish bid prices at artificial, noncompetitive levels and to deprive the Borrower of the benefits of free and open competition;

(b) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the Contract;

(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a Bank-financed contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a Bank-financed contract.

3.2 Furthermore, Bidders shall be aware of the provision stated in Clause 9.8 and Clause 41.2 of the General Conditions of Contract.

3.3 In pursuit of the policy defined in ITB Clause 3.1, the Bank will cancel the portion of the loan allocated to a contract for goods, works, or services if it at any time determines that corrupt or fraudulent practices were engaged in by representatives of the Borrower or of a beneficiary of the loan during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to the Bank to remedy the situation.

3.4 Any communications between the Bidder and the Purchaser related to matters of alleged fraud or corruption must be made in writing.

3.5 By signing the Bid Form, the Bidder represents that it either is the owner of the Intellectual Property Rights in the hardware, software or materials offered, or that it has proper authorization and/or license from the owner to offer them. For the purpose of

this Clause, Intellectual Property Rights shall be as defined in the GCC Clause 1.1 (c) (xvii). Willful misrepresentation of these facts shall be considered a fraudulent practice subject to the provisions of Clauses 3.1 through 3.4 above, without prejudice of other remedies that the Purchaser may take.

**4. Eligible Bidders**

4.1 Except as provided in ITB Clauses 4.2 and 4.3, this bidding process is open to:

(a) those pre-qualified firms from eligible source countries, as defined in the edition specified by the BDS of the Guidelines: Procurement under IBRD Loans and IDA Credits (the Procurement Guidelines), where a prequalification process has been undertaken for the Contract(s) for which these Bidding Documents have been issued,

(b) all firms from eligible source countries, as defined in the Procurement Guidelines where a prequalification process has not been undertaken for the Contract(s) for which these Bidding Documents have been issued.

In either case, Joint Ventures including members from ineligible source countries or including ineligible firms shall not be permitted to bid.

4.2 Firms of a member country may be excluded from bidding if:

(a) either: (i) as a matter of law or official regulation, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply and installation of the Information System required; or (ii) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods from that country or any payments to persons or entities in that country.

(b) a firm has been engaged by either: (i) the Borrower or (ii) the Purchaser or (iii) a Purchasing Agent that has been duly authorized to act on behalf of the Borrower or Purchaser, to provide consulting services for the preparation of the design, specifications, and other documents to be used for the procurement of the Information System described in these Bidding Documents.

(c) government-owned enterprises in the Borrower's country





may participate only if they can establish that they (i) are legally and financially autonomous and (ii) operate under commercial law. No dependent agency of the Borrower or Sub-Borrower under a Bank-financed project shall be permitted to bid or submit a proposal for the procurement of goods or services under the project.

4.3 A firm declared ineligible by the Bank in accordance with Paragraph 1.15 (d) of the Procurement Guidelines shall be ineligible to bid for a Bank-financed contract during the period of time determined by the Bank.

4.4 Bidders shall provide such evidence of their continued eligibility satisfactory to the Purchaser, as the Purchaser shall reasonably request.

**5. Eligible Goods and Services**

5.1 For the purposes of these Bidding Documents, the Information System means all:

(a) the required information technologies, including all information processing and communications-related hardware, software, supplies, and consumable items that the Supplier is required to supply and install under the Contract, plus all associated documentation, and all other materials and goods to be supplied, installed, integrated, and made operational (collectively called "the Goods" in some clauses of this ITB); and

(b) the related software development, transportation, insurance, installation, customization, integration, commissioning, training, technical support, maintenance, repair, and other services necessary for proper operation of the Information System to be provided by the selected Bidder and as specified in the Contract.

5.2 Funds from Bank loans are disbursed only for expenditures for an Information System made up of goods and services provided by nationals of, and produced in or supplied from, eligible source countries as defined in the Procurement Guidelines. An Information System is produced in a Bank member country when, in the territory of that country, through software development, manufacturing, or substantial and major assembly or integration of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components. An Information System, or any component thereof, provided from a Bank member country may be excluded if that member country is subject to the conditions specified in ITB Clauses 4.2 (a) (i) or 4.2 (a) (ii).

5.3 For purposes of this clause, the nationality of the Bidder is distinct from the country from which the Information System

and its goods components are produced or from which the related services are supplied. A Bidder shall have the nationality of a country if the Bidder is domiciled, incorporated and operates under the laws of that country.

**6. Qualifications of the Bidder**

6.1 By submission of documentary evidence in its bid, the Bidder must establish to the Purchaser's satisfaction:

(a) that it has the financial, technical, and production capability necessary to perform the Contract, meets the qualification criteria specified in the BDS, and has a successful performance history. If a prequalification process has been undertaken for the Contract(s) for which these Bidding Documents have been issued, the Bidder shall, as part of its bid, update any information submitted with its application for prequalification.
(For the purposes of establishing a Bidder's qualifications, the experience and / or resources of any Subcontractor will not contribute to the Bidder's qualifications; only those of a joint venture partner will be considered.)

(b) that, in the case of a Bidder offering to supply those key goods components of the Information System identified in the BDS under the Contract that the Bidder did not itself manufacture or otherwise produce, the Bidder has been duly authorized by the Manufacturer or producer to supply those components in the Purchaser's country. (This will be accomplished by submission of Manufacturer's Authorization Forms, as indicated in the section entitled Sample Forms); and

(c) that, in the case of a Bidder not doing business within the Purchaser's country, the Bidder is or will be (if awarded the Contract) represented by an Agent in that country who is equipped and able to carry out the Bidder's maintenance, technical support, training, and repair obligations prescribed in the General Conditions of Contract, Special Conditions of Contract, and / or Technical Requirements

6.2 Bids submitted by a joint venture of two or more firms as partners shall also comply with the following requirements:

(a) the bid shall be signed so as to be legally binding on all partners;

(b) one of the partners shall be nominated as being in charge, and this nomination shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the partners;





(c) the partner in charge shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture, and the entire execution of the Contract, including payment, shall be done exclusively with the partner in charge;

(d) the partner or combination of partners that is responsible for a specific component(s) of the Information System must meet the relevant minimum qualification criteria for that component.

(e) a firm may be a partner in only one joint venture or consortium that submits a bid in response to these Bidding Documents. This restriction shall not apply to commercially available hardware or software manufactured or produced by a Bidder that may be offered by more than one Bidder.

(f) all partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms, and a statement to this effect shall be included in the authorization mentioned under ITB Clause 6.2 (b) above, as well as in the bid and in the Contract (in case of a successful bid).

6.3 If a Bidder intends to subcontract major items of supply or services, it shall include in the bid details of the name and nationality of the proposed Subcontractor, including vendors, for each of those items and shall be responsible for ensuring that any Subcontractor proposed complies with the requirements of ITB Clause 4, and that any Goods or Services components of the Information System to be provided by the Subcontractor comply with the requirements of ITB Clause 5 and the related evidence required by ITB Clause 13.1 (e) (iii) is submitted. Bidders are free to list more than one Subcontractor against each item. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates or prices will be permitted. The Purchaser reserves the right to delete any proposed Subcontractor from the list. This shall be done prior to Contract signature, by deleting such unacceptable Subcontractors from Appendix 3 to the Contract Agreement, which shall list the approved Subcontractors for each item prior to Contract signature. Subsequent additions and deletions from the list of approved Subcontractors shall be performed in accordance with GCC Clause 20 (as revised in the SCC, if applicable) and Appendix 3 to the Contract Agreement.
For the purposes of these Bidding Documents, a Subcontractor is

any vendor or service provider with whom the selected Bidder contracts for the supply or execution of any part of the Information System to be provided by the selected Bidder under the Contract (such as the supply of any major hardware, software, or other components of the required Information Technologies specified, or the performance of any related Services, e.g., Software development, transportation, Installation, customization, integration, Commissioning, training, technical support, maintenance, repair, etc.).

**7. Cost of Bidding**

7.1 The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Purchaser will in no case be responsible or liable for those costs.

**8. Site Visit**

8.1 The Bidder may wish to visit and examine the site or sites of the Information System and obtain for itself, at its own responsibility and risk, all information that may be necessary for preparing the bid and entering into the Contract. The costs of visiting the site or sites shall be at the Bidder's own expense.

8.2 The Purchaser will arrange for the Bidder and any of its personnel or agents to gain access to the relevant site or sites, provided that the Bidder gives the Purchaser adequate notice of a proposed visit of at least fourteen (14) days. Alternatively, the Purchaser may organize a site visit or visits concurrently with the pre-bid meeting, as specified in the Bid Data for ITB Clause 10.2. Failure of a Bidder to make a site visit will not be a cause for its disqualification.

8.3 No site visits shall be arranged or scheduled after the deadline for the submission of the Bids and prior to the award of Contract.

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## B. THE BIDDING DOCUMENTS

**9. Content of Bidding Documents**

9.1 The contents of the Bidding Documents are listed below and should be read in conjunction with any addenda issued in accordance with ITB Clause 11:

Volume I of the Bidding Documents:

| | |
|---|---|
| Section I | Instructions to Bidders (ITB) |
| Section II | Bid Data Sheet (BDS) |
| Section III | Eligibility for the Provision of Goods, Works, and Services in Bank-Financed Procurement |
| Section IV | General Conditions of Contract (GCC) |
| Section V | Special Conditions of Contract (SCC) |
| Section VI | Sample Forms |

Volume II of the Bidding Documents:
Technical Requirements of the Interim Market Management





System (IMMS)
Volume III of the Bidding Documents:
Technical Requirements of the Final Market Management System (MMS)

9.2 Bidders are expected to examine all instructions, forms, terms, specifications, and other information in the Bidding Documents. Failure to furnish all information required by the Bidding Documents or to submit a bid not substantially responsive to the Bidding Documents in every respect will be at the Bidder's risk and may result in the rejection of its bid.

9.3 The Invitation for Bids does not form an official part of the Bidding Documents and is included for reference only. In case of inconsistencies, the latter shall prevail.

**10. Clarification of Bidding Documents and Pre-bid Meeting**

10.1 A prospective Bidder requiring any clarification of the Bidding Documents may notify the Purchaser in writing or by cable (for these ITB, the term "cable" is deemed to include Electronic Data Interchange (EDI), electronic mail, telex, or facsimile) at the Purchaser's address indicated in the BDS. Similarly, if a Bidder feels that any important provision in the documents will be unacceptable, such an issue should be raised as soon as possible. The Purchaser will respond in writing to any request for clarification or modification of the Bidding Documents that it receives no later than twenty-one (21) days prior to the deadline for submission of bids prescribed by the Purchaser. Copies of the
Purchaser's response (including an explanation of the query but not identifying its source) will be sent to all prospective Bidders that have received the Bidding Documents.

10.2 When specified in the BDS, the Purchaser will organize and Bidders may attend a pre-bid meeting at the time and place indicated in the BDS. The purpose of the meeting will be to clarify issues and answer questions on any matter that may be raised at this stage, with particular attention to issues related to the Technical Requirements. Bidders are requested, as far as possible, to submit any questions in writing or by cable, to reach the Purchaser not later than one week before the meeting. It may not be practicable at the meeting to answer questions received late, but questions and answers will be transmitted in accordance with ITB Clause 10.1. Minutes of the meeting, including the questions raised and responses given, together with any responses prepared after the meeting, will be transmitted without delay to all those who purchased the Bidding Documents. Any modification to the Bidding Documents listed in ITB Clause 9.1, which may become necessary as a result of the pre-bid meeting, shall be made by the Purchaser exclusively by issuing an Addendum pursuant to ITB Clause 11 and not through the

minutes of the pre-bid meeting.

**11. Amendment of Bidding Documents**

11.1 At any time prior to the deadline for submission of bids, the Purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, amend the Bidding Documents.

11.2 Amendments will be provided in the form of Addenda to the Bidding Documents and will be sent in writing, cable, facsimile, or electronic mail to all prospective Bidders that have received the Bidding Documents and will be binding on them. Bidders are required to immediately acknowledge receipt of any such Addenda, and it will be assumed that the amendments contained in such Addenda will have been taken into account by the Bidder in its bid.

11.3 In order to afford prospective Bidders reasonable time in which to take the amendment into account in preparing their bids, the Purchaser may, at its discretion, extend the deadline for the submission of bids, in which case, the Purchaser will notify all Bidders by cable confirmed in writing of the extended deadline.

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## C. Preparation of Bids

**12. Language of Bid**

12.1 The bid prepared by the Bidder and all correspondence and documents related to the bid exchanged by the Bidder and the Purchaser shall be written in the language specified in the BDS, provided that any printed literature furnished by the Bidder as part of its bid may be written in another language, as long as such literature is accompanied by a translation of its pertinent passages in the language specified in the BDS, in which case, for purposes of interpretation of the bid, the translation shall govern.

**13. Documents Comprising the Bid**

13.1 The bid submitted by the Bidder shall comprise the following:

(a) a Bid Form (single stage) duly completed and signed by a person or persons duly authorized to bind the Bidder to the Contract;

(b) all Price Schedules duly completed in accordance with ITB Clauses 14, 15, and 18 and signed by a person or persons duly authorized to bind the Bidder to the Contract;

(c) bid security furnished in accordance with ITB Clause 17;

(d) a duly notarized, written power of attorney in accordance with ITB Clause 19.2;

(e) Attachments:

(i) Attachment 1: Bidder's Eligibility
In the absence of prequalification, documents establishing to the Purchaser's satisfaction the Bidder's eligibility to bid, including but not limited to documentary evidence that the Bidder is legally





incorporated in a territory of an eligible source country as defined under ITB Clause 4.

(ii) Attachment 2: Bidder's Qualifications
Documentary evidence establishing to the Purchaser's satisfaction, and in accordance with ITB Clause 6, that the Bidder is qualified to perform the Contract if its bid is accepted. In the case where prequalification of Bidders has been undertaken, and pursuant to ITB Clause 6.1 (a), the Bidder must provide evidence on any changes in the information submitted as the basis for prequalification or, if there has been no change at all in said information, a statement to this effect.
Any Manufacturer's Authorizations specified as required in the Bid Data for ITB Clause 6.1 (b);

(iii) Attachment 3: Eligibility of Goods and Services
Documents establishing, to the Purchaser's satisfaction, that the Goods and Services components of the Information System to be supplied, installed, and / or performed by the Bidder are eligible Goods and Services as defined under ITB Clause 5. If awarded the Contract, the Bidder shall submit for such components of the Information System evidence of eligibility, which shall be confirmed by a certificate of origin issued at the time of shipment;

(iv) Attachment 4: Conformity of the Information System to the Bidding Documents
Documentary evidence establishing to the Purchaser's satisfaction, and in accordance with ITB Clause 16, that the Goods and Services components of the Information System to be supplied, installed, and / or performed by the Bidder conform to the Bidding Documents.

(v) Attachment 5: Proposed Subcontractors
A list of all major items of supply or services that the Bidder proposes to purchase or subcontract from others, and the name and nationality of the proposed Subcontractor, including vendors, for each of those items.

(vi) Attachment 6: Intellectual Property
a list of:

(1) all Software included in the Bidder's bid, assigning each item to one of the software categories defined in GCC Clause 1.1 (c):

(A) System, General Purpose, and Application Software; and

(B) Standard and Custom Software.

(2) all Custom Materials, as defined in GCC Clause 1.1 (c), included in the Bidder's bid.

All Materials not identified as Custom Materials shall be deemed Standard Materials, as defined in GCC Clause 1.1 (c).

Re-assignments among the Software and Materials categories, if necessary, will be made during the implementation of the Contract according to GCC Clause 39 (Changes to the System).

(vii) Attachment 7: Deviations

a list of all deviations in its bid to the contractual terms and conditions contained in the GCC and / or the SCC (including, but not restricted to, intellectual property rights, software licenses, liabilities, amount of performance security, governing law, etc.,) and / or to the required technical features specified in the Technical Requirements.

For any of the deviations listed in Attachment 7 to be considered, the Bidder must specify the increase in its Bid Price, if any, the Bidder would accept for the withdrawal of each proposed exception or deviation.

Bidders are reminded that their bids may be rejected as non-responsive, pursuant to ITB Clause 26 if material deviations are taken.

**14. Bid Prices**

14.1 All Goods and Services identified on –the Supply and Installation and the Recurrent Cost Sub-Tables in Section VI (Forms 2.5 and 2.6), and all other Goods and Services proposed by the Bidder to fulfill the requirements of the Information System, must be priced separately in the format of the same tables and summarized in the corresponding Cost Summary Tables provided in Section VI. Prices must be quoted in accordance with the general and specific instructions provided in Section VI for the various cost tables, in the manner specified below.

14.2 The price of items that the Bidder has left blank in the cost tables provided in Section VI shall be assumed to be included in the price of other items. Items omitted altogether from the cost tables shall be assumed to be omitted from the bid and, provided that the bid is substantially responsive, an adjustment to the bid price will be made during evaluation in accordance with ITB Clause 28.6 c (iii).

14.3 Unit prices must be quoted at a level of detail appropriate for calculation of any partial deliveries or partial payments under





the contract, in accordance with the Implementation Schedule in Volume II: Technical Requirements of IMMS, and with GCC and SCC Clause 12 – Terms of Payment. Bidders may be required to provide a breakdown of any composite or lump-sum items included in the Cost Tables.

14.4 The prices for Goods components of the System are to be expressed and shall be defined and governed in accordance with the rules prescribed in the edition of Incoterms specified in the **BDS,** and quoted as follows:

(a) For Products offered from outside the Purchaser's country, on the Imported Products Price Schedule. Unless otherwise specified in the **BDS**, the prices shall be quoted on a CIP (named place of destination) basis, exclusive of all taxes and duties in the Purchaser's country. The named place of destination and special instructions for the contract of carriage are as specified in the **BDS**. In quoting the price, the Bidder shall be free to use transportation through carriers registered in any eligible countries. Similarly, the Bidder may obtain insurance services from any eligible source country.

(b) Domestic Goods.

(i) Unit prices of Goods offered from within the Purchaser's Country, shall be quoted on an EXW (ex factory, ex works, ex warehouse or off-the-shelf, as applicable) basis, including all customs duties and sales and other taxes already paid or payable on previously imported Goods or on the components and raw materials used in the manufacture or assembly of the Goods, but excluding sales or other taxes assessed on the Goods in the Purchaser's country, if the contract is awarded.

(ii) inland transportation, insurance costs, and other local charges incidental to the delivery of the goods to their final destination must be shown separately as a service item quoted in accordance with ITB Clause 14.5 below.

14.5 The Price of Services shall be quoted in total for each service (and where appropriate, unit prices), broken down into their local and foreign currency components. These prices must include all incidental costs associated with the provision of the service, such as travel, subsistence, office support, communications, printing of materials, etc., and all taxes, levies,

duties and fees imposed on the Bidder, its subcontractors, or employees on account of such services in the Purchaser's country or in any other country.

14.6 Prices for Recurrent Costs to be incurred during the Warranty Period, defined in SCC Clause 29.4 and during the Post-Warranty Period, defined in SCC Clause 1.1. (e) (xii), shall be listed on the Recurrent Costs Form in detail, and on the Recurrent Costs Summary Form in currency total, as follows:

(a) the cost of all goods, such as diagnostic equipment, spare parts, consumables, supplies, new software releases, recurrent licensing fees, etc., shall be quoted in accordance with ITB Clauses 14.4.(a) and 14.4.(b) above for foreign or domestic Goods, respectively.

(b) the cost of all maintenance, technical support, and other services, as indicated in the Recurrent Costs Form and described in the SCC Clause 7.3, broken down into local and foreign currency components, and quoted in accordance with Clause 14.5 above.

14.7 Unless otherwise specified in the BDS, prices quoted by the Bidder shall be fixed during the Bidder's performance of the Contract and not subject to increases on any account. Bids submitted that are subject to price adjustment will be rejected.

**15. Bid Currencies**

15.1 Prices shall be quoted in the following currencies:

(a) the Bidder may quote its prices for all Information Technologies, associated Goods, and Services to be supplied from outside the Purchaser's Country entirely in the currency or currencies of Bank member countries. If the Bidder wishes to be paid in a combination of different currencies, it must quote unit prices accordingly, but no more than three foreign currencies may be used. Bidders expressing prices in any of the national currencies of the European Monetary Union or in euro should do so in accordance with the provisions in the BDS.

(b) unless specified otherwise in the BDS, the Bidder shall express its prices for such Information Technologies, associated Goods, and Services to be supplied from within the Purchaser's Country in the currency of the Purchaser's Country.





**16. Documents Establishing the Conformity of the Information System to Bidding Documents**

16.1 Pursuant to ITB Clause 13, the Bidder shall furnish, as part of its bid, documents establishing the conformity to the Bidding Documents of the Information System that the Bidder proposes to supply and install under the Contract.

16.2 The documentary evidence of conformity of the Information System to the Bidding Documents shall be in the form of written descriptions, literature, diagrams, certifications, and client references, including:

(a) a detailed description of the essential technical and performance characteristics of each component making up the Information System;

(b) an item-by-item commentary on the Purchaser's Technical Requirements, demonstrating the substantial responsiveness of the Information System offered to those requirements. In demonstrating responsiveness, the commentary shall include explicit cross references to the relevant pages in the supporting materials included in the bid. Whenever a discrepancy arises between the item-by-item commentary and any catalogs, technical specifications, or other preprinted materials submitted with the bid, the item-by-item commentary shall prevail;

(c) a Preliminary Project Plan describing, among other things, the methods by which the Bidder will carry out its overall management and coordination responsibilities if awarded the Contract, and the human and other resources the Bidder proposes to use. The Plan should include a detailed Contract Implementation Schedule in bar chart form, showing the estimated duration, sequence, and interrelationship of all key activities needed to complete the Contract. The Preliminary Project Plan must also address any other topics specified in the **BDS**. In addition, the Preliminary Project Plan should state the Bidder's assessment of what it expects the Purchaser and any other party involved in the implementation of the Information System to provide during implementation and how the Bidder proposes to coordinate the activities of all the involved parties;

(d) a written confirmation that the Bidder shall accept responsibility for the successful integration and inter-operability of all components of the Information System as required by the Bidding Documents.

16.3 For purposes of the commentary to be furnished pursuant to ITB Paragraph 16.2 (b), the Bidder shall note that references to brand names or model numbers or national or proprietary standards

designated by the Purchaser in its Technical Requirements are intended to be descriptive and not restrictive. Except where explicitly prohibited in the BDS for specific items or standards, the Bidder may substitute alternative brand/model names or standards in its bid, provided that it demonstrates to the Purchaser's satisfaction that the use of the substitute(s) will result in the Information System being able to perform substantially equivalent to or better than that specified in the Technical Requirements.

**17. Bid Security**

17.1 Unless otherwise specified in the BDS, the Bidder shall furnish, as part of its bid, a bid security in the amount stipulated in the BDS in the currency of the Purchaser's Country, or the equivalent amount in a freely convertible currency.

17.2 The bid security shall, at the Bidder's option, be in the form of a certified check, letter of credit, or a bank guarantee from a reputable bank selected by the Bidder and located in any eligible country. The format of the guarantee shall be substantially in accordance with one of the sample forms of bid security included in these Bidding Documents, and this guarantee shall be payable upon demand by the Purchaser in case any of the conditions listed in Clause 17.7 are invoked. Bid securities shall be submitted in their original form; copies will not be accepted. Bid securities shall remain valid for twenty-eight (30) days longer than the bid validity period or any period of extension subsequently requested under Clause 18.2.

17.3 The bid security of a joint venture shall be issued in the name of the joint venture submitting the bid, or alternatively, it shall be issued so as to commit fully all partners to the proposed joint venture in the event that the joint venture agreement is not executed until notification of award.

17.4 Any bid not accompanied by an acceptable bid security shall be rejected by the Purchaser as nonresponsive.

17.5 The bid securities of unsuccessful Bidders will be returned as promptly as possible, but not later than twenty-eight (30) days after the expiration of the period of bid validity.

17.6 The bid security of the successful Bidder will be returned when the Bidder has signed the Agreement and furnished the required performance security.

17.7 The bid security may be forfeited:

(a) if a Bidder:





(i) withdraws its bid during the period of bid validity specified by the Bidder on the Bid Form, except as provided in ITB Clause 23.3; or

(ii) fails to accept the Purchaser's corrections of arithmetic errors in the Bidder's bid (if any), in accordance with ITB Clause 26.2.

(b) in the case of the successful Bidder, if the Bidder fails to:

(i) sign the Contract in accordance with ITB Clause 36; or

(ii) furnish performance security in accordance with ITB Clause 37.

**18. Period of Validity of Bids**

18.1 Bids shall remain valid for the period specified in the BDS after the date of bid opening prescribed by the Purchaser, pursuant to ITB Clause 21. A bid valid for a shorter period shall be rejected by the Purchaser as non-responsive.

18.2 In exceptional circumstances, prior to expiry of the bid validity period, the Purchaser may request that the Bidders extend the period of validity for a specified additional period. The request and the responses to the request shall be made in writing. A Bidder may refuse the request without forfeiting its bid security. Except as provided in ITB Clause 18.3, a Bidder agreeing to the request will not be required or permitted to modify its bid, but will be required to extend the validity of its bid security for the period of the extension.

18.3 In the case of fixed price contracts, if the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the contract price will be adjusted as specified in the request for extension. Bid evaluation will be based on the bid prices without taking into consideration the above correction.

**19. Format and Signing of Bid**

19.1 The Bidder shall prepare an original and the number of copies/sets of the bid specified in the BDS, clearly marking each one as "Original Bid," "Copy NO. 1," "Copy NO. 2," etc., as appropriate. In the event of any discrepancy between them, the original shall govern.

19.2 The original and all copies of the bid, each consisting of the documents listed in ITB Clause 13.1, shall be typed or written in indelible ink and shall be signed by the Bidder or a person or persons duly authorized to bind the Bidder to the Contract. The latter authorization shall be indicated by written power of attorney, which pursuant to ITB Paragraph 13.1 (d) shall accompany the bid. All pages of the bid, except for unamended printed literature, shall be initialed by the person or persons

signing the bid.

19.3 The bid shall contain no interlineations, erasures, or overwriting, except to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

19.4 The Bidder shall furnish in the Bid Form (a sample of which is provided in the Sample Forms Section of the Bidding Documents) information regarding commissions or gratuities, if any, paid or to be paid to agents relating to this procurement and to the execution of the Contract should the Bidder be successful.

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## D. SUBMISSION OF BIDS

**20. Sealing and Marking of Bids**

20.1 The Bidder shall seal the original and each copy of the bid in separate envelopes, duly marking the envelopes as "ORIGINAL BID" and "COPY NO. [ number ]" The envelopes shall then be sealed in an outer envelope.

20.2 The inner and outer envelopes shall

(a) be addressed to the Purchaser at the address given in the BDS, and

(b) bear the Contract name(s) indicated in the Bid Data for ITB Clause 2.1, the Invitation for Bids title and number as indicated in the Bid Data for ITB Clause 1.2, and the statement "DO NOT OPEN BEFORE [ time and date ]," to be completed with the time and date specified in the Bid Data for ITB Clause 21.1.

20.3 The inner envelopes shall also indicate the name and address of the Bidder so that the bid can be returned unopened in case it is declared "late."

20.4 If the outer envelope is not sealed and marked as required by ITB Clause 20.2 above, the Purchaser will assume no responsibility for the bid's misplacement or premature opening. If the outer envelope discloses the Bidder's identity, the Purchaser will not guarantee the anonymity of the bid submission, but this disclosure will not constitute grounds for bid rejection.





**21. Deadline for Submission of Bids**

21.1 Bids must be received by the Purchaser at the address specified in the Bid Data for ITB Clause 20.2 no later than the time and date stated in the BDS.

21.2 The Purchaser may, at its discretion, extend this deadline for submission of bids by amending the Bidding Documents in accordance with ITB Clause 11.3, in which case all rights and obligations of the Purchaser and Bidders will thereafter be subject to the deadline as extended.

**22. Late Bids**

22.1 Any bid received by the Purchaser after the bid submission deadline prescribed by the Purchaser in the Bid Data for ITB Clause 21, will be rejected and returned unopened to the Bidder.

**23. Modification and Withdrawal of Bids**

23.1 The Bidder may modify or withdraw its bid after submission, provided that written notice of the modification or withdrawal is received by the Purchaser prior to the deadline prescribed for bid submission.

23.2 The Bidder's modifications shall be prepared, sealed, marked, and dispatched as follows:

(a) The Bidders shall provide an original and the number of copies specified in the Bid Data for ITB Clause 19.1 of any modifications to its bid, clearly identified as such, in two inner envelopes duly marked "Bid Modifications—Original" and "Bid Modifications—Copies." The inner envelopes shall be sealed in an outer envelope, which shall be duly marked "Bid Modifications."

(b) Other provisions concerning the marking and dispatch of bid modifications shall be in accordance with ITB Clauses 20.2, 20.3, and 20.4.

23.3 A Bidder wishing to withdraw its bid shall notify the Purchaser in writing prior to the deadline prescribed for bid submission. A withdrawal notice may also be sent by cable, but it must be followed by a signed confirmation copy, postmarked not later than the deadline for submission of bids. The notice of withdrawal shall

(a) be addressed to the Purchaser at the address named in the Bid Data for ITB Clause 20.2 (a), and

(b) bear the Contract name, the IFB Title and IFB Number, and the words "Bid Withdrawal Notice." Bid withdrawal notices received after the bid submission deadline will be ignored, and the submitted bid will be deemed to be a validly submitted bid.

23.4 No bid may be withdrawn in the interval between the bid

submission deadline and the expiration of the bid validity period specified in ITB Clause 18. Withdrawal of a bid during this interval may result in the forfeiture of the Bidder's bid security, pursuant to ITB Clause 17.7.

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## E. Bid Opening and Evaluation

**24. Opening of Bids by Purchaser**

24.1 The Purchaser will open all bids, including withdrawals and modifications, in public, in the presence of Bidders' representatives who choose to attend, at the time, on the date and at the place specified in the BDS. Bidders' representatives shall sign a register as proof of their attendance.

24.2 Envelopes marked "WITHDRAWAL" shall be read out, and the envelope with the corresponding bid shall not be opened. No bid withdrawal shall be permitted unless the corresponding withdrawal notice is read out at bid opening. Envelopes marked "MODIFICATION" shall be read out and opened with the corresponding bid.

24.3 Bids shall be opened one at a time, reading out: the name of the Bidder and whether there is a modification; the bid price; the presence or absence of a bid security, if one was required; the presence or absence of requisite powers of attorney; any discounts or alternatives offered, if allowed in the Bid Data for ITB Clause 28.1; and any other such details as the Purchaser may consider appropriate.

24.4 Bids (and modifications sent pursuant to ITB Clause 23.2) that are not opened and read out at bid opening shall not be considered for further evaluation, irrespective of the circumstances.

24.5 The Purchaser will prepare minutes of the bid opening at the end of the opening session, including the information disclosed to those present in accordance with ITB Clause 24.3. The minutes should be distributed to all Bidders who request them.

**25. Clarification of Bids**

25.1 During the bid evaluation, the Purchaser may, at its discretion, ask the Bidder for a clarification of its bid. The request for clarification and the response shall be in writing, and no change in the price or substance of the bid shall be sought, offered, or permitted.





**26. Preliminary Examination of Bids**

26.1 The Purchaser will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order. In the case where a prequalification process has been undertaken for the Contract(s) for which these Bidding Documents have been issued, the Purchaser will ensure that each bid is from a pre-qualified bidder.

26.2 Arithmetical errors will be rectified on the following basis. If there is a discrepancy between the unit price and the total price, which is obtained by multiplying the unit price and quantity, or between subtotals and the total price, the unit or subtotal price shall prevail, and the total price shall be corrected. If there is a discrepancy between words and figures, the amount in words will prevail. If a Bidder does not accept the correction of errors, its bid will be rejected and its bid security may be forfeited.

26.3 The Purchaser may waive any minor informality, nonconformity, or irregularity in a bid that does not constitute a material deviation, provided such waiver does not prejudice or affect the relative ranking of any Bidder.

26.4 Prior to the detailed evaluation, the Purchaser will determine whether each bid is of acceptable quality, is complete, and is substantially responsive to the Bidding Documents. For purposes of this determination, a substantially responsive bid is one that conforms to all the terms, conditions, and specifications of the Bidding Documents without material deviations, exceptions, objections, conditionalities, or reservations. A material deviation, exception, objection, conditionality, or reservation is one: (i) that limits in any substantial way the scope, quality, or performance of the Information System; or (ii) that limits, in any substantial way that is inconsistent with the Bidding Documents, the Purchaser's rights or the successful Bidder's obligations under the Contract; and (iii) that the acceptance of which would unfairly affect the competitive position of other Bidders who have submitted substantially responsive bids.

26.5 If a bid is not substantially responsive, it will be rejected by the Purchaser and may not subsequently be made responsive by the Bidder by correction of the nonconformity. The Purchaser's determination of bid responsiveness will be based on the contents of the bid itself.

**27. Conversion to Single Currency**

27.1 To facilitate evaluation and comparison, the Purchaser will convert all Bid Prices expressed in the various currencies in which they are payable to either:

(a) the currency of the Purchaser's Country at the selling exchange rate established for similar transactions by the Central Bank or a commercial bank in the Purchaser's Country; or

(b) a currency widely used in international trade, such as U.S. dollars, at the selling rate of exchange published in the international press for the amount payable in foreign currency; and at the selling exchange rate established for similar transactions by the Central Bank in the Purchaser's Country for the amount payable in the currency of the Purchaser's Country.

(c) With regard to ITB Paragraphs 27.1 (a) and 27.1 (b) above, prices quoted in the national currencies of the EMU countries will be converted to the euro using the irrevocable fixed exchange rates between the former national currencies and the euro. The amounts in euro will then be converted to the single currency at the exchange rates established pursuant to ITB Clause 27.2 and in accordance with the provisions of the BDS.

27.2 The currency selected for converting bid prices to a common base for the purpose of evaluation, and the date and source of the selling exchange rate is specified in the BDS.

**28. Evaluation and Comparison of Bids**

28.1 The Purchaser will evaluate and compare the bids that have been determined to be substantially responsive, pursuant to ITB Clause 26. The evaluation will be performed assuming either that:

(a) the Contract will be awarded to the lowest evaluated Bidder for the entire Information System; or

(b) if specified in the BDS, Contracts will be awarded to the Bidders for each individual Subsystem, lot, or slice defined in the Technical Requirements whose bids result in the lowest combined evaluated price for the entire System.

In the latter case, bids offering discounts for the award of more than one Subsystem, lot, or slice may be offered; however, such discounts will not be considered in the evaluation, unless allowed in the BDS.

28.2 To be considered for Contract award, Bidders must have





submitted bids that:

(a) are deemed by the Purchaser as commercially and technically responsive;

(b) include the hardware, Software, related equipment, products, Materials, and other Goods and Services components of the Information System in substantially the full quantities specified in the Bidding Documents or, if allowed in the Bid Data for ITB Clause 28.1, of the individual lot or slice bid on; and

(c) offer Information Technologies that are proven to perform up to the standards promised in the bid by having successfully passed the performance, benchmark, and/or functionality tests the Purchaser may require, pursuant to ITB Clause 31.2.

28.3 The Purchaser's evaluation of a bid will be made on the basis of prices quoted in accordance with ITB Clause 14 (Bid Prices).

28.4 If permitted by the BDS, the Purchaser's evaluation of responsive bids will take into account technical factors, in addition to cost factors. An Evaluated Bid Score (B) will be calculated for each responsive bid using the following formula, which permits a comprehensive assessment of the Bid Price and the technical merits of each bid:

$$B \cong \frac{C_{low}}{C} X + \frac{T}{T_{high}}(1 - X)$$

where

$C$ = Evaluated Bid Price

$C_{low}$ = the lowest of all Evaluated Bid Prices

$T$ = the total Technical Points awarded to the bid

$T_{high}$ = the highest Technical Points awarded to any responsive bid

$X$ = weight for the Price as specified in the **BDS**

The bid with the highest evaluated bid score (B) among responsive bids shall be termed the Lowest Evaluated Bid and is eligible for Contract award, provided the Bidder was pre-qualified and/or it was found to be qualified to perform the

Contract in accordance with ITB Clause 31 (Post-qualification).

28.5 If, in addition to the cost factors, the Purchaser has chosen to give weight to important technical factors (i.e., the price weight, X, is less than 1 in the evaluation), that cannot be reduced to life-cycle costs or pass/fail criteria, the Total Technical Points assigned to each bid in the Evaluated Bid Formula will be determined by adding and weighting the scores assigned by an evaluation committee to technical features of the bid in accordance with the criteria set forth below:

(a) the technical features to be evaluated are generally defined below and specifically identified in the BDS:

(i) performance, capacity, or functionality features that: either exceed levels specified as mandatory in the Technical Requirements; and/or influence the life-cycle cost and effectiveness of the Information System;

(ii) usability features, such as ease of use, ease of administration, or ease of expansion , which influence the life-cycle cost and effectiveness of the Information System;

(iii) The quality of the Bidder's Preliminary Project Plan as evidenced by the thoroughness, reasonableness, and responsiveness of: (a) the task and resource schedules, both general and specific, and (b) the proposed arrangements for management and coordination, training, quality assurance, technical support, logistics, problem resolution, and transfer of knowledge, and other such activities as specified by the Purchaser in the Technical Requirements or proposed by the Bidder based on the Bidder's experience.

(b) Feature scores will be grouped into a small number of evaluation categories, generally defined below and specifically identified in the BDS.

(i) the technical features that reflect how well the Information System meets the Purchaser's Business Requirements (including quality assurance and risk-containment measures associated with the implementation of the Information System);

(ii) the technical features that reflect how well the





Information System meets the System's Functional Performance Standards; and

(iii) the technical features that reflect how well the Information System meets the General Technical Requirements for hardware, network and communications, Software, and Services.

(c) As specified in the BDS, each category will be given a weight and within each category each feature may also be given a weight.

(d) During the evaluation process, the evaluation committee will assign each feature a whole number score from 1 to 4, where 1 = shows deficiencies; 2 = meets all requirements; 3 = marginally exceeds the requirements; and 4 = significantly exceeds the requirements.

(e) The score for each feature (i) within a category (j) will be combined with the scores of features in the same category as a weighted sum to form the Category Technical Score using the following formula:

$$S_j \equiv \sum_{i=1}^{k} t_{ji} * w_{ji}$$

where:

$t_{ji} \equiv$ *the technical score of feature "i" in category "j"*

$w_{ji} \equiv$ *the weight of feature "i" in category "j"*

$k \equiv$ *the number of scored features in category "j"*

and $\sum_{i=1}^{k} w_{ji} = 1$

(f) The Category Technical Scores will be combined in a weighted sum to form the total Technical Bid Score using the following formula:

$$T \equiv \sum_{j=1}^{n} S_j * W_j$$

where:

$S_j \equiv$ the Category Technical Score of category "j"

$W_j \equiv$ *the weight of category "j"* as specified in the **BDS**

$n \equiv$ *the number of categories*

and

$$\sum_{j=1}^{n} W_j = 1$$

28.6 The Evaluated Bid Price (C) for each responsive bid will be determined as the sum of the Adjusted Bid Price (P) plus the Recurrent Costs (R); where:

The Adjusted Bid Price (P) is determined as:

(a) The price of the hardware, Software, related equipment, products, Materials and other Goods offered from within or from outside the Purchaser's Country, in accordance with ITB 14.4 (a) and (b); plus

(b) The total price for all software development, transportation, insurance, installation, customization, integration, Commissioning, testing, training, technical support, repair, and other Services, in accordance with ITB 14.5;

(c) with adjustments for:

(i) Deviations proposed to the Implementation Schedule in the Technical Requirements resulting in delayed or advanced completion of the entire Information System, if permitted in the BDS and provided they do not exceed the maximum permissible advance or delay period specified in the BDS. For evaluation purposes, a pro rata increase or decrease of the Total Bid Price will be added or subtracted using the percentage(s) specified in the BDS for each week of delay or advance. Bids offering deliveries beyond the maximum permissible delay specified may be rejected.

(ii) Deviations taken to the Contract payment schedule specified in the SCC. If deviations are permitted in the BDS, the Total Bid Price will be increased pro rata by the amount of interest that could otherwise be earned on the amount of any payments that would fall due under the proposed schedule earlier than the schedule stipulated in the Bidding Documents, at the annual interest rate specified in the BDS.

(iii) Goods and Services that are required for the Information System but have been left out or are necessary to correct minor deviations of the bid will





be added to the Total Bid Price using costs taken from the highest prices from other responsive bids for the same Goods and Services, or in the absence of such information, the cost will be estimated at prevailing list prices. If the missing Goods and Services are a scored technical feature, the relevant score will be set at zero.

(iv) The prices associated with the withdrawal of the deviations or exceptions listed in Attachment 7 of the bid, in accordance with ITB Clause 13.1 (e) (vii).

(v) Corrections to errors in arithmetic, in accordance with ITB Clause 26.2.

(vi) Any discounts offered for the award of more than one Subsystem, lot, or slice, if permitted by the BDS.

(d) The Recurrent Costs (R) are reduced to net present value and determined using the following formula:

$$R \equiv \sum_{x=1}^{N+M} \frac{R_x}{(1+I)^x}$$

where

$N$ = number of years of the Warranty Period, defined in SCC Clause 29.4

$M$ = number of years of the Post-Warranty Services Period, as defined in SCC Clause 1.1.(e) (xii)

$x$ = an index number 1, 2, 3, ... N + M representing each year of the combined Warranty Service and Post-Warranty Service Periods.

$R_x$ = total Recurrent Costs for year "x," as recorded in the Recurrent Cost Form.

$I$ = discount rate to be used for the Net Present Value calculation, as specified in the **BDS.**

**29. Domestic Preference**

29.1 If indicated in the BDS, the Purchaser will grant a margin of preference for use of domestic Information Technologies and related Goods. Under this preference, for Goods supplied from outside the Purchaser's Country, the CIP (named place of destination) price, shall be increased by the applicable import tariff (custom duties and other import taxes) or fifteen (15) percent, whichever is less. If duties vary from item to item within the bid, the appropriate tariff for each item shall apply. No preference shall be applied for any associated Services or works components of the bid.

29.2 No margin of preference will be granted for any other price component, and Bidders will not be permitted or required to modify the source of any hardware, Software, related equipment,

Materials, products, or other Goods, as well as related Services after bid opening.

**30. Contacting the Purchaser**

30.1 From the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Purchaser on any matter related to the bid, it should do so in writing.

30.2 If a Bidder tries to directly influence the Purchaser or otherwise interfere in the bid evaluation process and the Contract award decision, its bid will be rejected.

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## F. Post-Qualification and Award of Contract

**31. Postqualification**

31.1 The Purchaser will determine at its own cost and to its satisfaction whether the Bidder that is selected as having submitted the Lowest Evaluated Bid is qualified to perform the Contract satisfactorily, in accordance with ITB Clause 6. If a prequalification process was undertaken for the Contract(s) for which these Bidding Documents were issued, the Purchaser will determine in the manner described above that no material changes have occurred after the prequalification that negatively affect the ability of the Bidder that has submitted the Lowest Evaluated Bid to perform the Contract.

31.2 Pursuant to ITB Clause 6 and 16, and specified in the BDS, the determination will evaluate the Bidder's financial, technical, design, integration, customization, production, management, and support capabilities and will be based on an examination of the documentary evidence of the Bidder's qualifications, as well as other information the Purchaser deems necessary and appropriate. This determination may include visits or interviews with the Bidder's clients referenced in its bids, site inspections, and any other measures. If specified in the BDS, at the time of post-qualification the Purchaser may also carry out tests to determine that the performance or functionality of the System offered meets those specified in the Technical Requirements.

31.3 An affirmative post-qualification determination will be a prerequisite for award of the Contract to the lowest evaluated Bidder. A negative determination will result in rejection of the Bidder's bid, in which event the Purchaser will proceed to the next lowest evaluated Bidder to make a similar determination of that Bidder's capabilities to perform satisfactorily.





**32. Award Criteria**

32.1 Pursuant to ITB Clauses 28, 29, and 35, the Purchaser will evaluate and award the Contract to the Bidder whose bid has been determined to be substantially responsive and the Lowest Evaluated Bid, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily, pursuant to ITB Clause 31.

**33. Purchaser's Right to Vary Quantities at Time of Award**

33.1 The Purchaser reserves the right at the time of Contract award to increase or decrease, by the percentage(s) indicated in the BDS any of the following:

(a) the quantity of substantially identical Subsystems; or

(b) the quantity of individual hardware, Software, related equipment, Materials, products, and other Goods components of the Information System; or

(c) the quantity of Installation or other Services to be performed,

beyond that originally specified in the Technical Requirements, without any change in unit prices or other terms and conditions.

**34. Purchaser's Right to Accept Any Bid and to Reject Any or All Bids**

34.1 The Purchaser reserves the right to accept or reject any bid or to annul the bidding process and reject all bids at any time prior to Contract award, without thereby incurring any liability to the Bidders.

**35. Notification of Award**

35.1 Prior to the expiration of the period of bid validity, the Purchaser will notify the successful Bidder in writing by registered letter, or by cable to be subsequently confirmed in writing by registered letter, that its bid has been accepted.

35.2 The notification of award will constitute the formation of the Contract.

35.3 Upon the successful Bidder's furnishing of the signed Contract Form and the performance security pursuant to ITB Clause 37, the Purchaser will promptly notify each unsuccessful Bidder and will discharge its bid security, pursuant to ITB Clause 17.

**36. Signing of Contract**

36.1 At the same time as the Purchaser notifies the successful Bidder that its bid has been accepted, the Purchaser will send the Bidder the Contract Form provided in the Bidding Documents, incorporating all agreements between the parties.

36.2 As soon as practically possible, but no more than twenty-eight (28) days following receipt of the Contract Form, the successful

(28) days following receipt of the Contract Form, the successful Bidder shall sign and date the Contract Form and return it to the Purchaser.

The Purchaser and successful Bidder may also agree to meet to finalize the Contract Agreement, detailing, for example, the approved Subcontractors, or the Adjudicator, or adjustments to the Supplier's Bid Price, pursuant to the ITB Clauses 18.3, 26.2, and 33.1.

**37. Performance Security**

37.1 As soon as practically possible, but no more than twenty-eight (28) days following receipt of notification of award from the Purchaser, the successful Bidder shall furnish the performance security in accordance with the GCC, using the Performance Security Form provided in the Bidding Documents or another form acceptable to the Purchaser.

37.2 Failure of the successful Bidder to comply with the requirements of ITB Clause 36 or ITB Clause 37.1 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security, in which event the Purchaser may make the award to the next lowest evaluated bid submitted by a qualified Bidder or call for new bids.

**38. Adjudicator**

38.1 The Purchaser proposes that the person named in the BDS be appointed as Adjudicator under the Contract to assume the role of informal Contract dispute mediator, as described in GCC Clause 6. A résumé of the named person is attached to the BDS. The proposed hourly fee for the Adjudicator is specified in the BDS. The expenses that would be considered reimbursable are also specified in the BDS. If a Bidder does not accept the Adjudicator proposed by the Purchaser, it should state it non-acceptance in its Bid Form and make a counterproposal of an Adjudicator and an hourly fee, attaching a résumé of the alternative. If by the day the Contract is signed, the Purchaser and the Supplier have not agreed on the appointment of the Adjudicator, the Adjudicator shall be appointed, at the request of either party, by the Appointing Authority specified in the SCC clause relating to GCC Clause 6.1.4.

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# SECTION II. BID DATA SHEET (BDS)

## Bid Data Sheet

The following specific information relating to the System to be procured and the procurement procedures that will be used shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions in the Bid Data Sheet (BDS) shall prevail over those in the ITB.

## A. General

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| ITB 1.1 | Name of Purchaser:<br>National Power Corporation<br><br>The Information System (IS) for which bids are invited includes the following:<br><br>The Interim Market Management System (IMMS) for the Philippines Wholesale Electricity Spot Market (WESM), that includes the following major functions: Market Administration, Market Operation, and Financial Reconciliation, and an optional Final Market Management System. The scope of the system includes an IMMS along with interface to NPC's new Energy Management System (EMS) supplied by GE-Harris, meter data collection system, and related communications infrastructures. The scope of services includes testing, commissioning, documentation and training. An Optional Bid for the full and final Market Management System (MMS) must also be submitted. One of the key factors in the evaluation of IMMS will be its adaptability and provision for migration to the Final MMS. NPC shall have the right to exercise or decline such Optional Bid within eight (8) months after the award and execution of a contract for the procurement of the IMMS. |
| ITB 1.2 | Name of IFB:<br><br>Interim Market Management System (IMMS) and Market Management System (MMS) for the Philippines Wholesale Electricity Spot Market |
| ITB 2.1 | Name of the Borrower:<br>National Power Corporation<br><br>Loan or credit number:<br>Loan No. IBRD_3996/3997<br><br>Name of Project: |





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| | Interim Market Management System (IMMS) [and an optional Final Market Management System (MMS)] for the Philippines Wholesale Electricity Spot Market |
| ITB 4.1 (a) | Applicable edition of the Guidelines: Procurement under IBRD Loans and IDA Credits:<br><br>Supply and Installation of Information Systems: Single Stage Bidding; February 1999, revised *Trial Version 2c—October 2001* |
| ITB 6.1 (a) | "Qualification and Experience" assessment will be based on the qualifications and experience of the particular company or division that will be executing the critical parts of the work (particularly the integration and testing of the system), and not the general experience of the parent company or conglomerate.<br>The minimum qualification requirements for Bidders are:<br>(a) During the past four (4) years, the Bidder must have successfully completed at least one contract for the development, testing, installation, and technical support of a Market Management System of comparable size and complexity to the Final MMS.<br>(b) The Bidder must have demonstrated ability and capability, as well as the track record, to meet tight project schedules;<br>(c) The Bidder must have proven availability of the required functions in field operations;<br>(d) The Bidder must have adequate financial resources to carry out this project and other ongoing businesses;<br>(e) The Bidder must have the availability of systems and key software components for IMMS delivery and implementation within the required schedule;<br>(f) The Bidder must have the capability and qualifications to deliver both the Interim-MMS and the Final MMS; and<br>(g) The Bidder must have the capability to adapt and migrate the IMMS to the Final MMS.<br>In reference to item (a) above, a system of comparable functional scope to the Final MMS must include the following functions, which are described in Volume III of this Bidding Document:<br>• Participant Registry<br>• Offer/Bid Processing<br>• Interface between MMS and EMS<br>• Dispatch Engine<br>• Load Forecast<br>• Meter Data Collection |

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| | • Meter Data Processing<br>• Data Warehouse<br>• Settlements Processing<br>• Internet-based User Interface<br>• Locational Energy Pricing<br>• Security-Constrained Dispatch<br>• Hourly Dispatch Schedule<br>• Real-time Network Modeling<br><br>Furthermore, a market management system of comparable scale shall have the following approximate dimensions: 400 trading participants, 600 trading nodes, 500 generating units, ten (10) offers/bids per day per participant, 700 network model buses, 12 user positions, 10,000 system database points, and 6 remote consoles<br><br>With regard to financial viability, Bidder must demonstrate an annual turnover of US Dollar Fifteen Million (US$15,000,000) during the past two years in power-utility-related Information Technology (IT) system installation work. In addition the Bidder must be willing to pay the specified liquidated damages in case of nonperformance.<br><br>In reference to items (b) and (c) above, the Bidders must be able to demonstrate the proposed Interim Market Management System (IMMS) during the Bid Evaluation period. Specifically, Bidder must be able to demonstrate, at its own cost in Manila within two (2) weeks after the Bid Opening date, such a complete and working software system which is capable of complying with the Market Rules of the Interim Wholesale Electricity Market (WESM) within the required delivery schedule. An evaluation of such on-site demonstration of the software system will be undertaken by the evaluation committee. The demonstration shall include an explicit, detailed, and credible explanation in writing of the alterations that have to be undertaken, and the time and effort required to make the operational software suitable for the Philippines WESM.<br><br>The IMMS to be demonstrated must include the following functions, which are described in Volume II of this Bidding Document<br><br>• Manual Participant Registry<br>• Offer/Bid Processing<br>• Dispatch Engine<br>• Manual Meter Data Collection<br>• Processing of Meter Data<br>• Settlements Processing<br>• User Interface for Entry and Maintenance of Meter Data |





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| | • Locational Energy Pricing at Limited Number of Nodes<br>• Security-Constrained Dispatch based on Linear Programming or more robust techniques<br>• Ex-Ante Pricing/Ex-Post Settlement<br>• Energy Optimization<br>• Hourly Dispatch Schedule<br>• Day-Ahead and Week-Ahead Projections<br><br>Failing to demonstrate all the above IMMS functions successfully will be grounds for immediate elimination in further consideration and evaluation of the Bid. |
| ITB 6.1 (b) | Manufacturer's authorizations are required for the following components/systems:<br><br>Servers, networking hardware, and user interface software |

## B. THE BIDDING DOCUMENTS

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| ITB 9.1 | The contents of the Bidding Documents are listed below and should be read in conjunction with any addenda issued in accordance with ITB Clause 11: |
| | Volume I of III:<br>Section I Instructions to Bidders (ITB)<br>Section II Bid Data Sheet (BDS)<br>Section III Eligibility for the Provision of Goods, Works, and Services in Bank-Financed Procurement<br>Section IV General Conditions of Contract (GCC)<br>Section V Special Conditions of Contract (SCC)<br>Section VI Sample Forms<br><br>Volume II of III:<br>Technical Requirements of the Interim Market Management System (IMMS), also referred to as the IMMS Specification.<br><br>Volume III of III:<br>Technical Requirements of the Final Market Management System (MMS), also referred to as the MMS Specification.<br><br>This Invitation for Bid is for an Interim MMS and an optional bid for the Final MMS. The Technical Requirements for the Final MMS are included here for the purpose of such optional bid, as well as for the Bidder to include the capability, in their proposed IMMS, to migrate to the Final MMS. The Final MMS will be required to conform to |

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| | the same terms and conditions as the Interim MMS. |
| ITB 10.1 | Purchaser's address:<br>National Power Corporation<br>Market Operations Group<br>Quezon Avenue, Corner Aghan Road<br>Diliman, Quezon City 1104<br>Philippines<br><br>Tel. No. (632) 921-2308<br>Fax No. (632) 921-2308<br>E-mail: rrseboli@napocor.com.ph<br><br>Contact Person:<br>Mr. Romeo V. Alejandro<br>Manager, BCMD<br>Chairman, Contracts and Awards Committee (CAC)<br>C/o Bids and Contracts Management Department<br>National Power Corporation |
| ITB 10.2 | There will be a Pre-Bid Conference, the date of which is indicated in the IFB. The Bidder is requested to submit any questions at least 3 working days prior to the date of the Pre-Bid Conference, to:<br><br>Mr. Romeo V.Alejandro<br>Manager, BCMD<br>Chairman, Contracts and Awards Committee (CAC)<br>C/o Bids and Contracts Management Department<br>National Power Corporation<br>Quezon Avenue, Corner Aghan Road<br>Diliman, Quezon City 1104<br>Philippines<br>Tel. No. (632) 921-2308<br>Fax No. (632) 921-2308<br>E-mail: rrseboli@napocor.com.ph<br>All questions must be submitted in writing. Answers to the questions will be transmitted to all Bidders. |

## C. PREPARATION OF BIDS

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| ITB 12.1 | The Language of Bid is English |
| ITB 14.4 (a) | The Incoterms edition is *"Incoterms 2000 — ICC Official Rules for* |





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| | *the Interpretation of Trade Terms" published in September 1999 by the International Chamber of Commerce, 38 Cours Albert 1er, 75008 Paris, France.* |
| ITB 14.4 (a) | For foreign goods priced on a CIP (named place of destination) basis:<br>(i) The contract of carriage shall include the cost of unloading the goods at destination, as well as payment by the Supplier of the cost of custom formalities, duties, taxes or other charges payable on the foreign Goods for their transit through any country other than the Purchaser's country<br><br>The named place of destination shall be "National Power Corporation, Quezon City, Philippines", the project site. |
| ITB 14.7 | The Price quoted by the Bidder shall be Fixed. |
| ITB 15.1 (a) | The currency to be used for quoting prices of the Goods and Services components of the System offered from outside the Purchaser's Country is:<br><br>A currency widely used in international trade, such as US Dollars, at the selling rate of exchange published in the international press for the amount payable in foreign currency; and at the selling exchange rate established for similar transactions by the Central Bank in the Purchaser's Country for the amount payable in the currency of the Purchaser's Country.<br><br>After January 1, 2002, bidders are not allowed to express their bids and/or request to be paid in any of the national currencies of the European Monetary Union. However, bidders may express their prices in euro and require to be paid in euro (wholly or partially as one of the three foreign currencies). |
| ITB 15.1 (b) | The currency to be used for quoting prices of the Goods and Services components of the System offered from within the Purchaser's country, as well as local currency expenditures for local technical support, training, maintenance, transportation, insurance, and other local services incidental to delivery, installation and operation of the System shall be the Philippine Peso. |
| ITB 16.2 (b) | Add the following at the end of sub-clause ITB 16.2 (b):<br><br>The Bidder shall prepare a separate Table of Compliance for each Volume of the Volumes I, II, and III of the Bidding Document.<br><br>Each Table of Compliance shall indicate the specific compliance proposed for each individual section and subsection in a table format, referencing the appropriate line number and spelling out the degree of compliance as follows: |

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| | **C - Compliant:** The Bidder understands and the Bid complies with all requirements in the cited sections or subsections. No explanations, interpretations, or comments have been added.<br><br>When a section or subsection is indicated as "compliant", it will be understood that full compliance exists regardless of what may be stated elsewhere in the Bidder's Bid.<br><br>**N - Noted:** The Bidder accepts the definitions, descriptions, etc. given in the cited in the section or subsection, which may not be an explicit requirement but which may be an implicit requirement or which may be related to other requirements. An "N" shall be considered as Bidder's compliance to the implicit or related requirements.<br><br>**A - Alternate:** The Bid is functionally compliant to the requirements cited, subject to a specific explanation, interpretation, or comment, or an alternate approach is offered. The Alternate should include comments to indicate clearly which specified requirement is addressed and clearly state in what way the proposed system offers an alternative to the requirement. An Alternate which reduces the functionality of the specified requirements should be bid as an Exception, and will nevertheless be considered by the Purchaser as an Exception.<br><br>**X - Exception:** The Bid is not compliant to the requirements in the cited line(s) and no functional alternative is proposed. The Exception should indicate clearly which specified requirement is addressed.<br><br>Only the symbols above shall be used, and one symbol shall be assigned to a line.<br><br>Bidders shall also indicate in the Table of Compliance when each function will be provided.<br><br>Answers to Questionnaires<br><br>Answers shall be provided to the Questionnaire that is included as Appendix A in Volume II and Volume III. The question shall be repeated before each response. The responses will be regarded as commitments by the Bidder.<br><br>Bidders are advised to provide careful and complete responses to the various questions, using standard accepted terminology. References to other parts of the Bid should be minimized, and used only to provide additional information that is directly relevant to the question. References to general background information and references that are difficult to locate as well as responses that are vague or ambiguous will be excluded from evaluation by Purchaser. |





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| | Bidders are advised to pay special attention to the preparation of the Table of Compliance and responses to the Questionnaire, as they will be used as the primary source of information for the evaluation of the Bid. Supplemental information included in Bids may not be reviewed in detail. |
| ITB 16.3 | Please refer to the attached IMMS and MMS Technical Requirements in Volume II and Volume III, respectively, of this Bidding Document. |
| ITB 16.4 | Add the following additional ITB 16.4 after sub-clause ITB 16.3:<br><br>Bidders should include appropriate evidences for the following qualification requirements, including all references and contact information:<br><br>• During the past four (4) years, the Bidder must have successfully completed at least one contract for the development, testing, installation, and technical support of a Market Management System of comparable size and complexity to the Final MMS.<br>• The Bidder must have demonstrated ability and capability, as well as the track record, to meet tight project schedules;<br>• The Bidder must have proven availability of the required functions in field operations;<br>• The Bidder must have adequate financial resources to carry out this project and other ongoing businesses;<br>• The Bidder must have the availability of systems and key software components for IMMS delivery and implementation within the required schedule;<br>• The Bidder must have the capability and qualifications to deliver both the Interim-MMS and the Final MMS; and<br>• The Bidder must have the capability to adapt and migrate the IMMS to the Final MMS. A system of comparable functional scope to the Final MMS must include the following functions, which are described in Volume III of this Bidding Document:<br><br>- Participant registry;<br>- Offers/bid processing;<br>- Interface between MMS and EMS;<br>- Dispatch engine;<br>- Load forecast;<br>- Meter data collection<br>- Meter data processing;<br>- Data warehouse; |

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| | - Settlements processing;<br>- Internet based user interface;<br>- Locational energy pricing;<br>- Security constrained dispatch;<br>- Hourly dispatch schedule<br>- Real-time network modeling;<br><br>• Bidders shall be able to demonstrate all functions listed above at sites where they are operational<br>•<br>• Bidders shall demonstrate financial viability with regard to annual turnover of USD Fifteen Million (US$15,000,000) through the sale of similar integrated IT Systems<br>• Bidders shall be able to pay liquidated damages of up to 10% of the contract price in case of late contract completion or non-performance of systems<br><br>As stated in ITB 6.1 (a), "Bidder must be able to demonstrate, at its own cost in Manila within two (2) weeks after the Bid Opening date, such a complete and working software system which is capable of complying with the Market Rules of the Interim Wholesale Electricity Market (WESM) within the required delivery schedule". Bidder shall provide evidence of (a) the tasks needed to be performed, (b) database modifications required, (c) man power resources required, ( d) man power resources that are available, and (e) a project plan, on a week-by-week basis for the incremental effort required to bring the system to an operational stage. |
| ITB 17.1 | A bid security is required.<br>Amount of bid security shall be USD Five Hundred Thousand (US$ 500,000). |
| ITB 17.2 | ITB 17.2 is replaced with the following text:<br><br>17.2 The bid security shall be denominated in the currency of the bid or in another freely convertible currency, and shall:<br><br>(a) at the bidder's option, be in the form of either a certified check, letter of credit, or a bank guarantee from a banking institution, or a bond issued by an insurance or bonding institution;<br>(b) be issued by a reputable institution selected by the bidder and located in any eligible country;<br>(c) be substantially in accordance with one of the forms of bid security included in Section VII or other form approved by the Purchaser prior to bid submission;<br>(d) be payable promptly upon written demand by the employer |





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| | in case any of the conditions listed in ITB Clause 17.7 are invoked;<br>(e) be submitted in its original form; copies will not be accepted;<br>(f) remain valid for a period of 30 days beyond the original validity period of bids, or beyond any period of extension subsequently requested under ITB Clause 18.2. |
| ITB 18.1 | Bids shall remain valid for at least sixty (60) calendar days after the bid opening date.<br><br>Bid security shall remain valid 28 days after the end of the bid validity period. |
| ITB 19.1 | Required number of copies of the bid:<br><br>Two (2) originals and six (6) copies.<br>Two (2) copies of the electronic files of the completed Forms included in Section VI of this Volume I (including the Price Forms), and the Table of Conformance, shall also be provided. However, in case of conflicting information, only the original text copy will be treated as the official and formal copy. |

## D. SUBMISSION OF BIDS

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| ITB 20.2 (a) | Address for bid submission:<br><br>Chairman, Contracts and Awards Committee<br>C/o Bids and Contracts<br>Management Department<br>National Power Corporation<br>Quezon Avenue, Corner Aghan Road<br>Diliman, Quezon City 1104<br>Philippines |
| ITB 21.1 | Deadline for bid submission (Bid Due Date and Time) shall be as specified in the IFB. |

## E. BID OPENING AND EVALUATION

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| ITB 24.1 | The Purchaser will open all bids, in the presence of bidders' representatives who choose to attend immediately after 10:00 AM on the bid due date specified in the BDS (for ITB 21.1) and at the following location:<br><br>National Power Corporation |

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| | Quezon Avenue, Corner Aghan Road,<br>Kanao Room, Solarium, Ground Floor, Building 1<br>Diliman, Quezon City 1104<br>Philippines |
| ITB 26.4 | Any bid which will not meet the required IMMS Operational Acceptance date specified in the SCC for GCC 8.2, will be deemed non-responsive (i.e., not substantially responsive). |
| ITB 27.1(c) | This clause is not applicable since bidders are not allowed to express their bids and/or request to be paid in any of the national currencies of the European Monetary Union after January 1, 2002. |
| ITB 27.2 | The currency chosen for converting to a common currency is US Dollar.<br>The exchange rate shall be the rate posted by the Bangko Sentral ng Pilipinas at the close of trading hours on the business day immediately before the Bid Due Date. |
| ITB 28.1 | The bid evaluation will take into account technical factors in addition to cost factors. Key among the technical factors are (1) the ability to migrate IMMS to Final MMS, and the level of effort required for such migration, and (2) in reference to ITB 16.4, the incremental effort required to bring the proposed working system to an operational stage.<br>Bidding only for subsystems, lots, or slices of the overall system will not be accepted. |
| ITB 28.3 | Add the following sentence: The quoted prices for the Interim Market Management System (IMMS) will be the basis for the evaluation. |
| ITB 28.4 | The bid evaluation will take into account technical factors in addition to cost factors.<br>The weight of the Evaluated Bid Price will be sixty five percent (65%). The weight of the technical factors will be thirty five percent (35%). |
| ITB 28.5 | The technical evaluation categories and features to be evaluated are included in Volume II: Technical Requirements of the Interim Market Management System (IMMS).<br>During the evaluation process, the evaluation committee will assign each feature a whole number score from 0 to 4, where 0 = no |





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| | response to this mandatory requirement, 1 = meets some parts of this mandatory requirement, 2 = meets a majority of parts of this mandatory requirement, 3 = meets almost all parts of this mandatory requirement, 4 = meets all parts of this mandatory requirement. |
| ITB 28.6 (c) (i) | The Purchaser will not accept deviations in the schedule for the IMMS Operational Acceptance date. |
| ITB 28.6 (c) (ii) | The Purchaser will not accept deviations in the payment schedule. |
| ITB 28.6 (d) | Interest Rate for Net Present Value calculations of recurrent costs = 10% per annum |
| ITB 29.1 | A margin of domestic preference will not apply (because of LIB rules). |

## F. POST-QUALIFICATION AND AWARD OF CONTRACT

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| ITB 31.2 | The following performance benchmarks shall be applied to the Offers from Bidders:<br>• Experience in Providing systems of comparable size and complexity<br>• Availability of the required functions in field operations<br>• Reference site visits<br>• Satisfactory track record of completing projects successfully of this size and complexity on schedule<br>• Ready availability of system and key components for IMMS delivery and implementation by the specified date<br>• Capability to deliver both the Interim MMS and Final MMS<br>• Capability of the proposed IMMS to adapt and migrate to Final MMS<br>• Ability to provide system demonstration during bid evaluation<br>A system of comparable functional scope to the Final MMS must include the following functions, which are described in Volume III of this Bidding Document:<br>• Participant Registry<br>• Offer/Bid Processing<br>• Interface between MMS and EMS<br>• Dispatch Engine<br>• Load Forecast<br>• Meter Data Collection<br>• Meter Data Processing<br>• Data Warehouse<br>• Settlements Processing<br>• Internet-based User Interface<br>• Locational Energy Pricing<br>• Security-Constrained Dispatch<br>•<br>• Hourly Dispatch Schedule |





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| | • Real-time Network Modeling<br>Bidder must be able to demonstrate, at its own cost in Manila within two (2) weeks after the Bid Opening date, such a complete and working software system which is capable of complying with the Market Rules of the Interim Wholesale Electricity Market (WESM) within the required delivery schedule.<br>The IMMS to be demonstrated must include the following functions, which are described in Volume II of the Bidding Document:<br>• Manual Participant Registry<br>• Offer/Bid Processing<br>• Manual Meter Data Collection<br>• Processing of Meter Data<br>• Settlements Processing<br>• User Interface for Entry and Maintenance of Meter Data<br>• Locational Energy Pricing at Limited Number of Nodes<br>• Security Constrained Dispatch that Utilizes Linear Programming Solver<br>• Ex-Ante Pricing/Ex-Post Settlement<br>• Energy Optimization<br>• Hourly Dispatch Schedule<br>• Day-Ahead and Week-Ahead Projections<br>Failing to do so successfully will be grounds for immediate elimination in further consideration and evaluation of the Bid.<br>The above evaluation will be carried out by the Purchaser or by the Purchaser's designated party. |
| ITB 33.1 | Percentage of quantity increase or decrease: 10% |
| ITB 38.1 | The proposed Adjudicator is Dr. Tom Dyliacco. Attached to this Bid Data Sheet is the résumé of the proposed Adjudicator.<br>The proposed hourly fee is USD Two Hundred and Twenty Five (US$225) per hour. Reimbursable expenses include: business-class air travel, phone, fax and other communication costs, and lodging and boarding expenses. |

## Résumé Of Proposed Adjudicator

**Tomas DyLiacco, Ph.D.**

### Summary of Qualifications:

Consultant on power control issues, including system configuration issues and EMS functions; provided consultation for 35 control center projects.

Consulting experience covers the entire gamut of activities related to the development of a computer control project, namely: analysis of operating requirements; review and performance verification of existing control centers; feasibility studies; review or development of technical specifications; budget estimates; bid evaluation; contract negotiations and review of statement of work; review of contractor's design specifications; monitoring and progress review of design implementation; review of factory appearance procedures; performance of factory acceptance tests; participation in field tuning and site acceptance tests.

High-level of expertise in RTUs, communication controllers and channel requirements, open architecture configuration, local area networks, wide area networks, data acquisition and control, man-machine interface, generation control, advanced application software functions, and operator training simulators.

Design concept in a predecessor EPRI project lead to EPRI's OTS.

His paper "Innovations in Control Center Design" documents many of the innovations which he has introduced and which are in service in control centers, and describes fundamental concepts of what should make an open architecture system open.

His major projects include the following:

**ENTIDAD BINACIONAL YACYRETA:** Evaluation of five technical proposals for the SCADA system of a large hydro power plant owned jointly by Paraguay and Argentina.

**Siderugica del Orinoco (SIDOR):** Feasibility study for the modernization and conversion of the existing SCADA into an EMS. Specifications for an open architecture EMS has been written by Dr. DyLiacco. For an interim solution to the problem of maintaining an obsolete system he developed an intermediate step toward the future open EMS. This intermediate setup has been accepted by SIDOR.

**Comision Ejecutiva Hidroelectrica del Rio Lempa:** Feasibility study, requirements, and technical specifications for modernization and conversion of existing SCADA into an EMS.

**Korea Water Resources Corporation (KOWACO):** Design concepts and preparation of the technical specifications for the Water Energy Management System (WEMS) for a complex consisting of four river basis systems with 15 multipurpose dams and 20 water supply offices. the functional design by Dr. DyLiacco comprises a hierarchical system with remote SCADA systems at all dam locations. The remote SCADA as well as the central WEMS will have state-of-the-art features in computer open architectures, communications, and advanced water management application software. Advanced applications prescribed by Dr. DyLiacco include: water inflow forecasting, water demand forecasting, optimal hydro generation scheduling considering power schedules, flood control, navigation, and other river flow requirements in cascaded dam operation.

**EDELCA (Macagua II project) - Puerto Ordaz, Venezuela:** Assistance in conceptual design and development of technical specifications for the expansion of the Macagua hydro power plant downstream from the Guri plant (see EDELCA listed previously) on the river Rio Caroni. Future power plants, Oaruachi and Tocoma will be built on the same river. When completed the complex will thus consist of four cascaded power plants. Specifications written by Dr. DyLiacco include requirements for the following features and functions: intelligent RTUs with software for performing the unit startup and shutdown sequences and for spillway gate control; master-master RTU protocol; automatic generation control; automatic voltage/var control; interactive work permit and maintenance management system; spare parts inventory control.

**Manila Electric Company - Manila, Philippines:** Assistance in the development of technical specifications, project management, and acceptance testing of an EMS.





**EGAT - Nonthaburi, Thailand:** Review of requirements for upgrading the existing National Control Center and the regional control centers and establishing a Control hierarchy for the entire interconnected network of Thailand. Review of functional specifications, assistance in bid evaluation, and project management. Hydrothermal scheduling function will be included.

**Cadafe - Caracas, Venezuela:** Assistance in the development of the functional specifications, bid evaluation, contract negotiation, statement of work, project management, acceptance testing. Application software includes hydrothermal scheduling taking into consideration cascaded hydro power plants.

**HIDRONOR - Cipolletti, Argentina:** Assistance in the development of functional specifications for an EMS characterized by a 3-computer configuration and in the bid evaluation. Assistance in statement of work, project management, factory and field acceptance tests. The generation is 100% hydro with cascaded power plants on the river Rio Negro.

**Itaipu BiNacional - Foz do Iguacu, Brazil:** Assistance in the development of technical specifications, bid evaluation and project management of a SCADA/EMS for the world's largest power plant. The state-of-the-art open architecture configuration was defined completely by Dr. DyLiacco. Innovations introduced by Dr. DyLiacco for this project included: ultra-fast state estimator; trouble analysis by expert system.

**Korea Electric Power Company - Seoul, South Korea:** Assistance in factory acceptance tests of a 2-level hierarchical control system for the entire interconnected network of South Korea. Dr. DyLiacco developed additional test procedures for the advanced application software using a special test configuration which tied the operator training simulator to the EMS.

**Taiwan Power Company - Taipei, Taiwan:** Assistance in the review of the factory acceptance test results of the first phase of the HDCS (Hierarchical Dispatch and Control System) project. Participation in the initial concepts for the second phase of the project.

**CEI - Cleveland, Ohio:** Assistance in the development of the new System Operation Center.

**National Electricity Board of the States of Malaya - Kuala Lumpur, Malaysia:** Assistance in the development of technical specifications for a 2-level EMS system.

**COPEL - Curitiba, Brazil:** Assistance in the development of technical specifications

### Affiliations and Distinctions:

Fellow, IEEE
Cigre (US Advisor to Cigre Study Committee 39)
IFAC (Committee Chairman in many IFAC Symposia)

### Education:

MS in Electrical Engineering, Illinois Institute of Technology
Ph.D. in Systems Engineering, Case Western Reserve University

**Nationality:** U.S. Citizen

**Language:** English (Excellent), Tagalog (Excellent)

# SECTION III. ELIGIBILITY FOR THE PROVISION OF GOODS, WORKS, AND SERVICES IN BANK-FINANCED PROCUREMENT





**Public Information Center**

## Eligibility for the Provision of Goods, Works, and Services in Bank-Financed Procurement

As of October 2001[1]

For the information of borrowers and bidders, and with reference to paragraph 1.6, footnote 9, of the Guidelines: Procurement under IBRD Loans and IDA Credits, dated January 1995 (revised January and August 1996, September 1997, and January 1999), set forth below is a list of countries from which Bidders, Goods, and Services are not eligible to participate in procurement financed by the World Bank or IDA.[2]

- Andorra
- Cuba
- Democratic People's Republic of Korea (North Korea)
- Liechtenstein
- Monaco
- Nauru
- Tuvalu

In addition, Bidders, Goods, and Services from other countries or territories may be declared ineligible by a provision in the bidding documents if the borrower's country has excluded them by a law, an official regulation, or an act of compliance meeting the requirements of paragraph 1.8 (a) of the Guidelines: Procurement under IBRD Loans and IDA Credits.

The Loan/Credit Agreement also prohibits a withdrawal from the Loan/Credit Account for the purpose of any payment to persons or entities, or for any import of goods, if such payment or import, to the knowledge of the Bank, is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. At the present time, this prohibition applies to

- Iraq

[1] The most current listing of eligible countries can be viewed on the Public Information Center's Web page at http://www.worldbank.org/html/pic/PROCURE.html. A list of firms debarred from participating in World Bank projects is available at: http://www.worldbank.org/html/opr/procure/debarr.html

[2] Any questions regarding this list should be addressed to the Director, Procurement Policy and Services Group, Operation Policy and Country Services Vice Presidency, the World Bank.

# SECTION IV. GENERAL CONDITIONS OF CONTRACT





## Notes on the General Conditions of Contract (GCC)

The General Conditions of Contract (GCC) contained in this section are to be read in conjunction with the Special Conditions of Contract (SCC) in Section V and the other documents listed in the Contract Agreement. Together they form a complete document expressing all the rights and obligations of the parties to the Contract.

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# General Conditions of Contract

## A. Contract and Interpretation

**1. Definitions**

1.1 In this Contract, the following terms shall be interpreted as indicated below.

(a) contract elements

(i) "Contract" means the Contract Agreement entered into between the Purchaser and the Supplier, together with the Contract Documents. The Contract Agreement and the Contract Documents shall constitute the Contract, and the term "the Contract" shall in all such documents be construed accordingly.

(ii) "Contract Documents" means the documents specified in Article 1.1 (Contract Documents) of the Form of Contract Agreement (including any amendments to these Documents).

(iii) "Contract Agreement" means the agreement entered into between the Purchaser and the Supplier using the Form of Contract Agreement contained in the Sample Forms Section of the Bidding Documents and any modifications to this form agreed to by the Purchaser and the Supplier. The date of the Contract Agreement shall be recorded in the signed form.

(iv) "GCC" means the General Conditions of Contract.

(v) "SCC" means the Special Conditions of Contract.

(vi) "Technical Requirements" means the Technical Requirements Section of the Bidding Documents.

(vii) "Implementation Schedule" means the Implementation Schedule Chapter of the Technical Requirements.

(viii) "Contract Price" means the price or prices defined in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.

(ix) "Procurement Guidelines" refers to the edition specified in the SCC of the World Bank Guidelines: Procurement under IBRD Loans and IDA Credits.

(x) "Bidding Documents" refers to the collection of





documents issued by the Purchaser to instruct and inform potential suppliers of the processes for bidding, selection of the winning bid, and Contract formation, as well as the contractual conditions governing the relationship between the Purchaser and the Supplier. The General and Special Conditions of Contract, the Technical Requirements, and all other documents included in the Bidding Documents reflect the World Bank Procurement Guidelines that the Purchaser is obligated to follow during procurement and administration of this Contract.

(b) entities

(i) "Purchaser" means the person purchasing the Information System, as specified in the SCC.

(ii) "Project Manager" means the person appointed by the Purchaser in the manner provided in GCC Clause 18.1 (Project Manager) and named as such in the SCC to perform the duties delegated by the Purchaser.

(iii) "Supplier" means the person(s) whose bid to perform the Contract has been accepted by the Purchaser and is named as such in the Contract Agreement and includes the legal successors or permitted assigns of the Supplier.

(iv) "Supplier's Representative" means any person nominated by the Supplier and named as such in the Contract Agreement and approved by the Purchaser in the manner provided in GCC Clause 18.2 (Supplier's Representative) to perform the duties delegated by the Supplier.

(v) "Subcontractor," including vendors, means any person to whom any of the obligations of the Supplier, including preparation of any design or supply of any Information Technologies or other Goods or Services, is subcontracted directly or indirectly by the Supplier and includes its legal successors or permitted assigns.

(vi) "Adjudicator" means the person or persons named as such in the Contract Agreement appointed by agreement between the Purchaser

and the Supplier to make a decision on or to settle any dispute or difference between the Purchaser and the Supplier referred to him or her by the parties, pursuant to GCC Clause 6.1 (Adjudicator).

(vii) "Purchaser's Group" means the Purchaser, a subsidiary undertaking or holding company for the time being of the Purchaser, or a subsidiary or subsidiary undertaking for the time being of a holding company of the Purchaser.

(viii) "The World Bank" (also called "The Bank") means the International Bank for Reconstruction and Development (IBRD) or the International Development Association (IDA).

(c) subject

(i) "Information System," also called "the System," means all the Information Technologies, Materials, and other Goods to be supplied, installed, integrated, and made operational (exclusive of the Supplier's Equipment), together with the Services to be carried out by the Supplier under the Contract.

(ii) "Subsystem" means any subset of the System identified as such in the Contract that may be supplied, installed, tested, and commissioned individually before Commissioning of the entire System.

(iii) "Information Technologies" means all information processing and communications-related hardware, Software, supplies, and consumable items that the Supplier is required to supply and install under the Contract.

(iv) "Goods" means all equipment, machinery, furnishings, Materials, and other tangible items that the Supplier is required to supply or supply and install under the Contract, including, without limitation, the Information Technologies and Materials, but excluding the Supplier's Equipment.

(v) "Services" means all technical, logistical, management, and any other Services to be provided by the Supplier under the Contract to





supply, install, customize, integrate, and make operational the System. Such Services may include, but are not restricted to, activity management and quality assurance, design, development, customization, documentation, transportation, insurance, inspection, expediting, site preparation, installation, integration, training, data migration, Pre-commissioning, Commissioning, maintenance, and technical support.

(vi) "The Project Plan" means the document to be developed by the Supplier and approved by the Purchaser, pursuant to GCC Clause 19 and the SCC, based on the requirements of the Contract and the Preliminary Project Plan included in the Supplier's bid. For the sake of clarity, "the Agreed and Finalized Project Plan" refers to the version of the Project Plan approved by the Purchaser, in accordance with GCC Clause 19.2. Should the Project Plan conflict with the Contract in any way, the relevant provisions of the Contract, including any amendments, shall prevail.

(vii) "Software" means that part of the System which are instructions that cause information processing Subsystems to perform in a specific manner or execute specific operations.

(viii) "System Software" means Software that provides the operating and management instructions for the underlying hardware and other components, and is identified as such in Appendix 4 of the Contract Agreement and such other Software as the parties may agree in writing to be Systems Software. Such System Software includes, but is not restricted to, micro-code embedded in hardware (i.e., "firmware"), operating systems, communications, system and network management, and utility software.

(ix) "General-Purpose Software" means Software that supports general-purpose office and software development activities and is identified as such in Appendix 4 of the Contract Agreement and such other Software as the

parties may agree in writing to be General-Purpose Software. Such General-Purpose Software may include, but is not restricted to, word processing, spreadsheet, generic database management, and application development software.

(x) "Application Software" means Software formulated to perform specific business or technical functions and interface with the business or technical users of the System and is identified as such in Appendix 4 of the Contract Agreement and such other Software as the parties may agree in writing to be Application Software.

(xi) "Standard Software" means Software identified as such in Appendix 4 of the Contract Agreement and such other Software as the parties may agree in writing to be Standard Software.

(xii) "Custom Software" means Software identified as such in Appendix 4 of the Contract Agreement and such other Software as the parties may agree in writing to be Custom Software.

(xiii) "Source Code" means the database structures, dictionaries, definitions, program source files, and any other symbolic representations necessary for the compilation, execution, and subsequent maintenance of the Software (typically, but not exclusively, required for Custom Software).

(xiv) "Materials" means all documentation in printed or printable form and all instructional and informational aides in any form (including audio, video, and text) and on any medium, provided to the Purchaser under the Contract.

(xv) "Standard Materials" means all Materials not specified as Custom Materials.

(xvi) "Custom Materials" means Materials developed by the Supplier at the Purchaser's expense under the Contract and identified as such in Appendix 5 of the Contract Agreement and





such other Materials as the parties may agree in writing to be Custom Materials. Custom Materials includes Materials created from Standard Materials.

(xvii) "Intellectual Property Rights" means any and all copyright, moral rights, trademark, patent, and other intellectual and proprietary rights, title and interests worldwide, whether vested, contingent, or future, including without limitation all economic rights and all exclusive rights to reproduce, fix, adapt, modify, translate, create derivative works from, extract or re-utilize data from, manufacture, introduce into circulation, publish, distribute, sell, license, sublicense, transfer, rent, lease, transmit or provide access electronically, broadcast, display, enter into computer memory, or otherwise use any portion or copy, in whole or in part, in any form, directly or indirectly, or to authorize or assign others to do so.

(xviii) "Supplier's Equipment" means all equipment, tools, apparatus, or things of every kind required in or for installation, completion and maintenance of the System that are to be provided by the Supplier, but excluding the Information Technologies, or other items forming part of the System.

(d) activities

(i) "Delivery" means the transfer of the Goods from the Supplier to the Purchaser in accordance with the Incoterms 2000 specified in the Contract.

(ii) "Installation" means that the System or a Subsystem as specified in the Contract is ready for Commissioning as provided in GCC Clause 26 (Installation).

(iii) "Precommissioning" means the testing, checking, and any other required activity that may be specified in the Technical Requirements that are to be carried out by the Supplier in preparation for Commissioning of the System as provided in GCC Clause 26 (Installation).

(iv) "Commissioning" means operation of the System or any Subsystem by the Supplier

following Installation, which operation is to be carried out by the Supplier as provided in GCC Clause 27.1 (Commissioning), for the purpose of carrying out Operational Acceptance Test(s).

(v) "Operational Acceptance Tests" means the tests specified in the Technical Requirements and Agreed and Finalized Project Plan to be carried out to ascertain whether the System, or a specified Subsystem, is able to attain the functional and performance requirements specified in the Technical Requirements and Agreed and Finalized Project Plan, in accordance with the provisions of GCC Clause 27.2 (Operational Acceptance Test).

(vi) "Operational Acceptance" means the acceptance by the Purchaser of the System (or any Subsystem(s) where the Contract provides for acceptance of the System in parts), in accordance with GCC Clause 27.3 (Operational Acceptance).

(e) place and time

(i) "Purchaser's Country" is the country named in the SCC.

(ii) "Supplier's Country" is the country in which the Supplier is legally organized, as named in the Contract Agreement.

(iii) "Project Site(s)" means the place(s) specified in the SCC for the supply and installation of the System.

(iv) "Eligible Country" means the countries and territories eligible for participation in procurements financed by the World Bank as defined in the Guidelines: Procurement under IBRD Loans and IDA Credits. (**Note:** The Bank maintains a list of countries which Bidders, Goods, and Services are not eligible to participate in procurement financed by the Bank. This is updated regularly and is available from the Public Information Center of the World Bank. A copy of the negative list is contained in the Section of the Bidding Documents entitled "Eligibility for the Provision of Goods, Works,





and Services in Bank-Financed Procurement").

(v) "Day" means calendar day of the Gregorian Calendar.

(vi) "Week" means seven (7) consecutive Days, beginning the day of the week as is customary in the Purchaser's Country.

(vii) "Month" means calendar month of the Gregorian Calendar.

(viii) "Year" means twelve (12) consecutive Months.

(ix) "Effective Date" means the date of fulfillment of all conditions specified in Article 3 (Effective Date for Determining Time for Achieving Operational Acceptance) of the Contract Agreement, for the purpose of determining the Delivery, Installation, and Operational Acceptance dates for the System or Subsystem(s).

(x) "Contract Period" is the time period during which this Contract governs the relations and obligations of the Purchaser and Supplier in relation to the System, as specified in the SCC.

(xi) "Defect Liability Period" (also referred to as the "Warranty Period") means the period of validity of the warranties given by the Supplier commencing at date of the Operational Acceptance Certificate of the System or Subsystem(s), during which the Supplier is responsible for defects with respect to the System (or the relevant Subsystem[s]) as provided in GCC Clause 29 (Defect Liability).

(xii) "The Post-Warranty Services Period" means the number of years defined in the SCC (if any), following the expiration of the Warranty Period during which the Supplier may be obligated to provide Software licenses, maintenance, and/or technical support services for the System, either under this Contract or under separate contract(s).

(xiii) "The Coverage Period" means the Days of the Week and the hours of those Days during which maintenance, operational, and/or technical

support services (if any) must be available.

**2. Contract Documents**

2.1 Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts of these documents) are intended to be correlative, complementary, and mutually explanatory. The Contract shall be read as a whole.

**3. Interpretation**

3.1 Language

3.1.1 Unless the Supplier is a national of the Purchaser's Country and the Purchaser and the Supplier agree to use the national language, all Contract Documents, all correspondence, and communications to be given shall be written in the language specified in the SCC, and the Contract shall be construed and interpreted in accordance with that language.

3.1.2 If any of the Contract Documents, correspondence, or communications are prepared in any language other than the governing language under GCC Clause 3.1.1 above, the translation of such documents, correspondence, or communications shall prevail in matters of interpretation. The originating party, with respect to such documents, correspondence, and communications, shall bear the costs and risks of such translation.

3.2 Singular and Plural

The singular shall include the plural and the plural the singular, except where the context otherwise requires.

3.3 Headings

The headings and marginal notes in the GCC are included for ease of reference and shall neither constitute a part of the Contract nor affect its interpretation.

3.4 Persons

Words importing persons or parties shall include firms, corporations, and government entities.

3.5 Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of parties thereunder shall be as prescribed by Incoterms 2000. "Incoterms 2000" means the international rules for interpreting trade terms published by the International





Chamber of Commerce , 38 Cours Albert 1er, 75008 Paris, France.

3.6 Entire Agreement

The Contract constitutes the entire agreement between the Purchaser and Supplier with respect to the subject matter of Contract and supersedes all communications, negotiations, and agreements (whether written or oral) of parties with respect to the subject matter of the Contract made prior to the date of Contract.

3.7 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party to the Contract.

3.8 Independent Supplier

The Supplier shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture, or other joint relationship between the parties to the Contract.

Subject to the provisions of the Contract, the Supplier shall be solely responsible for the manner in which the Contract is performed. All employees, representatives, or Subcontractors engaged by the Supplier in connection with the performance of the Contract shall be under the complete control of the Supplier and shall not be deemed to be employees of the Purchaser, and nothing contained in the Contract or in any subcontract awarded by the Supplier shall be construed to create any contractual relationship between any such employees, representatives, or Subcontractors and the Purchaser.

3.9 Joint Venture or Consortium

If the Supplier is a joint venture or consortium of two or more persons, all such firms shall be jointly and severally bound to the Purchaser for the fulfillment of the provisions of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture or consortium. The composition or constitution of the joint venture or consortium shall not be altered without the prior consent of the Purchaser.

3.10 Nonwaiver

3.10.1 Subject to GCC Clause 3.9.2 below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.10.2 Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

3.11 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity, or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.12 Country of Origin

"Origin" means the place where the Information Technologies, Materials, and other Goods for the System were produced or from which the Services are supplied. Goods are produced when, through manufacturing, processing, Software development, or substantial and major assembly or integration of components, a commercially recognized product results that is substantially different in basic characteristics or in purpose or utility from its components. The Origin of Goods and Services is distinct from the nationality of the Supplier and may be different.

**4. Notices**

4.1 Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing and shall be sent by personal delivery, airmail post, special courier, cable, telegraph, telex, facsimile, electronic mail, or Electronic Data Interchange (EDI) to the address of the relevant party as specified in the SCC, with the following provisions.

4.1.1 Any notice sent by cable, telegraph, telex, facsimile, electronic mail, or EDI shall be confirmed within two (2) days after dispatch by notice sent by airmail post or special courier, except as otherwise specified in the Contract.





4.1.2 Any notice sent by airmail post or special courier shall be deemed (in the absence of evidence of earlier receipt) to have been delivered ten (10) days after dispatch. In proving the fact of dispatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, stamped, and conveyed to the postal authorities or courier service for transmission by airmail or special courier.

4.1.3 Any notice delivered personally or sent by cable, telegraph, telex, facsimile, electronic mail, or EDI shall be deemed to have been delivered on the date of its dispatch.

4.1.4 Either party may change its postal, cable, telex, facsimile, electronic mail, or EDI address or addressee for receipt of such notices by ten (10) days' notice to the other party in writing.

4.2 Notices shall be deemed to include any approvals, consents, instructions, orders, and certificates to be given under the Contract.

**5. Governing Law**

5.1 The Contract shall be governed by and interpreted in accordance with the laws of the country specified in the SCC.

**6. Settlement of Disputes**

6.1 Adjudicator

6.1.1 If any dispute of any kind whatsoever shall arise between the Purchaser and the Supplier in connection with or arising out of the Contract, including without prejudice to the generality of the foregoing, any question regarding its existence, validity, or termination, or the operation of the System (whether during the progress of implementation or after its achieving Operational Acceptance and whether before or after the termination, abandonment, or breach of the Contract), the parties shall seek to resolve any such dispute or difference by mutual consultation. If the parties fail to resolve such a dispute or difference by mutual consultation, within fourteen (14) days after one party has notified the other in writing of the dispute or difference, then the dispute shall be referred

in writing by either party to the Adjudicator, with a copy to the other party.

6.1.2 The Adjudicator shall give his or her decision in writing to both parties within twenty-eight (28) days of a dispute being referred to the Adjudicator. If the Adjudicator has done so, and no notice of intention to commence arbitration has been given by either the Purchaser or the Supplier within fifty-six (56) days of such reference, the decision shall become final and binding upon the Purchaser and the Supplier. Any decision that has become final and binding shall be implemented by the parties forthwith.

6.1.3 The Adjudicator shall be paid an hourly fee at the rate specified in the Contract Agreement plus reasonable expenditures incurred in the execution of duties as Adjudicator, and these costs shall be divided equally between the Purchaser and the Supplier.

6.1.4 Should the Adjudicator resign or die, or should the Purchaser and the Supplier agree that the Adjudicator is not fulfilling his or her functions in accordance with the provisions of the Contract, a new Adjudicator shall be jointly appointed by the Purchaser and the Supplier. Failing agreement between the two within twenty-eight (28) days, the new Adjudicator shall be appointed at the request of either party by the Appointing Authority specified in the SCC.

6.2 Arbitration

6.2.1 If either the Purchaser or the Supplier is dissatisfied with the Adjudicator's decision, or if the Adjudicator fails to give a decision within twenty-eight (28) days of a dispute being referred to him or her, then either the Purchaser or the Supplier may, within fifty-six (56) days of such reference, give notice to the other party, with a copy for information to the Adjudicator, of its intention to commence arbitration, as provided below, as to the matter in dispute, and no arbitration in respect of this matter may be commenced unless such notice is given.

6.2.2 Any dispute in respect of which a notice of intention to commence arbitration has been given, in accordance with GCC Clause 6.2.1, shall be finally settled by arbitration. Arbitration may be commenced





prior to or after Installation of the Information System.

6.2.3 Arbitration proceedings shall be conducted: (i) in accordance with the rules of procedure specified in the SCC, (ii) in the place specified in the SCC, and (iii) in the language in which this Contract has been executed.

6.2.4 Decisions that, according to: (i) the rules of procedure as specified in the SCC, need to be made by an appointing authority, shall be made by (ii) the Appointing Authority as specified in the SCC.

6.3 Notwithstanding any reference to the Adjudicator or arbitration in this clause,

(a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree;

(b) the Purchaser shall pay the Supplier any monies due the Supplier.

## B. SUBJECT MATTER OF CONTRACT

**7. Scope of the System**

7.1 Unless otherwise expressly limited in the SCC or Technical Requirements, the Supplier's obligations cover the provision of all Information Technologies, Materials and other Goods as well as the performance of all Services required for the design, development, and implementation (including procurement, quality assurance, assembly, associated site preparation, Delivery, Precommissioning, Installation, Testing, and Commissioning) of the System, in accordance with the plans, procedures, specifications, drawings, codes, and any other documents specified in the Contract and the Agreed and Finalized Project Plan.

7.2 The Supplier shall, unless specifically excluded in the Contract, perform all such work and / or supply all such items and Materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Operational Acceptance of the System as if such work and / or items and Materials were expressly mentioned in the Contract.

7.3 The Supplier's obligations (if any) to provide Goods and Services identified in the Recurrent Cost Form of the

Supplier's bid, such as consumables, spare parts, and technical services (e.g., maintenance, technical assistance, and operational support), are as specified in the SCC, including the relevant terms, characteristics, and timings.

**8. Time for Commencement and Operational Acceptance**

8.1 The Supplier shall commence work on the System within the period specified in the SCC, and without prejudice to GCC Clause 28.2, the Supplier shall thereafter proceed with the System in accordance with the time schedule specified in the Implementation Schedule in the Technical Requirements Section and any refinements made in the Agreed and Finalized Project Plan.

8.2 The Supplier shall achieve Operational Acceptance of the System (or Subsystem(s) where a separate time for Operational Acceptance of such Subsystem(s) is specified in the Contract) within the time specified in the SCC and in accordance with the time schedule specified in the Implementation Schedule in the Technical Requirements Section and any refinements made in the Agreed and Finalized Project Plan, or within such extended time to which the Supplier shall be entitled under GCC Clause 40 (Extension of Time for Achieving Operational Acceptance).

**9. Supplier's Responsibilities**

9.1 The Supplier shall conduct all contracted activities with due care and diligence, in accordance with the Contract and with the skill and care expected of a competent provider of information technologies, information systems, support, maintenance, training, and other related services, or in accordance with best industry practices. In particular, the Supplier shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

9.2 The Supplier confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the System provided by the Purchaser and on the basis of information that the Supplier could have obtained from a visual inspection of the site (if access to the site was available) and of other data readily available to the Supplier relating to the System as at the date twenty-eight (28) days prior to bid submission. The Supplier acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Contract.

9.3 The Supplier shall be responsible for timely provision of all resources, information, and decision making under its





control that are necessary to reach a mutually Agreed and Finalized Project Plan (pursuant to GCC Clause 19.2) within the time schedule specified in the Implementation Schedule in the Technical Requirements Section. Failure to provide such resources, information, and decision making may constitute grounds for termination pursuant to GCC Clause 41.2.

9.4 The Supplier shall acquire in its name all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the Purchaser's Country that are necessary for the performance of the Contract, including, without limitation, visas for the Supplier's and Subcontractor's personnel and entry permits for all imported Supplier's Equipment. The Supplier shall acquire all other permits, approvals, and/or licenses that are not the responsibility of the Purchaser under GCC Clause 10.4 and that are necessary for the performance of the Contract.

9.5 The Supplier shall comply with all laws in force in the Purchaser's Country. The laws will include all national, provincial, municipal, or other laws that affect the performance of the Contract and are binding upon the Supplier. The Supplier shall indemnify and hold harmless the Purchaser from and against any and all liabilities, damages, claims, fines, penalties, and expenses of whatever nature arising or resulting from the violation of such laws by the Supplier or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Clause 10.1. The Supplier shall not indemnify the Purchaser to the extent that such liability, damage, claims, fines, penalties, and expenses were caused or contributed to by a fault of the Purchaser.

9.6 The Supplier shall, in all dealings with its labor and the labor of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs, and all local laws and regulations pertaining to the employment of labor.

9.7 Any Information Technologies or other Goods and Services that will be incorporated in or be required for the System and other supplies shall have their Origin, as defined in GCC Clause 3.11, in a country that shall be an Eligible Country, as defined in GCC Clause 1.1 (e) (iv).

9.8 The Supplier shall permit the Bank to inspect the Supplier's accounts and records relating to the performance of the

Supplier and to have them audited by auditors appointed by the Bank, if so required by the Bank.

9.9 During the Contract Period and for six (6) months after the end of the Contract Period, the Supplier shall refrain from canvassing the Purchaser's key personnel that are engaged in the implementation and operation of the System with a view to offering employment.
For the purposes of this GCC Clause 9.9, "key personnel" shall mean those persons named as such in the SCC by name or by reference to their job title and such additional persons as the Purchaser and Supplier may agree from time to time will be "key personnel."

**10. Purchaser's Responsibilities**

10.1 The Purchaser shall ensure the accuracy of all information and/or data to be supplied by the Purchaser to the Supplier, except when otherwise expressly stated in the Contract.

10.2 The Purchaser shall be responsible for timely provision of all resources, information, and decision making under its control that are necessary to reach an Agreed and Finalized Project Plan (pursuant to GCC Clause 19.2) within the time schedule specified in the Implementation Schedule in the Technical Requirements Section. Failure to provide such resources, information, and decision making may constitute grounds for Termination pursuant to GCC Clause 41.3.1 (b).

10.3 The Purchaser shall be responsible for acquiring and providing legal and physical possession of the site and access to it, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract.

10.4 If requested by the Supplier, the Purchaser shall use its best endeavors to assist the Supplier in obtaining in a timely and expeditious manner all permits, approvals, and/or licenses necessary for the execution of the Contract from all local, state, or national government authorities or public service undertakings that such authorities or undertakings require the Supplier or Subcontractors or the personnel of the Supplier or Subcontractors, as the case may be, to obtain.

10.5 In such cases where the responsibilities of specifying and acquiring or upgrading telecommunications and/or electric power services falls to the Supplier, as specified in the Technical Requirements, SCC, Agreed and Finalized Project Plan, or other parts of the Contract, the Purchaser shall use its best endeavors to assist the Supplier in obtaining such services in a timely and expeditious manner.

10.6 The Purchaser shall be responsible for timely provision of all resources, access, and information necessary for the Installation and Operational Acceptance of the System





(including, but not limited to, any required telecommunications or electric power services), as identified in the Agreed and Finalized Project Plan, except where provision of such items is explicitly identified in the Contract as being the responsibility of the Supplier. Delay by the Purchaser may result in an appropriate extension of the Time for Operational Acceptance, at the Supplier's discretion.

10.7 Unless otherwise specified in the Contract or agreed upon by the Purchaser and the Supplier, the Purchaser shall provide sufficient, properly qualified operating and technical personnel, as required by the Supplier to properly carry out Delivery, Precommissioning, Installation, Commissioning, and Operational Acceptance, at or before the time specified in the Implementation Schedule in the Technical Requirements Section and the Agreed and Finalized Project Plan.

10.8 The Purchaser will designate appropriate staff for the training courses to be given by the Supplier and shall make all appropriate logistical arrangements for such training as specified in the Technical Requirements, SCC, the Agreed and Finalized Project Plan, or other parts of the Contract.

10.9 The Purchaser assumes primary responsibility for the Operational Acceptance Test(s) for the System, in accordance with GCC Clause 27.2, and shall be responsible for the continued operation of the System after Operational Acceptance. However, this shall not limit in any way the Supplier's responsibilities after the date of Operational Acceptance otherwise specified in the Contract.

10.10 The Purchaser is responsible for performing and safely storing timely and regular backups of its data and Software in accordance with accepted data management principles, except where such responsibility is clearly assigned to the Supplier elsewhere in the Contract.

10.11 All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Purchaser, save those to be incurred by the Supplier with respect to the performance of the Operational Acceptance Test(s), in accordance with GCC Clause 27.2.

10.12 During the Contract Period and for six (6) months after the end of the Contract Period, the Purchaser shall refrain from canvassing the Supplier's key personnel that are engaged in the supply and installation of the System with a view to offering employment.
For the purposes of this GCC Clause 10.12, "Key Personnel" shall mean those persons named as such in the SCC by name

or by reference to their job title and such additional persons as the Purchaser and Supplier may agree from time to time will be "Key Personnel."

## C. PAYMENT

**11. Contract Price**

11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.

11.2 The Contract Price shall be a firm lump sum not subject to any alteration, except:
(a) in the event of a Change in the System pursuant to GCC Clause 39 or to other clauses in the Contract;
(b) in accordance with the price adjustment formula (if any) specified in the SCC.

11.53The Supplier shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.

**12. Terms of Payment**

12.1 The Supplier's request for payment shall be made to the Purchaser in writing, accompanied by an invoice describing, as appropriate, the System or Subsystem(s), Delivered, Precommissioned, Installed, and Operationally Accepted, and by documents submitted pursuant to GCC Clause 22.5.1 and upon fulfillment of other obligations stipulated in the Contract.

The Contract Price shall be paid as specified in the SCC.

12.2 No payment made by the Purchaser herein shall be deemed to constitute acceptance by the Purchaser of the System or any Subsystem(s).

12.3 Payments shall be made promptly by the Purchaser, but in no case later than forty five (45) days after submission of a valid invoice by the Supplier. In the event that the Purchaser fails to make any payment by its respective due date or within the period set forth in the Contract, the Purchaser shall pay to the Supplier interest on the amount of such delayed payment at the rate(s) specified in the SCC for the period of delay until payment has been made in full, whether before or after judgment or arbitration award.

12.4 All payments shall be made in the currency(ies) specified in





the Contract Agreement, pursuant to GCC Clause 11. If both the specified currency(ies) and, because of a membership in the European Monetary Union (EMU), the euro are valid in the country(ies) of the specified currency(ies), payments may also be made in euro. In case the specified currency(ies) has ceased to be valid in the country(ies) of the specified currency(ies) because of a membership in the EMU, payment shall be made in the corresponding amount of the euro. The conversion of the amount of the specified currency(ies) into the euro shall, in both cases, be made in accordance with the statutory rate of conversion applicable in the country(ies) of the specified currency(ies). For Goods and Services supplied from within the Purchaser's Country, payments shall be made in the currency of the Purchaser's Country, unless otherwise specified in the SCC.

12.5 Unless otherwise specified in the SCC, payment of the foreign currency portion of the Contract Price for Goods and Services supplied from outside the Purchaser's Country shall be made to the Supplier through an irrevocable letter of credit opened by an authorized bank in the Supplier's Country and will be payable on presentation of the appropriate documents. It is agreed that the letter of credit will be subject to Article 10 of the latest revision of Uniform Customs and Practice for Documentary Credits, published by the International Chamber of Commerce, Paris.

**13. Securities**

13.1 Issuance of Securities
The Supplier shall provide the securities specified below in favor of the Purchaser at the times and in the amount, manner, and form specified below.

13.2 Advance Payment Security

13.2.1 As specified in the SCC, the Supplier shall provide a security equal in amount and currency to the advance payment, and valid until the System is Operationally Accepted.

13.2.2 The security shall be in the form provided in the Bidding Documents or in another form acceptable to the Purchaser. The amount of the security shall be reduced in proportion to the value of the System executed by and paid to the Supplier from time to time and shall automatically become null and void when the full amount of the advance payment has been recovered by the Purchaser. The security shall be returned to the Supplier immediately after its expiration.

13.3 Performance Security

13.3.1 The Supplier shall, within twenty-eight (28) days of the notification of Contract award, provide a security for the due performance of the Contract in the amount and currency specified in the SCC.

13.3.2 The security shall be in one of the following forms:

(a) a bank guarantee, in the form provided in the Sample Forms Section of the Bidding Documents, or an irrevocable letter of credit issued by a reputable bank located in the Purchaser's Country or outside the Purchaser's Country, acceptable to the Purchaser; or

(b) a cashier's or certified check.

13.3.3 The security shall automatically become null and void once all the obligations of the Supplier under the Contract have been fulfilled, including, but not limited to, any obligations during the Warranty Period and any extensions to the period. The security shall be returned to the Supplier no later than thirty (30) days after its expiration.

13.3.4 The security shall be reduced:

(a) pro rata by the portion of the Contract Price payable for any Subsystem(s) that has achieved Operational Acceptance, if permitted by the Contract, on the date of such Operational Acceptance;

(b) by the amount specified in the SCC, to reflect Operational Acceptance of the entire System, on the date of such Operational Acceptance, and provide for reduced coverage during the Warranty Period.

**14. Taxes and Duties**

14.1 Except as otherwise specifically provided in the Contract, the Supplier shall bear and pay all taxes, duties, levies, and charges assessed on the Supplier, its Subcontractors, or their employees by all municipal, state, or national government authorities, both within and outside the Purchaser's Country, in connection with the Goods and Services supplied under the Contract.

14.2 Notwithstanding GCC Clause 14.1 above, the Purchaser shall bear and promptly pay all customs clearance costs,





sales or other indirect taxes imposed by law in the Purchaser's Country on the Goods supplied under the Contract.

14.3 If any tax exemptions, reductions, allowances, or privileges may be available to the Supplier in the Purchaser's Country, the Purchaser shall use its best efforts to enable the Supplier to benefit from any such tax savings to the maximum allowable extent.

14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies, and charges prevailing at the date twenty-eight (28) days prior to the date of bid submission in the Purchaser's Country (also called "Tax" in this GCC Clause 14.4). If any Tax rates are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of the Contract, which was or will be assessed on the Supplier, its Subcontractors, or their employees in connection with performance of the Contract, an equitable adjustment to the Contract Price shall be made to fully take into account any such change by addition to or reduction from the Contract Price, as the case may be.

## D. INTELLECTUAL PROPERTY

**15. Copyright**

15.1 The Intellectual Property Rights in all Standard Software and Standard Materials shall remain vested in the owner of such rights.

15.2 The Purchaser agrees to restrict use, copying, or duplication of the Standard Software and Standard Materials in accordance with GCC Clauses 16.1 and 16.2 and the SCC, except that additional copies of Standard Materials may be made by the Purchaser for use within the scope of the project of which the System is a part, in the event that the Supplier does not deliver copies within thirty (30) days from receipt of a request for such Standard Materials.

15.3 The Purchaser's contractual rights to use the Standard Software or elements of the Standard Software may not be assigned, licensed, or otherwise transferred voluntarily except in accordance with the relevant license agreement or as may be otherwise specified in the SCC.

15.4 As applicable, the Purchaser's and Supplier's rights and obligations with respect to Custom Software or elements of the Custom Software, including any license agreements, and with respect to Custom Materials or elements of the Custom Materials are specified the SCC. Subject to the SCC, the Intellectual Property Rights in all Custom Software and Custom Materials specified in Appendices 4 and 5 of the Contract Agreement (if any) shall, at the date of this Contract or on creation of the rights (if later than the date of this Contract), vest in the Purchaser. The Supplier shall do and execute or arrange for the doing and executing of each necessary act, document, and thing that the Purchaser may consider necessary or desirable to perfect the right, title, and interest of the Purchaser in and to those rights. In respect of such Custom Software and Custom Materials, the Supplier shall ensure that the holder of a moral right in such an item does not assert it, and the Supplier shall, if requested to do so by the Purchaser and where permitted by applicable law, ensure that the holder of such a moral right waives it.

15.5 The parties shall enter into such (if any) escrow arrangements in relation to the Source Code to some or all of the Software as are specified in the SCC and in accordance with the SCC.

**16. Software License Agreements**

16.1 Except to the extent that the Intellectual Property Rights in the Software vest in the Purchaser, the Supplier hereby grants to the Purchaser license to access and use the Software, including all inventions, designs, and marks embodied in the Software.

Such license to access and use the Software shall:

(a) be:

(i) nonexclusive;

(ii) fully paid up and irrevocable (except that it shall terminate if the Contract terminates under GCC Clauses 41.1 or 41.3);

(iii) valid throughout the territory of the Purchaser's Country (or such other territory as specified in the SCC); and

(iv) subject to additional restrictions (if any) as specified in the SCC.

(b) permit the Software to be:

(i) used or copied for use on or with the computer(s)





for which it was acquired (if specified in the Technical Requirements and/or the Supplier's bid), plus a backup computer(s) of the same or similar capacity, if the primary is(are) inoperative, and during a reasonable transitional period when use is being transferred between primary and backup;

(ii) as specified in the SCC, used or copied for use on or transferred to a replacement computer(s), (and use on the original and replacement computer(s) may be simultaneous during a reasonable transitional period) provided that, if the Technical Requirements and/or the Supplier's bid specifies a class of computer to which the license is restricted and unless the Supplier agrees otherwise in writing, the replacement computer(s) is(are) within that class;

(iii) if the nature of the System is such as to permit such access, accessed from other computers connected to the primary and/or backup computer(s) by means of a local or wide-area network or similar arrangement, and used on or copied for use on those other computers to the extent necessary to that access;

(iv) reproduced for safekeeping or backup purposes;

(v) customized, adapted, or combined with other computer software for use by the Purchaser, provided that derivative software incorporating any substantial part of the delivered, restricted Software shall be subject to same restrictions as are set forth in this Contract;

(vi) as specified in the SCC, disclosed to, and reproduced for use by, support service suppliers and their subcontractors, (and the Purchaser may sublicense such persons to use and copy for use the Software) to the extent reasonably necessary to the performance of their support service contracts, subject to the same restrictions as are set forth in this Contract; and

(vii) disclosed to, and reproduced for use by, the Purchaser or by the Purchaser's Group and by such other persons as are specified in the SCC (and the Purchaser may sublicense such persons

to use and copy for use the Software), subject to the same restrictions as are set forth in this Contract.

16.2 The Standard Software may be subject to audit by the Supplier, in accordance with the terms specified in the SCC, to verify compliance with the above license agreements.

**17. Confidential Information**

17.1 Except if otherwise specified in the SCC, the Purchaser and the Supplier ("the Receiving Party") shall each keep confidential and shall not, without the written consent of the other party to this Contract ("the Disclosing Party"), divulge to any third party any documents, data, or other information of a confidential nature ("Confidential Information"):

(a) furnished directly or indirectly by the Disclosing Party in connection with this Contract; or

(b) where the Supplier is the Receiving Party, generated by the Supplier in the course of the performance of its obligations under the Contract and relating to the businesses, finances, suppliers, employees, or other contacts of the Purchaser or the Purchaser's use of the System,

whether such information has been furnished or generated prior to, during, or following termination of the Contract ("Confidential Information").

17.2 Notwithstanding the above:

(a) the Supplier may furnish to its Subcontractor Confidential Information of the Purchaser to the extent reasonably required for the Subcontractor to perform its work under the Contract; and

(b) the Purchaser may furnish Confidential Information of the Supplier: (i) to its support service suppliers and their subcontractors to the extent reasonably required for them to perform their work under their support service contracts; and (ii) to its affiliates and subsidiaries,

in which event the Receiving Party shall ensure that the person to whom it furnishes Confidential Information of the Disclosing Party is aware of and abides by the Receiving Party's obligations under this GCC Clause 17 as if that person were party to the Contract in place of the Receiving Party.

17.3 The Purchaser shall not, without the Supplier's prior written consent, use any Confidential Information received from the





Supplier for any purpose other than the operation, maintenance and further development of the System. Similarly, the Supplier shall not, without the Purchaser's prior written consent, use any Confidential Information received from the Purchaser for any purpose other than those that are required for the performance of the Contract.

17.4 The obligation of a party under GCC Clauses 17.1, 17.2, and 17.3 above, however, shall not apply to that information which:

(a) now or hereafter enters the public domain through no fault of the Receiving Party;

(b) can be proven to have been possessed by the Receiving Party at the time of disclosure and that was not previously obtained, directly or indirectly, from the Disclosing Party;

(c) otherwise lawfully becomes available to the Receiving Party from a third party that has no obligation of confidentiality.

17.5 The above provisions of this GCC Clause 17 shall not in any way modify any undertaking of confidentiality given by either of the parties to this Contract prior to the date of the Contract in respect of the System or any part thereof.

17.6 The provisions of this GCC Clause 17 shall survive the termination, for whatever reason, of the Contract for three (3) years or such longer period as may be specified in the SCC.

## E. Supply, Installation, Testing, Commissioning, and Acceptance of the System

**18. Representatives** 18.1 Project Manager

If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Purchaser shall appoint and notify the Supplier in writing of the name of the Project Manager. The Purchaser may from time to time appoint some other person as the Project Manager in place of the person previously so appointed and shall give a notice of the name of such other person to the Supplier without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the System. Such appointment shall take effect only upon receipt of such notice by the Supplier. Subject to the extensions and/or limitations specified in the SCC (if any), the Project Manager shall have the authority to represent the Purchaser on all day-to-day matters relating to the System or arising from the Contract. All notices, instructions, orders, certificates, approvals, and all other communications under the Contract shall be given by the Project Manager, except as otherwise provided for in this Contract.

All notices, instructions, information, and other communications given by the Supplier to the Purchaser under the Contract shall be given to the Project Manager, except as otherwise provided for in this Contract.

18.2 Supplier's Representative

18.2.1 If the Supplier's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Supplier shall appoint the Supplier's Representative and shall request the Purchaser in writing to approve the person so appointed. The request must be accompanied by a detailed curriculum vitae for the nominee, as well as a description of any other System or non-System responsibilities the nominee would retain while performing the duties of the Supplier's Representative. If the Purchaser does not object to the appointment within fourteen (14) days, the Supplier's Representative shall be deemed to have been approved. If the Purchaser objects to the appointment within fourteen (14) days giving the reason therefor,





then the Supplier shall appoint a replacement within fourteen (14) days of such objection in accordance with this GCC Clause 18.2.1.

18.2.2 Subject to the extensions and/or limitations specified in the SCC (if any), the Supplier's Representative shall have the authority to represent the Supplier on all day-to-day matters relating to the System or arising from the Contract. The Supplier's Representative shall give to the Project Manager all the Supplier's notices, instructions, information, and all other communications under the Contract.

All notices, instructions, information, and all other communications given by the Purchaser or the Project Manager to the Supplier under the Contract shall be given to the Supplier's Representative or, in its absence, its deputy, except as otherwise provided for in this Contract.

18.2.3 The Supplier shall not revoke the appointment of the Supplier's Representative without the Purchaser's prior written consent, which shall not be unreasonably withheld. If the Purchaser consents to such an action, the Supplier shall appoint another person of equal or superior qualifications as the Supplier's Representative, pursuant to the procedure set out in GCC Clause 18.2.1.

18.2.4 The Supplier's Representative and staff are obliged to work closely with the Purchaser's Project Manager and staff, act within their own authority, and abide by directives issued by the Purchaser that are consistent with the terms of the Contract. The Supplier's Representative is responsible for managing the activities of its personnel and any subcontracted personnel.

18.2.5 The Supplier's Representative may, subject to the approval of the Purchaser (which shall not be unreasonably withheld), at any time delegate to any person any of the powers, functions, and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Supplier's Representative and shall specify the powers, functions, and authorities thereby delegated or

revoked. No such delegation or revocation shall take effect unless and until a copy of such a notice has been delivered to the Purchaser and the Project Manager.

18.2.6 Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with GCC Clause 18.2.5 shall be deemed to be an act or exercise by the Supplier's Representative.

18.3 Objections and Removals

18.3.1 The Purchaser may by notice to the Supplier object to any representative or person employed by the Supplier in the execution of the Contract who, in the reasonable opinion of the Purchaser, may have behaved inappropriately, be incompetent, or be negligent. The Purchaser shall provide evidence of the same, whereupon the Supplier shall remove such person from work on the System.

18.3.2 If any representative or person employed by the Supplier is removed in accordance with GCC Clause 18.3.1, the Supplier shall, where required, promptly appoint a replacement.

**19. Project Plan**

19.1 In close cooperation with the Purchaser and based on the Preliminary Project Plan included in the Supplier's bid, the Supplier shall develop a Project Plan encompassing the activities specified in the Contract. The contents of the Project Plan shall be as specified in the SCC and/or Technical Requirements.

19.2 The Supplier shall formally present to the Purchaser the Project Plan in accordance with the procedure specified in the SCC.

19.3 If required, the impact on the Implementation Schedule of modifications agreed during finalization of the Agreed and Finalized Project Plan shall be incorporated in the Contract by amendment, in accordance with GCC Clauses 39 and 40.

19.4 The Supplier shall undertake to supply, install, test, and commission the System in accordance with the Agreed and Finalized Project Plan and the Contract.

19.5 The Progress and other reports specified in the SCC shall be prepared by the Supplier and submitted to the Purchaser in the format and frequency specified in the Technical





Requirements.

**20. Subcontracting**

20.1 Appendix 3 (List of Approved Subcontractors) to the Contract Agreement specifies critical items of supply or services and a list of Subcontractors for each item that are considered acceptable by the Purchaser. If no Subcontractors are listed for an item, the Supplier shall prepare a list of Subcontractors it considers qualified and wishes to be added to the list for such items. The Supplier may from time to time propose additions to or deletions from any such list. The Supplier shall submit any such list or any modification to the list to the Purchaser for its approval in sufficient time so as not to impede the progress of work on the System. The Purchaser shall not withhold such approval unreasonably. Such approval by the Purchaser of a Subcontractor(s) shall not relieve the Supplier from any of its obligations, duties, or responsibilities under the Contract.

20.2 The Supplier may, at its discretion, select and employ Subcontractors for such critical items from those Subcontractors listed pursuant to GCC Clause 20.1. If the Supplier wishes to employ a Subcontractor not so listed, or subcontract an item not so listed, it must seek the Purchaser's prior approval under GCC Clause 20.3.

20.3 For items for which pre-approved Subcontractor lists have not been specified in Appendix 3 to the Contract Agreement, the Supplier may employ such Subcontractors as it may select, provided: (i) the Supplier notifies the Purchaser in writing at least twenty-eight (28) days prior to the proposed mobilization date for such Subcontractor; and (ii) by the end of this period either the Purchaser has granted its approval in writing or fails to respond. The Supplier shall not engage any Subcontractor to which the Purchaser has objected in writing prior to the end of the notice period. The absence of a written objection by the Purchaser during the above specified period shall constitute formal acceptance of the proposed Subcontractor. Except to the extent that it permits the deemed approval of the Purchaser of Subcontractors not listed in the Contract Agreement, nothing in this Clause, however, shall limit the rights and obligations of either the

Purchaser or Supplier as they are specified in GCC Clauses 20.1 and 20.2, in the SCC, or in Appendix 3 of the Contract Agreement.

**21. Design and Engineering**

21.1 Technical Specifications and Drawings

21.1.1 The Supplier shall execute the basic and detailed design and the implementation activities necessary for successful installation of the System in compliance with the provisions of the Contract or, where not so specified, in accordance with good industry practice.

The Supplier shall be responsible for any discrepancies, errors or omissions in the specifications, drawings, and other technical documents that it has prepared, whether such specifications, drawings, and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors, or omissions are not because of inaccurate information furnished in writing to the Supplier by or on behalf of the Purchaser.

21.1.2 The Supplier shall be entitled to disclaim responsibility for any design, data, drawing, specification, or other document, or any modification of such design, drawings, specification, or other documents provided or designated by or on behalf of the Purchaser, by giving a notice of such disclaimer to the Project Manager.

21.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of bid submission shall apply unless otherwise specified in the SCC. During Contract execution, any changes in such codes and standards shall be applied after approval by the Purchaser and shall be treated in accordance with GCC Clause 39.3.

21.3 Approval/Review of Technical Documents by Project Manager

21.3.1 The Supplier shall prepare and furnish to the Project Manager the documents as specified in the SCC for the Project Manager's approval or review.

Any part of the System covered by or related to the





documents to be approved by the Project Manager shall be executed only after the Project Manager's approval of these documents.

GCC Clauses 21.3.2 through 21.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.

21.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Clause 21.3.1, the Project Manager shall either return one copy of the document to the Supplier with its approval endorsed on the document or shall notify the Supplier in writing of its disapproval of the document and the reasons for disapproval and the modifications that the Project Manager proposes. If the Project Manager fails to take such action within the fourteen (14) days, then the document shall be deemed to have been approved by the Project Manager.

21.3.3 The Project Manager shall not disapprove any document except on the grounds that the document does not comply with some specified provision of the Contract or that it is contrary to good industry practice.

21.3.4 If the Project Manager disapproves the document, the Supplier shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Clause 21.3.2. If the Project Manager approves the document subject to modification(s), the Supplier shall make the required modification(s), and the document shall then be deemed to have been approved, subject to GCC Clause 21.3.5. The procedure set out in GCC Clauses 21.3.2 through 21.3.4 shall be repeated, as appropriate, until the Project Manager approves such documents.

21.3.5 If any dispute or difference occurs between the Purchaser and the Supplier in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) to a document that cannot be settled between the parties within a reasonable period, then such dispute or difference may be referred to an Adjudicator for determination in accordance with GCC Clause 6.1

(Adjudicator). If such dispute or difference is referred to an Adjudicator, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Supplier shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Adjudicator upholds the Supplier's view on the dispute and if the Purchaser has not given notice under GCC Clause 6.1.2, then the Supplier shall be reimbursed by the Purchaser for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Adjudicator shall decide, and the Time for Achieving Operational Acceptance shall be extended accordingly.

21.3.6 The Project Manager's approval, with or without modification of the document furnished by the Supplier, shall not relieve the Supplier of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager or inaccurate information furnished in writing to the Supplier by or on behalf of the Purchaser.

21.3.7 The Supplier shall not depart from any approved document unless the Supplier has first submitted to the Project Manager an amended document and obtained the Project Manager's approval of the document, pursuant to the provisions of this GCC Clause 21.3. If the Project Manager requests any change in any already approved document and/or in any document based on such an approved document, the provisions of GCC Clause 39 (Changes to the System) shall apply to such request.

**22. Procurement, Delivery, and Transport**

22.1 Subject to GCC Clause 14.2, the Supplier shall manufacture or procure and transport all the Information Technologies, Materials, and other Goods in an expeditious and orderly manner to the Project Site.





22.2 Delivery of the Information Technologies, Materials, and other Goods shall be made by the Supplier in accordance with the Technical Requirements.

22.3 Early or partial deliveries require the explicit written consent of the Purchaser, which consent shall not be unreasonably withheld.

22.4 Transportation

22.4.1 The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during shipment. The packing, marking, and documentation within and outside the packages shall comply strictly with the Purchaser's instructions to the Supplier.

22.4.2 The Supplier will bear responsibility for and cost of transport to the Project Sites in accordance with the terms and conditions used in the specification of prices in the Price Schedules, including the terms and conditions of the associated Incoterms.

22.4.3 Unless otherwise specified in the SCC, The Supplier shall be free to use transportation through carriers registered in any eligible country and to obtain insurance from any eligible source country.

22.5 Unless otherwise specified in the SCC, the Supplier will provide the Purchaser with shipping and other documents, as specified below:

22.5.1 For Goods supplied from outside the Purchaser's Country:

Upon shipment, the Supplier shall notify the Purchaser and the insurance company contracted by the Supplier to provide cargo insurance by telex, cable, facsimile, electronic mail, or

EDI with the full details of the shipment. The Supplier shall promptly send the following documents to the Purchaser by mail or courier, as appropriate, with a copy to the cargo insurance company:

(a) two copies of the Supplier's invoice showing the description of the Goods, quantity, unit price, and total amount;

(b) usual transportation documents;

(c) insurance certificate;

(d) certificate(s) of origin; and

(e) estimated time and point of arrival in the Purchaser's Country and at the site.

22.5.2 For Goods supplied from within the Purchaser's Country:

Upon shipment, the Supplier shall notify the Purchaser by telex, cable, facsimile, electronic mail, or EDI with the full details of the shipment. The Supplier shall promptly send the following documents to the Purchaser by mail or courier, as appropriate:

(a) two copies of the Supplier's invoice showing the Goods' description, quantity, unit price, and total amount;

(b) delivery note, railway receipt, or truck receipt;

(c) insurance certificate;

(d) certificate(s) of origin; and

(e) estimated time of arrival at the site.

22.6 Customs Clearance

(a) The Purchaser will bear responsibility for and cost of customs clearance into the Purchaser's country n accordance with the Incoterm 2000 used for pricing of foreign goods, as per GCC Clause 11.3.(a).

(b) At the request of the Purchaser, the Supplier will make available a representative or agent during the process of customs clearance in the Purchaser's country for goods supplied from outside the Purchaser's country. In the





event of delays in customs clearance that are not the fault of the Supplier:

(i) the Supplier shall be entitled to an extension in the Time for Achieving Operational Acceptance, pursuant to GCC Clause 40;

(ii) the Contract Price shall be adjusted to compensate the Supplier for any additional storage charges that the Supplier may incur as a result of the delay.

**23. Product Upgrades**

23.1 At any point during performance of the Contract, should technological advances be introduced by the Supplier for Information Technologies originally offered by the Supplier in its bid and still to be delivered, the Supplier shall be obligated to offer to the Purchaser the latest versions of the available Information Technologies having equal or better performance or functionality at the same or lesser unit prices, pursuant to GCC Clause 39 (Changes to the System).

23.2 At any point during performance of the Contract, for Information Technologies still to be delivered, the Supplier will also pass on to the Purchaser any cost reductions and additional and/or improved support and facilities that it offers to other clients of the Supplier in the Purchaser's Country, pursuant to GCC Clause 39 (Changes to the System).

23.3 During performance of the Contract, the Supplier shall offer to the Purchaser all new versions, releases, and updates of Standard Software, as well as related documentation and technical support services, within thirty (30) days of their availability from the Supplier to other clients of the Supplier in the Purchaser's Country, and no later than twelve (12) months after they are released in the country of origin. In no case will the prices for these Software exceed those quoted by the Supplier in the Recurrent Costs Form in its bid.

23.4 During the Warranty Period, unless otherwise specified in the SCC, the Supplier will provide at no additional cost to the Purchaser all new versions, releases, and updates for all Standard Software that are used in the System, within thirty (30) days of their availability from the Supplier to other

clients of the Supplier in the Purchaser's country, and no later than twelve (12) months after they are released in the

country of origin of the Software.

23.5 The Purchaser shall introduce all new versions, releases or updates of the Software within eighteen (18) months of receipt of a production-ready copy of the new version, release, or update, provided that the new version, release, or update does not adversely affect System operation or performance or require extensive reworking of the System. In cases where the new version, release, or update adversely affects System operation or performance, or requires extensive reworking of the System, the Supplier shall continue to support and maintain the version or release previously in operation for as long as necessary to allow introduction of the new version, release, or update. In no case shall the Supplier stop supporting or maintaining a version or release of the Software less than twenty four (24) months after the Purchaser receives a production-ready copy of a subsequent version, release, or update. The Purchaser shall use all reasonable endeavors to implement any new version, release, or update as soon as practicable, subject to the twenty-four-month-long stop date.

**24. Implementation, Installation, and Other Services**

24.1 The Supplier shall provide all Services specified in the Contract and Agreed and Finalized Project Plan in accordance with the highest standards of professional competence and integrity.

24.2 Prices charged by the Supplier for Services, if not included in the Contract, shall be agreed upon in advance by the parties (including, but not restricted to, any prices submitted by the Supplier in the Recurrent Cost Schedules of its Bid) and shall not exceed the prevailing rates charged by the Supplier to other purchasers in the Purchaser's Country for similar services.

**25. Inspections and Tests**

25.1 The Purchaser or its representative shall have the right to inspect and/or test any components of the System, as specified in the Technical Requirements, to confirm their good working order and/or conformity to the Contract at the point of delivery and/or at the Project Site.

25.2 The Purchaser and the Project Manager or their designated representatives shall be entitled to attend any such inspections and/or tests of the components, provided that the Purchaser shall bear all costs and expenses incurred in connection with such attendance, including but not limited to all inspection agent fees, travel, and related expenses.

25.3 Should the inspected or tested components fail to conform to





the Contract, the Purchaser may reject the component(s), and the Supplier shall either replace the rejected component(s), or make alterations as necessary so that it meets the Contract requirements free of cost to the Purchaser.

25.4 The Project Manager may require the Supplier to carry out any inspection and/or test not specified in the Contract, provided that the Supplier's reasonable costs and expenses incurred in the carrying out of such inspection and/or test shall be added to the Contract Price. Further, if such inspection and/or test impedes the progress of work on the System and/or the Supplier's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Achieving Operational Acceptance and the other obligations so affected.

25.5 If any dispute or difference of opinion shall arise between the parties in connection with or arising out of an inspection and/or of any component to be incorporated in the System that cannot be settled amicably between the parties within a reasonable period of time, it may be referred to an Adjudicator for determination in accordance with GCC Clause 6.1 (Reference to Adjudicator).

**26. Installation of the System**

26.1 As soon as the System, or any Subsystem, has, in the opinion of the Supplier, been delivered, Precommissioned, and made ready for Commissioning and Operational Acceptance Testing in accordance with the Technical Requirements the SCC and the Agreed and Finalized Project Plan, the Supplier shall so notify the Purchaser in writing.

26.2 The Project Manager shall, within fourteen (14) days after receipt of the Supplier's notice under GCC Clause 26.1, either issue an Installation Certificate in the form specified in the Sample Forms Section in the Bidding Documents, stating that the System, or major component or Subsystem (if Acceptance by major component or Subsystem is specified in the Contract), has achieved Installation by the date of the Supplier's notice under GCC Clause 26.1, or notify the Supplier in writing of any defects and/or deficiencies, including, but not limited to, defects or deficiencies in the interoperability or integration of the various components and/or Subsystems making up the System. The Supplier shall use all reasonable endeavors to promptly remedy any defect and/or deficiencies that the Project Manager has notified the Supplier of. The Supplier shall then promptly carry out retesting of the System or Subsystem and, when in

the Supplier's opinion the System or Subsystem is ready for Commissioning and Operational Acceptance Testing, notify the Purchaser in writing, in accordance with GCC Clause 26.1. The procedure set out in this GCC Clause 26.2 shall be repeated, as necessary, until an Installation Certificate is issued.

26.3 If the Project Manager fails to issue the Installation Certificate and fails to inform the Supplier of any defects and/or deficiencies within fourteen (14) days after receipt of the Supplier's notice under GCC Clause 26.1, or if the Purchaser puts the System or a Subsystem into production operation, then the System (or Subsystem) shall be deemed to have achieved successful Installation as of the date of the Supplier's notice or repeated notice, or when the Purchaser put the System into production operation, as the case may be.

**27. Commissioning and Operational Acceptance**

27.1 Commissioning

27.1.1 Commissioning of the System (or Subsystem if specified in the Contract) shall be commenced by the Supplier:

(a) immediately after the Installation Certificate is issued by the Project Manager, pursuant to GCC Clause 26.2; or

(b) as otherwise specified in the Technical Requirement or the Agreed and Finalized Project Plan; or

(c) immediately after Installation is deemed to have occurred, under GCC Clause 26.3.

27.1.2 The Purchaser shall supply the operating and technical personnel and all materials and information reasonably required to enable the Supplier to carry out its obligations with respect to Commissioning.

Production use of the System or Subsystem(s) shall not commence prior to the start of formal Operational Acceptance Testing.

27.2 Operational Acceptance Tests

27.2.1 The Operational Acceptance Tests (and repeats of such tests) shall be the primary responsibility of the Purchaser (in accordance with GCC Clause 10.9), but shall be conducted with the full cooperation of the





Supplier during Commissioning of the System (or Subsystem[s] if specified in the Contract), to ascertain whether the System (or major component or Subsystem[s]) conforms to the Technical Requirements and meets the standard of performance quoted in the Supplier's bid, including, but not restricted to, the functional and technical performance requirements. The Operational Acceptance Tests during Commissioning will be conducted as specified in the SCC, the Technical Requirements and/or the Agreed and Finalized Project Plan.

At the Purchaser's discretion, Operational Acceptance Tests may also be performed on replacement Goods, upgrades and new version releases, and Goods that are added or field-modified after Operational Acceptance of the System.

27.2.2 If for reasons attributable to the Purchaser, the Operational Acceptance Test of the System (or Subsystem[s] or major component if allowed by the SCC and/or the Technical Specifications) cannot be successfully completed within the period specified in the SCC, from the date of Installation or any other period agreed upon in writing by the Purchaser and the Supplier, the Supplier shall be deemed to have fulfilled its obligations with respect to the technical and functional aspects of the Technical Specifications, SCC and/or the Agreed and Finalized Project Plan, and GCC Clause 28.2 and 28.3 shall not apply.

27.3 Operational Acceptance

27.3.1 Subject to GCC Clause 27.4 (Partial Acceptance) below, Operational Acceptance shall occur in respect of the System, when

(a) the Operational Acceptance Tests, as specified in the Technical Requirements, and/or SCC and/or the Agreed and Finalized Project Plan have been successfully completed; or

(b) the Operational Acceptance Tests have not been successfully completed or have not been carried

out for reasons that are attributable to the Purchaser within the period from the date of Installation or any other agreed-upon period as specified in GCC Clause 27.2.2 above; or

(c) the Purchaser has put the System into production or use for sixty (60) consecutive days. If the System is put into production or use in this manner, the Supplier shall notify the Purchaser and document such use.

27.3.2 At any time after any of the events set out in GCC Clause 27.3.1 have occurred, the Supplier may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate.

27.3.3 After consultation with the Purchaser, and within fourteen (14) days after receipt of the Supplier's notice, the Project Manager shall:

(a) issue an Operational Acceptance Certificate; or

(b) notify the Supplier in writing of any defect or deficiencies or other reason for the failure of the Operational Acceptance Tests; or

(c) issue the Operational Acceptance Certificate, if the situation covered by GCC Paragraph 27.3.1 (b) arises.

27.3.4 The Supplier shall use all reasonable endeavors to promptly remedy any defect and/or deficiencies and/or other reasons for the failure of the Operational Acceptance Test that the Project Manager has notified the Supplier of. Once such remedies have been made by the Supplier, the Supplier shall notify the Purchaser, and the Purchaser, with the full cooperation of the Supplier, shall use all reasonable endeavors to promptly carry out retesting of the System or Subsystem. Upon the successful conclusion of the Operational Acceptance Tests, the Supplier shall notify the Purchaser of its request for Operational Acceptance Certification, in accordance with GCC Clause 27.3.3. The Purchaser shall then issue to the Supplier the Operational Acceptance Certification, in accordance with GCC Paragraph 27.3.3 (a) or notify the Supplier of further defects, deficiencies, or other reasons for the failure of the Operational Acceptance





Test. The procedure set out in this GCC Clause 27.3.4 shall be repeated, as necessary, until an Operational Acceptance Certificate is issued.

27.3.5 If the System or Subsystem fails to pass the Operational Acceptance Test(s) in accordance with GCC Clause 27.2, then either:

(a) the Purchaser may consider terminating the Contract, pursuant to GCC Clause 41.2.2;

or

(b) if the failure to achieve Operational Acceptance within the specified time period is a result of the failure of the Purchaser to fulfill its obligations under the Contract, then the Supplier shall be deemed to have fulfilled its obligations with respect to the relevant technical and functional aspects of the Contract, and GCC Clauses 30.3 and 30.4 shall not apply.

27.3.6 If within fourteen (14) days after receipt of the Supplier's notice the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Supplier in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the System or Subsystem shall be deemed to have been accepted as of the date of the Supplier's said notice.

27.4 Partial Acceptance

27.4.1 If specified in the Contract, Installation and Commissioning shall be carried out individually for each identified major component or Subsystem(s) of the System. In this event, the provisions in the Contract relating to Installation and Commissioning, including the Operational Acceptance Test, shall apply to each such major component or Subsystem individually, and Operational Acceptance Certificate(s) shall be issued accordingly for each such major component or Subsystem of the System, subject to the limitations contained in GCC Clause 27.4.2.

27.4.2 The issuance of Operational Acceptance Certificates for individual major components or Subsystems pursuant to GCC Clause 27.4.1 shall not relieve the

Supplier of its obligation to obtain an Operational Acceptance Certificate for the System as a whole (if specified in the Contract) once all major components and Subsystems have been supplied, installed, tested, and commissioned.

27.4.3 In the case of minor components for the System that by their nature do not require Commissioning or an Operational Acceptance Test (e.g., minor fittings, furnishings or site works, etc.), the Project Manager shall issue an Operational Acceptance Certificate within fourteen (14) days after the fittings and/or furnishings have been delivered and/or installed or the site works have been completed. The Supplier shall, however, use all reasonable endeavors to promptly remedy any defects or deficiencies in such minor components detected by the Purchaser or Supplier.

## F. GUARANTEES AND LIABILITIES

**28. Operational Acceptance Time Guarantee**

28.1 The Supplier guarantees that it shall complete the supply, Installation, Commissioning, and achieve Operational Acceptance of the System (or Subsystems, if specified in the Contract) within the time periods specified in the Implementation Schedule in the Technical Requirements Section and/or the Agreed and Finalized Project Plan pursuant to GCC Clause 8.2, or within such extended time to which the Supplier shall be entitled under GCC Clause 40 (Extension of Time for Achieving Operational Acceptance).

28.2 If the Supplier fails to supply, install, commission, and achieve Operational Acceptance of the System (or Subsystems if specified in the Contract) within the time for achieving Operational Acceptance specified in the Implementation Schedule in the Technical Requirement or the Agreed and Finalized Project Plan, or any extension of the time for achieving Operational Acceptance previously granted under GCC Clause 40 (Extension of Time for Achieving Operational Acceptance), the Supplier shall pay to the Purchaser liquidated damages at the rate specified in the SCC as a percentage of the Contract Price, or the relevant part of the Contract Price if a Subsystem has not achieved Operational Acceptance. The aggregate amount of such liquidated damages shall in no event exceed the amount specified in the SCC ("the Maximum"). Once the Maximum is reached, the Purchaser may consider termination of the





Contract, pursuant to GCC Clause 41.2.2.

28.3 Unless otherwise specified in the SCC, liquidated damages payable under this GCC Clause 28.2 shall apply only to the failure to achieve Operational Acceptance of the System (and Subsystems) as specified in the Implementation Schedule in the Technical Requirements and/or Agreed and Finalized Project Plan. This Clause 28.3 shall not limit, however, any other rights or remedies the Purchaser may have under the Contract for other delays.

28.4 If liquidated damages are claimed by the Purchaser for the System (or Subsystem), the Supplier shall have no further liability whatsoever to the Purchaser in respect to the Operational Acceptance time guarantee for the System (or Subsystem). However, the payment of liquidated damages shall not in any way relieve the Supplier from any of its obligations to complete the System or from any other of its obligations and liabilities under the Contract.

**29. Defect Liability**

29.1 The Supplier warrants that the System, including all Information Technologies, Materials, and other Goods supplied and Services provided, shall be free from defects in the design, engineering, Materials, and workmanship that prevent the System and/or any of its components from fulfilling the Technical Requirements or that limit in a material fashion the performance, reliability, or extensibility of the System and/or Subsystems. Exceptions and/or limitations, if any, to this warranty with respect to Software (or categories of Software), shall be as specified in the SCC . Commercial warranty provisions of products supplied under the Contract shall apply to the extent that they do not conflict with the provisions of this Contract.

29.2 The Supplier also warrants that the Information Technologies, Materials, and other Goods supplied under the Contract are new, unused, and incorporate all recent improvements in design that materially affect the System's or Subsystem's ability to fulfill the Technical Requirements.

29.3 In addition, the Supplier warrants that: (i) all Goods components to be incorporated into the System form part of the Supplier's and/or Subcontractor's current product lines, (ii) they have been previously released to the market, and (iii) those specific items identified in the SCC (if any) have been in the market for at least the minimum periods specified in the SCC.

29.4 The Warranty Period shall commence from the date of Operational Acceptance of the System (or of any major component or Subsystem for which separate Operational Acceptance is provided for in the Contract) and shall extend for the length of time specified in the SCC.

29.5 If during the Warranty Period any defect, as described in GCC Clause 29.1 and/or the corresponding SCC, should be found in the design, engineering, Materials, and workmanship of the Information Technologies and other Goods supplied or of the Services provided by the Supplier, the Supplier shall promptly, in consultation and agreement with the Purchaser regarding appropriate remedying of the defects, and at its sole cost, repair, replace, or otherwise make good (as the Supplier shall, at its discretion, determine) such defect as well as any damage to the System caused by such defect. Any defective Information Technologies or other Goods that have been replaced by the Supplier shall remain the property of the Supplier.

29.6 The Supplier shall not be responsible for the repair, replacement, or making good of any defect or of any damage to the System arising out of or resulting from any of the following causes:

(a) improper operation or maintenance of the System by the Purchaser;

(b) normal wear and tear;

(c) use of the System with items not supplied by the Supplier, unless otherwise identified in the Technical Requirements, or approved by the Supplier; or

(d) modifications made to the System by the Purchaser, or a third party, not approved by the Supplier.

29.7 The Supplier's obligations under this GCC Clause 29 shall not apply to:

(a) any materials that are normally consumed in operation or have a normal life shorter than the Warranty Period; or

(b) any designs, specifications, or other data designed, supplied, or specified by or on behalf of the Purchaser or any matters for which the Supplier has disclaimed responsibility, in accordance with GCC Clause 21.1.2.





29.8 The Purchaser shall give the Supplier a notice promptly following the discovery of such defect, stating the nature of any such defect together with all available evidence. The Purchaser shall afford all reasonable opportunity for the Supplier to inspect any such defect. The Purchaser shall afford the Supplier all necessary access to the System and the site to enable the Supplier to perform its obligations under this GCC Clause 29.

29.9 The Supplier may, with the consent of the Purchaser, remove from the site any Information Technologies and other Goods that are defective, if the nature of the defect, and/or any damage to the System caused by the defect, is such that repairs cannot be expeditiously carried out at the site. If the repair, replacement, or making good is of such a character that it may affect the efficiency of the System, the Purchaser may give the Supplier notice requiring that tests of the defective part be made by the Supplier immediately upon completion of such remedial work, whereupon the Supplier shall carry out such tests.

If such part fails the tests, the Supplier shall carry out further repair, replacement, or making good (as the case may be) until that part of the System passes such tests. The tests shall be agreed upon by the Purchaser and the Supplier.

29.10 If the Supplier fails to commence the work necessary to remedy such defect or any damage to the System caused by such defect within the time period specified in the SCC, the Purchaser may, following notice to the Supplier, proceed to do such work or contract a third party (or parties) to do such work, and the reasonable costs incurred by the Purchaser in connection with such work shall be paid to the Purchaser by the Supplier or may be deducted by the Purchaser from any monies due the Supplier or claimed under the Performance Security.

29.11 If the System or Subsystem cannot be used by reason of such defect and/or making good of such defect, the Warranty Period for the System shall be extended by a period equal to the period during which the System or Subsystem could not be used by the Purchaser because of such defect and/or making good of such defect.

29.12 Items substituted for defective parts of the System during the Warranty Period shall be covered by the Defect Liability Warranty for the remainder of the Warranty Period applicable for the part replaced or three (3) months,

whichever is greater.

29.13 At the request of the Purchaser and without prejudice to any other rights and remedies that the Purchaser may have against the Supplier under the Contract, the Supplier will offer all possible assistance to the Purchaser to seek warranty services or remedial action from any subcontracted third-party producers or licensor of Goods included in the System, including without limitation assignment or transfer in favor of the Purchaser of the benefit of any warranties given by such producers or licensors to the Supplier.

**30. Functional Guarantees**

30.1 The Supplier guarantees that, once the Operational Acceptance Certificate(s) has been issued, the System represents a complete, integrated solution to the Purchaser's requirements set forth in the Technical Requirements and it conforms to all other aspects of the Contract. The Supplier acknowledges that GCC Clause 27 regarding Commissioning and Operational Acceptance governs how technical conformance of the System to the Contract requirements will be determined.

30.2 Year 2000 Compliance. Subject to provisions to the contrary in the SCC, the Supplier represents and warrants that the Information Technologies being acquired pursuant to this Contract are designed to be used prior to, during, and after the calendar year 2000 A.D. ("Year 2000").

30.3 If, for reasons attributable to the Supplier, the System does not conform to the Technical Requirements or does not conform to all other aspects of the Contract, the Supplier shall at its cost and expense make such changes, modifications, and/or additions to the System as may be necessary to conform to the Technical Requirements and meet all functional and performance standards. The Supplier shall notify the Purchaser upon completion of the necessary changes, modifications, and/or additions and shall request the Purchaser to repeat the Operational Acceptance Tests until the System achieves Operational Acceptance.

30.4 If the System (or Subsystem[s]) fails to achieve Operational Acceptance, the Purchaser may consider termination of the Contract, pursuant to GCC Clause 41.2.2, and forfeiture of the Supplier's performance security in accordance with GCC Clause 13.3 in compensation for the extra costs and delays likely to result from this failure.

**31. Intellectual Property Rights**

31.1 The Supplier hereby represents and warrants that:





**Warranty**

(a) the System as supplied, installed, tested, and accepted;

(b) use of the System in accordance with the Contract; and

(c) copying of the Software and Materials provided to the Purchaser in accordance with the Contract

do not and will not infringe any Intellectual Property Rights held by any third party and that it has all necessary rights or at its sole expense shall have secured in writing all transfers of rights and other consents necessary to make the assignments, licenses, and other transfers of Intellectual Property Rights and the warranties set forth in the Contract, and for the Purchaser to own or exercise all Intellectual Property Rights as provided in the Contract. Without limitation, the Supplier shall secure all necessary written agreements, consents, and transfers of rights from its employees and other persons or entities whose services are used for development of the System.

**32. Intellectual Property Rights Indemnity**

32.1 The Supplier shall indemnify and hold harmless the Purchaser and its employees and officers from and against any and all losses, liabilities, and costs (including losses, liabilities, and costs incurred in defending a claim alleging such a liability), that the Purchaser or its employees or officers may suffer as a result of any infringement or alleged infringement of any Intellectual Property Rights by reason of:

(a) installation of the System by the Supplier or the use of the System, including the Materials, in the country where the site is located;

(b) copying of the Software and Materials provided the Supplier in accordance with the Agreement; and

(c) sale of the products produced by the System in any country, except to the extent that such losses, liabilities, and costs arise as a result of the Purchaser's breach of GCC Clause 32.2.

32.2 Such indemnity shall not cover any use of the System, including the Materials, other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the System, or any

products of the System produced thereby in association or combination with any other goods or services not supplied by the Supplier, where the infringement arises because of such association or combination and not because of use of the System in its own right.

32.3 Such indemnities shall also not apply if any claim of infringement:

(a) is asserted by a parent, subsidiary, or affiliate of the Purchaser's organization;

(b) is a direct result of a design mandated by the Purchaser's Technical Requirements and the possibility of such infringement was duly noted in the Supplier's Bid; or

(c) results from the alteration of the System, including the Materials, by the Purchaser or any persons other than the Supplier or a person authorized by the Supplier.

32.4 If any proceedings are brought or any claim is made against the Purchaser arising out of the matters referred to in GCC Clause 32.1, the Purchaser shall promptly give the Supplier notice of such proceedings or claims, and the Supplier may at its own expense and in the Purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Supplier fails to notify the Purchaser within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Purchaser shall be free to conduct the same on its own behalf. Unless the Supplier has so failed to notify the Purchaser within the twenty-eight (28) days, the Purchaser shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Purchaser shall, at the Supplier's request, afford all available assistance to the Supplier in conducting such proceedings or claim and shall be reimbursed by the Supplier for all reasonable expenses incurred in so doing.

32.5 The Purchaser shall indemnify and hold harmless the Supplier and its employees, officers, and Subcontractors from and against any and all losses, liabilities, and costs (including losses, liabilities, and costs incurred in defending a claim alleging such a liability) that the Supplier or its employees, officers, or Subcontractors may suffer as a result





of any infringement or alleged infringement of any Intellectual Property Rights arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided to the Supplier in connection with this Contract by the Purchaser or any persons (other than the Supplier) contracted by the Purchaser, except to the extent that such losses, liabilities, and costs arise as a result of the Supplier's breach of GCC Clause 32.8.

32.6 Such indemnity shall not cover any use of the design, data, drawing, specification, or other documents or materials, other than for the purpose indicated by or to be reasonably inferred from the Contract, or any infringement resulting from the use of the design, data, drawing, specification, or other documents or materials, or any products produced thereby, in association or combination with any other Goods or Services not provided by the Purchaser or any other person contacted by the Purchaser, where the infringement arises because of such association or combination and not because of the use of the design, data, drawing, specification, or other documents or materials in its own right.

32.7 Such indemnities shall also not apply:

(a) if any claim of infringement is asserted by a parent, subsidiary, or affiliate of the Supplier's organization;

(b) to the extent that any claim of infringement caused by the alteration, by the Supplier, or any persons contracted by the Supplier, of the design, data, drawing, specification, or other documents or materials provided to the Supplier by the Purchaser or any persons contracted by the Purchaser.

32.8 If any proceedings are brought or any claim is made against the Supplier arising out of the matters referred to in GCC Clause 32.5, the Supplier shall promptly give the Purchaser notice of such proceedings or claims, and the Purchaser may at its own expense and in the Supplier's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Purchaser fails to notify the Supplier within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Supplier shall be free to

conduct the same on its own behalf. Unless the Purchaser has so failed to notify the Supplier within the twenty-eight (28) days, the Supplier shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Supplier shall, at the Purchaser's request, afford all available assistance to the Purchaser in conducting such proceedings or claim and shall be reimbursed by the Purchaser for all reasonable expenses incurred in so doing.

**33. Limitation of Liability**

33.1 Provided the following does not exclude or limit any liabilities of either party in ways not permitted by applicable law:

(a) the Supplier shall not be liable to the Purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Supplier to pay liquidated damages to the Purchaser; and

(b) the aggregate liability of the Supplier to the Purchaser, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to any obligation of the Supplier to indemnify the Purchaser with respect to patent infringement.

33.2 Notwithstanding GCC Clause 33.1, the parties shall accept all liability without limit for death or personal injury resulting from negligence, fraud or deceit, and any other liabilities that may not be excluded or limited by applicable law.

## G. Risk Distribution

**34. Transfer of Ownership**

34.1 With the exception of Software and Materials, the ownership of the Information Technologies and other Goods shall be transferred to the Purchaser at the time of Delivery or otherwise under terms that may be agreed upon and specified in the Contract Agreement.





34.2 Ownership and the terms of usage of the Software and Materials supplied under the Contract shall be governed by GCC Clause 15 (Copyright), the corresponding SCC, and any elaboration in the Technical Requirements.

34.3 Ownership of the Supplier's Equipment used by the Supplier and its Subcontractors in connection with the Contract shall remain with the Supplier or its Subcontractors.

**35. Care of the System**

35.1 The Purchaser shall become responsible for the care and custody of the System or Subsystems upon their Delivery. The Purchaser shall make good at its own cost any loss or damage that may occur to the System or Subsystems from any cause from the date of Delivery until the date of Operational Acceptance of the System or Subsystems, pursuant to GCC Clause 27 (Commissioning and Operational Acceptance), excepting such loss or damage arising from acts or omissions of the Supplier, its employees, or subcontractors.

35.2 If any loss or damage occurs to the System or any part of the System by reason of:

(a) (insofar as they relate to the country where the Project Site is located) nuclear reaction, nuclear radiation, radioactive contamination, a pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance taken out under GCC Clause 37;

(b) any use not in accordance with the Contract, by the Purchaser or any third party ;

(c) any use of or reliance upon any design, data, or specification provided or designated by or on behalf of the Purchaser, or any such matter for which the Supplier has disclaimed responsibility in accordance with GCC Clause 21.1.2,

the Purchaser shall pay to the Supplier all sums payable in respect of the System or Subsystems that have achieved Operational Acceptance, notwithstanding that the same be lost, destroyed, or damaged. If the Purchaser requests the Supplier in writing to make good any loss or damage to the System thereby occasioned, the Supplier shall make good the

same at the cost of the Purchaser in accordance with GCC Clause 39. If the Purchaser does not request the Supplier in writing to make good any loss or damage to the System thereby occasioned, the Purchaser shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the System thereby lost, destroyed, or damaged, or, where the loss or damage affects a substantial part of the System, the Purchaser shall terminate the Contract pursuant to GCC Clause 41.1.

35.3 The Purchaser shall be liable for any loss of or damage to any Supplier's Equipment which the Purchaser has authorized to locate within the Purchaser's premises for use in fulfillment of Supplier's obligations under the Contract, except where such loss or damage arises from acts or omissions of the Supplier, its employees, or subcontractors.

**36. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification**

36.1 The Supplier and each and every Subcontractor shall abide by the job safety, insurance, customs, and immigration measures prevalent and laws in force in the Purchaser's Country.

36.2 Subject to GCC Clause 36.3, the Supplier shall indemnify and hold harmless the Purchaser and its employees and officers from and against any and all losses, liabilities and costs (including losses, liabilities, and costs incurred in defending a claim alleging such a liability) that the Purchaser or its employees or officers may suffer as a result of the death or injury of any person or loss of or damage to any property (other than the System, whether accepted or not) arising in connection with the supply, installation, testing, and Commissioning of the System and by reason of the negligence of the Supplier or its Subcontractors, or their employees, officers or agents, except any injury, death, or property damage caused by the negligence of the Purchaser, its contractors, employees, officers, or agents.

36.3 If any proceedings are brought or any claim is made against the Purchaser that might subject the Supplier to liability under GCC Clause 36.2, the Purchaser shall promptly give the Supplier notice of such proceedings or claims, and the Supplier may at its own expense and in the Purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Supplier fails to notify the Purchaser within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Purchaser





shall be free to conduct the same on its own behalf. Unless the Supplier has so failed to notify the Purchaser within the twenty-eight (28) day period, the Purchaser shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Purchaser shall, at the Supplier's request, afford all available assistance to the Supplier in conducting such proceedings or claim and shall be reimbursed by the Supplier for all reasonable expenses incurred in so doing.

36.4 The Purchaser shall indemnify and hold harmless the Supplier and its employees, officers, and Subcontractors from any and all losses, liabilities, and costs (including losses, liabilities, and costs incurred in defending a claim alleging such a liability) that the Supplier or its employees, officers, or Subcontractors may suffer as a result of the death or personal injury of any person or loss of or damage to property of the Purchaser, other than the System not yet achieving Operational Acceptance, that is caused by fire, explosion, or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 37 (Insurances), provided that such fire, explosion, or other perils were not caused by any act or failure of the Supplier.

36.5 If any proceedings are brought or any claim is made against the Supplier that might subject the Purchaser to liability under GCC Clause 36.4, the Supplier shall promptly give the Purchaser notice of such proceedings or claims, and the Purchaser may at its own expense and in the Supplier's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Purchaser fails to notify the Supplier within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Supplier shall be free to conduct the same on its own behalf. Unless the Purchaser has so failed to notify the Supplier within the twenty-eight (28) days, the Supplier shall make no admission that may be prejudicial to the defense of any such proceedings or claim. The Supplier shall, at the Purchaser's request, afford all available assistance to the Purchaser in conducting such proceedings or claim and shall be reimbursed by the Purchaser for all reasonable expenses incurred in so doing.

36.6 The party entitled to the benefit of an indemnity under this GCC Clause 36 shall take all reasonable measures to mitigate any loss or damage that has occurred. If the party

fails to take such measures, the other party's liabilities shall be correspondingly reduced.

**37. Insurances**

37.1 The Supplier shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurance set forth below. The identity of the insurers and the form of the policies shall be subject to the approval of the Purchaser, who should not unreasonably withhold such approval.

(a) Cargo Insurance During Transport

as applicable, 110 percent of the price of the Information Technologies and other Goods in a freely convertible currency, covering the Goods from physical loss or damage during shipment through receipt at the Project Site.

(b) Installation "All Risks" Insurance

as applicable, 110 percent of the price of the Information Technologies and other Goods covering the Goods at the site from all risks of physical loss or damage (excluding only perils commonly excluded under "all risks" insurance policies of this type by reputable insurers) occurring prior to Operational Acceptance of the System.

(c) Third-Party Liability Insurance

On terms as specified in the SCC, covering bodily injury or death suffered by third parties (including the Purchaser's personnel) and loss of or damage to property (including the Purchaser's property and any Subsystems that have been accepted by the Purchaser) occurring in connection with the supply and installation of the Information System.

(d) Automobile Liability Insurance

In accordance with the statutory requirements prevailing in the Purchaser's Country, covering use of all vehicles used by the Supplier or its Subcontractors (whether or not owned by them) in connection with the execution of the Contract.

(e) Other Insurance (if any),





as specified in the SCC.

37.2 The Purchaser shall be named as co-insured under all insurance policies taken out by the Supplier pursuant to GCC Clause 37.1, except for the Third-Party Liability, and the Supplier's Subcontractors shall be named as co-insured under all insurance policies taken out by the Supplier pursuant to GCC Clause 37.1 except for Cargo Insurance During Transport. All insurer's rights of subrogation against such co-insured for losses or claims arising out of the performance of the Contract shall be waived under such policies.

37.3 The Supplier shall deliver to the Purchaser certificates of insurance (or copies of the insurance policies) as evidence that the required policies are in full force and effect.

37.4 The Supplier shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Supplier.

37.5 If the Supplier fails to take out and/or maintain in effect the insurance referred to in GCC Clause 37.1, the Purchaser may take out and maintain in effect any such insurance and may from time to time deduct from any amount due the Supplier under the Contract any premium that the Purchaser shall have paid to the insurer or may otherwise recover such amount as a debt due from the Supplier.

37.6 Unless otherwise provided in the Contract, the Supplier shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 37, and all monies payable by any insurers shall be paid to the Supplier. The Purchaser shall give to the Supplier all such reasonable assistance as may be required by the Supplier in connection with any claim under the relevant insurance policies. With respect to insurance claims in which the Purchaser's interest is involved, the Supplier shall not give any release or make any compromise with the insurer without the prior written consent of the Purchaser. With respect to insurance claims in which the Supplier's interest is involved, the Purchaser shall not give any release or make any compromise with the insurer without the prior written consent of the Supplier.

**38. Force Majeure**

38.1 "Force Majeure" shall mean any event beyond the reasonable control of the Purchaser or of the Supplier, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected and shall include, without limitation, the following:

(a) war, hostilities, or warlike operations (whether a state of war be declared or not), invasion, act of foreign enemy, and civil war;

(b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion, and terrorist acts;

(c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler, or any other act or failure to act of any local state or national government authority;

(d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine, and plague;

(e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves, or other natural or physical disaster;

(f) failure, by the Supplier, to obtain the necessary export permit(s) from the governments of the Country(s) of Origin of the Information Technologies or other Goods, or Supplier's Equipment provided that the Supplier has made all reasonable efforts to obtain the required export permit(s), including the exercise of due diligence in determining the eligibility of the System and all of its components for receipt of the necessary export permits.

38.2 If either party is prevented, hindered, or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances of the event of Force Majeure within fourteen





(14) days after the occurrence of such event.

38.3 The party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such party's performance is prevented, hindered, or delayed. The Time for Achieving Operational Acceptance shall be extended in accordance with GCC Clause 40 (Extension of Time for Achieving Operational Acceptance).

38.4 The party or parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect of the event of Force Majeure upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either party's right to terminate the Contract under GCC Clause 38.6.

38.5 No delay or nonperformance by either party to this Contract caused by the occurrence of any event of Force Majeure shall:

(a) constitute a default or breach of the Contract;

(b) (subject to GCC Clauses 35.2, 38.3, and 38.4) give rise to any claim for damages or additional cost or expense occasioned by the delay or nonperformance;

if, and to the extent that, such delay or nonperformance is caused by the occurrence of an event of Force Majeure.

38.6 If the performance of the Contract is substantially prevented, hindered, or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the time period covered by the Contract, the parties will attempt to develop a mutually satisfactory solution, failing which, either party may terminate the Contract by giving a notice to the other.

38.7 In the event of termination pursuant to GCC Clause 38.6, the rights and obligations of the Purchaser and the Supplier shall be as specified in GCC Clauses 41.1.2 and 41.1.3.

38.8 Notwithstanding GCC Clause 38.5, Force Majeure shall not apply to any obligation of the Purchaser to make payments to the Supplier under this Contract.

## H. CHANGE IN CONTRACT ELEMENTS

**39. Changes to the System**

39.1 Introducing a Change

39.1.1 Subject to GCC Clauses 39.2.5 and 39.2.7, the Purchaser shall have the right to propose, and subsequently require, the Project Manager to order the Supplier from time to time during the performance of the Contract to make any change, modification, addition, or deletion to, in, or from the System (interchangeably called "Change"), provided that such Change falls within the general scope of the System, does not constitute unrelated work, and is technically practicable, taking into account both the state of advancement of the System and the technical compatibility of the Change envisaged with the nature of the System as originally specified in the Contract.

A Change may involve, but is not restricted to, the substitution of updated Information Technologies and related Services in accordance with GCC Clause 23 (Product Upgrades).

39.1.2 The Supplier may from time to time during its performance of the Contract propose to the Purchaser (with a copy to the Project Manager) any Change that the Supplier considers necessary or desirable to improve the quality or efficiency of the System. The Purchaser may at its discretion approve or reject any Change proposed by the Supplier.

39.1.3 Notwithstanding GCC Clauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Supplier in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Achieving Operational Acceptance.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Clauses 39.2 and 39.3, and further details and sample forms are provided in the Sample Forms Section in the Bidding





Documents.

39.1.5 Moreover, the Purchaser and Supplier will agree, during development of the Project Plan, to a date prior to the scheduled date for Operational Acceptance, after which the Technical Requirements for the System shall be "frozen." Any Change initiated after this time will be dealt with after Operational Acceptance.

39.2 Changes Originating from Purchaser

39.2.1 If the Purchaser proposes a Change pursuant to GCC Clauses 39.1.1, it shall send to the Supplier a "Request for Change Proposal," requiring the Supplier to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following:

(a) brief description of the Change;

(b) impact on the Time for Achieving Operational Acceptance;

(c) estimated cost of the Change;

(d) effect on Functional Guarantees (if any);

(e) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the "Change Proposal," the Supplier shall submit to the Project Manager an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal. Upon receipt of the Supplier's Estimate for Change Proposal, the Purchaser shall do one of the following:

(a) accept the Supplier's estimate with instructions to the Supplier to proceed with the preparation of the Change Proposal;

(b) advise the Supplier of any part of its Estimate for Change Proposal that is unacceptable and request the Supplier to review its estimate;

(c) advise the Supplier that the Purchaser does not

intend to proceed with the Change.

39.2.3 Upon receipt of the Purchaser's instruction to proceed under GCC Paragraph 39.2.2 (a), the Supplier shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Clause 39.2.1. The Supplier, at its discretion, may specify a validity period for the Change Proposal, after which if the Purchaser and Supplier has not reached agreement in accordance with GCC Clause 39.2.6, then GCC Clause 29.2.7 shall apply.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If the nature of the Change is such that the Contract rates and prices are inequitable, the parties to the Contract shall agree on other specific rates to be used for valuing the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate impact of compliance with the Request for Change Proposal and with all other Change Orders that have already become binding upon the Supplier under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen (15) percent, the Supplier may give a written notice of objection to this Request for Change Proposal prior to furnishing the Change Proposal. If the Purchaser accepts the Supplier's objection, the Purchaser shall withdraw the proposed Change and shall notify the Supplier in writing of its acceptance.

The Supplier's failure to so object to a Request for Change Proposal shall neither affect its right to object to any subsequent requested Changes or Change Orders, nor affect its right to take into account, when making such subsequent objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Supplier represents.

39.2.6 Upon receipt of the Change Proposal, the Purchaser





and the Supplier shall mutually agree upon all matters contained in the Change Proposal. Within fourteen (14) days after such agreement, the Purchaser shall, if it intends to proceed with the Change, issue the Supplier a Change Order. If the Purchaser is unable to reach a decision within fourteen (14) days, it shall notify the Supplier with details of when the Supplier can expect a decision. If the Purchaser decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Supplier accordingly. Under such circumstances, the Supplier shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Supplier in its Estimate for Change Proposal submitted in accordance with GCC Clause 39.2.2.

39.2.7 If the Purchaser and the Supplier cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Achieving Operational Acceptance, or any other matters identified in the Change Proposal, the Change will not be implemented. However, this provision does not limit the rights of either party under GCC Clause 6 (Settlement of Disputes).

39.3 Changes Originating from Supplier

39.3.1 If the Supplier proposes a Change pursuant to GCC Clause 39.1.2, the Supplier shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Clause 39.2.1. Upon receipt of the Application for Change Proposal, the parties shall follow the procedures outlined in GCC Clauses 39.2.6 and 39.2.7, except that the words "Change Proposal" shall be read, for the purposes of this GCC Clause 39.3.1 as "Application for Change Proposal." However, should the Purchaser choose not to proceed or the Purchaser and the Supplier cannot come to agreement on the change during any validity period that the Supplier may specify in its Application for Change Proposal, the Supplier shall not be entitled to recover the costs of preparing the

Application for Change Proposal, unless subject to an agreement between the Purchaser and the Supplier to the contrary.

**40. Extension of Time for Achieving Operational Acceptance**

40.1 The time(s) for achieving Operational Acceptance specified in the Schedule of Implementation shall be extended if the Supplier is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

(a) any Change in the System as provided in GCC Clause 39 (Change in the Information System);
(b) any occurrence of Force Majeure as provided in GCC Clause 38 (Force Majeure);
(c) default of the Purchaser; or
(d) any other matter specifically mentioned in the Contract;

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Supplier.

40.2 Except where otherwise specifically provided in the Contract, the Supplier shall submit to the Project Manager a notice of a claim for an extension of the time for achieving Operational Acceptance, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Purchaser and the Supplier shall agree upon the period of such extension. In the event that the Supplier does not accept the Purchaser's estimate of a fair and reasonable time extension, the Supplier shall be entitled to refer the matter to an Adjudicator, pursuant to GCC Clause 6.2 (Arbitration).

40.3 The Supplier shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

**41. Termination**

41.1 Termination for Purchaser's Convenience

41.1.1 The Purchaser may at any time terminate the Contract for any reason by giving the Supplier a notice of termination that refers to this GCC Clause 41.1.

41.1.2 Upon receipt of the notice of termination under GCC Clause 41.1.1, the Supplier shall either as soon as reasonably practical or upon the date specified in the





notice of termination

(a) cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the System already executed, or any work required to leave the site in a clean and safe condition;

(b) terminate all subcontracts, except those to be assigned to the Purchaser pursuant to Sub-Paragraph 41.1.2 (d) (ii) below;

(c) remove all Supplier's Equipment from the site, repatriate the Supplier's and its Subcontractors' personnel from the site, remove from the site any wreckage, rubbish, and debris of any kind;

(d) in addition, the Supplier, subject to the payment specified in GCC Clause 41.1.3, shall

(i) deliver to the Purchaser the parts of the System executed by the Supplier up to the date of termination;

(ii) to the extent legally possible, assign to the Purchaser all right, title, and benefit of the Supplier to the System, or Subsystem, as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Supplier and its Subcontractors;

(iii) deliver to the Purchaser all nonproprietary drawings, specifications, and other documents prepared by the Supplier or its Subcontractors as of the date of termination in connection with the System.

41.1.3 In the event of termination of the Contract under GCC Clause 41.1.1, the Purchaser shall pay to the Supplier the following amounts:

(a) the Contract Price, properly attributable to the parts of the System executed by the Supplier as of the date of termination;

(b) the costs reasonably incurred by the Supplier in

the removal of the Supplier's Equipment from the site and in the repatriation of the Supplier's and its Subcontractors' personnel;

(c) any amount to be paid by the Supplier to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges;

(d) costs incurred by the Supplier in protecting the System and leaving the site in a clean and safe condition pursuant to GCC Clause 41.1.2 (a); and

(e) the cost of satisfying all other obligations, commitments, and claims that the Supplier may in good faith have undertaken with third parties

in connection with the Contract and that are not covered by Paragraphs 41.1.3 (a) through (d) above.

41.2 Termination for Supplier's Default

41.2.1 The Purchaser, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefor to the Supplier, referring to this GCC Clause 41.2:

(a) if the Supplier becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Supplier is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Supplier takes or suffers any other analogous action in consequence of debt;

(b) if the Supplier assigns or transfers the Contract or any right or interest therein in violation of the





provision of GCC Clause 42 (Assignment); or

(c) if the Supplier, in the judgment of the Purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the Contract, including but not limited to willful misrepresentation of facts concerning ownership of Intellectual Property Rights in, or proper authorization and/or licenses from the owner to offer, the hardware, software, or materials provided under this Contract.

For the purposes of this Clause:

"corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution.

"fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Purchaser, and includes collusive practices among Bidders (prior to or after bid submission) designed to establish bid prices at artificial noncompetitive levels and to deprive the Purchaser of the benefits of free and open competition.

41.2.2 If the Supplier:

(a) has abandoned or repudiated the Contract;

(b) has without valid reason failed to commence work on the System promptly;

(c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause;

(d) refuses or is unable to provide sufficient Materials, Services, or labor to execute and complete the System in the manner specified in the Agreed and Finalized Project Plan furnished under GCC Clause 19 at rates of progress that give reasonable assurance to the Purchaser that the Supplier can attain Operational Acceptance of the System by the Time for Achieving

Operational Acceptance as extended;

then the Purchaser may, without prejudice to any other rights it may possess under the Contract, give a notice to the Supplier stating the nature of the default and requiring the Supplier to remedy the same. If the Supplier fails to remedy or to take steps to remedy the same within fourteen (14) days of its receipt of such notice, then the Purchaser may terminate the Contract forthwith by giving a notice of termination to the Supplier that refers to this GCC Clause 41.2.

41.2.3 Upon receipt of the notice of termination under GCC Clauses 41.2.1 or 41.2.2, the Supplier shall, either immediately or upon such date as is specified in the notice of termination:

(a) cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the System already executed or any work required to leave the site in a clean and safe condition;

(b) terminate all subcontracts, except those to be assigned to the Purchaser pursuant to Paragraph 41.2.3 (d) below;

(c) deliver to the Purchaser the parts of the System executed by the Supplier up to the date of termination;

(d) to the extent legally possible, assign to the Purchaser all right, title and benefit of the Supplier to the System or Subsystems as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Supplier and its Subcontractors;

(e) deliver to the Purchaser all drawings, specifications, and other documents prepared by the Supplier or its Subcontractors as at the date of termination in connection with the System.

41.2.4 The Purchaser may enter upon the site, expel the Supplier, and complete the System itself or by employing any third party. Upon completion of the





System or at such earlier date as the Purchaser thinks appropriate, the Purchaser shall give notice to the Supplier that such Supplier's Equipment will be returned to the Supplier at or near the site and shall return such Supplier's Equipment to the Supplier in accordance with such notice. The Supplier shall thereafter without delay and at its cost remove or arrange removal of the same from the site.

41.2.5 Subject to GCC Clause 41.2.6, the Supplier shall be entitled to be paid the Contract Price attributable to the portion of the System executed as at the date of termination and the costs, if any, incurred in protecting the System and in leaving the site in a clean and safe condition pursuant to GCC Clause 41.2.3 (a). Any sums due the Purchaser from the Supplier accruing prior to the date of termination shall be deducted from the amount to be paid to the Supplier under this Contract.

41.2.6 If the Purchaser completes the System, the cost of completing the System by the Purchaser shall be determined. If the sum that the Supplier is entitled to be paid, pursuant to GCC Clause 41.2.5, plus the reasonable costs incurred by the Purchaser in completing the System, exceeds the Contract Price, the Supplier shall be liable for such excess. If such excess is greater than the sums due the Supplier under GCC Clause 41.2.5, the Supplier shall pay the balance to the Purchaser, and if such excess is less than the sums due the Supplier under GCC Clause 41.2.5, the Purchaser shall pay the balance to the Supplier. The Purchaser and the Supplier shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

41.3 Termination by Supplier

41.3.1 If:

(a) the Purchaser has failed to pay the Supplier any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the SCC, or commits a substantial

breach of the Contract, the Supplier may give a notice to the Purchaser that requires payment of such sum, with interest on this sum as stipulated in GCC Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Purchaser to remedy the same, as the case may be. If the Purchaser fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Supplier's notice; or

(b) the Supplier is unable to carry out any of its obligations under the Contract for any reason attributable to the Purchaser, including but not limited to the Purchaser's failure to provide possession of or access to the site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the System;

then the Supplier may give a notice to the Purchaser of such events, and if the Purchaser has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within twenty-eight (28) days of such notice, or if the Supplier is still unable to carry out any of its obligations under the Contract for any reason attributable to the Purchaser within twenty-eight (28) days of the said notice, the Supplier may by a further notice to the Purchaser referring to this GCC Clause 41.3.1, forthwith terminate the Contract.

41.3.2 The Supplier may terminate the Contract immediately by giving a notice to the Purchaser to that effect, referring to this GCC Clause 41.3.2, if the Purchaser becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Purchaser takes or suffers any other





analogous action in consequence of debt.

41.3.3 If the Contract is terminated under GCC Clauses 41.3.1 or 41.3.2, then the Supplier shall immediately:

(a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the System already executed, or any work required to leave the site in a clean and safe condition;

(b) terminate all subcontracts, except those to be assigned to the Purchaser pursuant to Clause 41.3.3 (d) (ii);

(c) remove all Supplier's Equipment from the site and repatriate the Supplier's and its Subcontractor's personnel from the site.

(d) In addition, the Supplier, subject to the payment specified in GCC Clause 41.3.4, shall:

(i) deliver to the Purchaser the parts of the System executed by the Supplier up to the date of termination;

(ii) to the extent legally possible, assign to the Purchaser all right, title, and benefit of the Supplier to the System, or Subsystems, as of the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Supplier and its Subcontractors;

(iii) to the extent legally possible, deliver to the Purchaser all drawings, specifications, and other documents prepared by the Supplier or its Subcontractors as of the date of termination in connection with the System.

41.3.4 If the Contract is terminated under GCC Clauses 41.3.1 or 41.3.2, the Purchaser shall pay to the Supplier all payments specified in GCC Clause 41.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the Supplier arising out of, in connection with, or in

consequence of such termination.

41.3.5 Termination by the Supplier pursuant to this GCC Clause 41.3 is without prejudice to any other rights or remedies of the Supplier that may be exercised in lieu of or in addition to rights conferred by GCC Clause 41.3.

41.4 In this GCC Clause 41, the expression "portion of the System executed" shall include all work executed, Services provided, and all Information Technologies, or other Goods acquired (or subject to a legally binding obligation to purchase) by the Supplier and used or intended to be used for the purpose of the System, up to and including the date of termination.

41.5 In this GCC Clause 41, in calculating any monies due from the Purchaser to the Supplier, account shall be taken of any sum previously paid by the Purchaser to the Supplier under the Contract, including any advance payment paid pursuant to the SCC.

**42. Assignment**

42.1 Neither the Purchaser nor the Supplier shall, without the express prior written consent of the other, assign to any third party the Contract or any part thereof, or any right, benefit, obligation, or interest therein or thereunder, except that the Supplier shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.





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# Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions of the SCC shall prevail over those in the General Conditions of Contract. For the purposes of clarity, any referenced GCC clause numbers are indicated in the left column of the SCC.
The term "Technical Requirement" when used below refers to the Interim Market Management System (IMMS), and the Final Market Management System where appropriate.

## A. CONTRACT AND INTERPRETATION

### 1. Definitions (GCC Clause 1)

| | |
|---|---|
| GCC 1.1 (a) (vi) | "Technical Requirements" means Volume III of the Bidding Documents |
| GCC 1.1 (a) (ix) | The applicable edition of the World Bank Guidelines: Procurement under IBRD Loans and IDA Credits is dated: Supply and Installation of Information Systems: Single Stage bidding, February 1999, Revised Trial Version 2c – October 2001 (released in November 2001).. |
| GCC 1.1 (b) (i) | The Purchaser is:<br>National Power Corporation (NPC) |
| GCC 1.1 (b) (ii) | The Project Manager is:<br>Mr. Rizalino G. Santos |
| Add to GCC 1.1 (b) | Add The term "Contractor" :<br>" Contractor" is the same as "Supplier". |
| Add to GCC 1.1(b) | Add the term "Contractor's Project Manager" :<br>" Contractor's Project Manager" is the same as " Supplier's Representative". |
| Add to GCC 1.1 ( c ) | Add the term "System Commissioning Tests":<br>" System Commissioning Tests" are the tests conducted in conjunction with the commissioning of the system, as specified in Section 10.5 of Volume III of Bidding Document. |
| Add to GCC 1.1 ( c ) | Add the term "Project Schedule":<br>"Project Schedule" is the same as Project Plan. |
| GCC 1.1 (d) (ii) | Installation:<br>"Installation" means placing the System in the facility of the Market Operator (MO) and cabling and wiring it ready for start-up. |
| GCC 1.1 (d) (iv) | Commissioning:<br>"Commissioning" means system installation, start-up, integration with external systems and trading participants, and related testing, as specified in Section 10.5 of Volume III of Bidding Document. |
| GCC 1.1 (d) (v) | Operational Acceptance Tests:<br>"Operational Acceptance Tests" include both the Site Acceptance Test |





| | |
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| | and the Market dry run test, as specified in Section 10.5 of Volume III of Bidding Document. |
| GCC 1.1 (d) (vi) | " Operational Acceptance" is subject to the conditions of Section 11.5 of Volume III of Bidding Document. |
| GCC 1.1 (e) (i) | The Purchaser's Country is:<br>Philippines |
| GCC 1.1 (e) (iii) | The Project Site(s) is:<br>National Power Corporation<br>Market Operations Group<br>Quezon Avenue, Corner Aghan Road<br>Diliman, Quezon City 1104<br>Philippines |
| GCC 1.1 (e) (x) | The Contract shall continue in force until the Interim Market Management System (IMMS) and the Final Market Management System (MMS), if the option to purchase the MMS has been exercised, and all the Services have been provided unless the Contract is terminated earlier in accordance with the terms set out in the Contract. |
| GCC 1.1. (e) (xii) | The Post-Warranty Services Period is six months starting with the completion of the Warranty Period. |

### 2. Contract Documents (GCC Clause 2)

| | |
|---|---|
| GCC 2 | There are no Special Conditions of Contract applicable to GCC Clause 2. |

### 3. Interpretation (GCC Clause 3)

| | |
|---|---|
| GCC 3.1.1 | The language of the Contract, all correspondence and communications to be given, and all other documentation to be prepared and supplied under the Contract not otherwise specified in the Technical Requirements shall be English. |

### 4. Notices (GCC Clause 4)

| | |
|---|---|
| GCC 4.1 | Notices shall be addressed to: Mr. Rizalino G. Santos<br>Notices shall be delivered to the above named person at:<br>National Power Corporation<br>Market Operations Group<br>Quezon Avenue, Corner Aghan Road<br>Diliman, Quezon City 1104<br>Philippines<br><br>Tel. No. (632) 921-3449<br>Fax No: (632) 921-3328<br>e-mail address:<br>rgsantos@napocor.com.ph |

### 5. Governing Law (GCC Clause 5)

| | |
|---|---|
| GCC 5.1 | The Contract shall be interpreted in accordance with the laws of the: Philippines |

### 6. Settlement of Disputes (GCC Clause 6)

| | |
|---|---|
| GCC 6.1.4 | The Appointing Authority for the Adjudicator is: International Standards Organization (ISO) |
| GCC 6.2.3 (i) | The rules of procedure for arbitration proceedings are: "the UNCITRAL Conciliation Rules of 1980;" or "(a) for international conciliation or arbitration {under: ICC, UNCITRAL, or other rules } in the case of a dispute with a foreign supplier; and (b) for adjudication/arbitration in accordance with the law of the {Philippines} in the case of a dispute with a supplier who is a national in the Philippines. |
| GCC 6.2.3 (ii) | Arbitration proceedings shall be conducted in: Manila, Philippines |
| GCC 6.2.4 (i) | The rules of procedure for Arbitration are as specified above in connection with GCC Clause 6.2.3 (i). |
| GCC 6.2.4 (ii) | The Appointing Authority is as specified above in GCC Clause 6.1.4. |

## B. Subject Matter of Contract

### 7. Scope of the System (GCC Clause 7)

| | |
|---|---|
| GCC 7.3 | No recurrent cost items/services are included in the Contract.<br>The Supplier agrees to supply spare parts required for the operation and maintenance of the System, as stated below, for the two years beginning with Operational Acceptance. Moreover, the price of such spare parts shall be those specified in the spare parts price schedule submitted by the Supplier as part of its bid. These prices shall include the purchase price for such spare parts and other costs and expenses (including the Supplier's fees) relating to the supply of spare parts. |

### 8. Time for Commencement and Operational Acceptance (GCC Clause 8)

| | |
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| GCC 8.1 | The Supplier shall commence work on the System within a day from the Effective Date of the Contract. |
| GCC 8.2 | **Successfully achieving Factory Acceptance, System Delivery, and successful commissioning shall occur on or before:** |





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| | July 15, 2002 for the Interim MMS<br>September 15, 2003 for the (optional) Final MMS<br><br>**Operational Acceptance shall occur on or before:**<br><br>September 15, 2002 for the Interim MMS<br>December 15, 2003 for the (optional) Final MMS<br><br>Liquidated damages shall be assessed in case any one of these dates is not met. |

### 9. Supplier's Responsibilities (GCC Clause 9)

| | |
|---|---|
| GCC 9.9 | The following personnel of the Purchaser are "key personnel":<br><br>Mr. Rizalino G. Santos<br>Mr. Mario Pangilinan |

### 10. Purchaser's Responsibilities (GCC Clause 10)

| | |
|---|---|
| GCC 10.12 | The following personnel of the Supplier are "key personnel":<br>[These shall be determined at the time of contract finalization and recorded as an amendment to the contract.] |

## C. PAYMENT

### 11. Contract Price (GCC Clause 11)

| | |
|---|---|
| GCC 11.2 (c) | Adjustments to the Contract Price shall be as follows:<br>None |

### 12. Terms of Payment (GCC Clause 12)

| | |
|---|---|
| GCC 12.1 | Subject to the provisions of GCC Clause 12 (Terms of Payment), the Purchaser shall pay the Contract Price to the Supplier in the manner specified below.<br><br>Progress payments shall be made according to the schedule below. No milestone payment shall be made until all lower numbered milestones have been achieved.<br><br>1. Ten percent (10%) of the entire Contract Price, exclusive of all Recurrent Costs, shall be paid against receipt of a claim accompanied by the Advance Payment Security specified in GCC Clause 13.2.<br><br>2. Five percent (5%) of the price of the Contract when the submittal of Project Schedule and Documentation Plan, all Functional and Detailed Design Documents, the User Manuals and Test Documentation, the Maintenance Documents, and the Facilities and Installation Manuals to the Purchaser is completed.<br><br>3. Ten percent (10%) of the price of the Contract when all the documents required for Milestone 2 above are approved by the Purchaser. |





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| | 4. Twenty-five percent (25%) of the price of the Contract upon approval of successful completion of the Factory Acceptance Test and the delivery of the Contract.<br><br>5. Ten percent (10%) of the price of the Contract upon approval of successful completion of the Site Accetance Test<br><br>6. Thirty percent (30%) of the price of the Contract upon satisfactory completion of the the Contract, including the successful completion of the System Operational Test.<br><br>Final Payment: A final payment, which is equal to the price of the Contract less the sum of all progress payments paid by the Purchaser under this Agreement, shall be paid by the Purchaser to the Supplier within sixty (60) days of the satisfactory completion of the System Availability Test, the Final Acceptance by the Purchaser, and receipt by the purchaser of a proper final invoice. The final payment shall be made within thirty (30) days if Purchaser is satisfied by bond or otherwise that there are no outstanding third-party claims against the System. |
| GCC 12.3 | The Purchaser shall pay to the Supplier interest on the delayed payments at an annual rate of six percent (6%). |
| GCC 12.4 | For Goods and Services supplied from within the Purchaser's Country, the Purchaser will pay the Supplier in:<br>Philippines Pesos |
| GCC 12.5 | Payment for Goods and Services supplied from outside the Purchaser's Country shall be in the form of an irrevocable letter of credit. |

### 13. Securities (GCC Clause 13)

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|---|---|
| GCC 13.2 | The Supplier shall provide within twenty-eight (28) days of the notification of Contract award an Advance Payment Security in the amount and currency of the Advance Payment specified in SCC Clause 12 above. |
| GCC 13.3.1 | Performance Security shall be denominated in U.S. Dollars for an amount equal to eight percent (8%) of the Contract Price excluding any Recurrent Costs. |
| GCC 13.3.4 (b) | During the Warranty Period (i.e., after Operational Acceptance of the System), the Performance Security shall be reduced to one (1) percentage of the Contract Price, exclusive of the Recurrent Costs. |

### 14. Taxes and Duties (GCC Clause 14)

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| GCC 14 | Import Duties, as well as value added tax levied on the import of |

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| | supplies, equipment and tools to be permanently installed and used in the work under this Contract shall be paid by the Contractor, and the Employer shall verify that the imported supplies under the Contract arrived at the site, reimburse the Contractor the equal sum approximately thirty (30) days after the Employer receives notice and proof of payment in the form of receipts issued by government offices concerned. Taxes and duties, if paid in excess of the actual, shall be for the Contractor's account. Customs clearance shall be processed by the Contractor.<br><br>All local taxes, fees and duty stamps imposed by the Government of Philippines, on the Contractor or his employees shall be paid by the Contractor. The Employer will pay only the Value Added Tax (VAT) to be imposed on both goods and services, provided the Contractor shall submit the VAT Registration Certificate upon signing the Contract, and submit the Tax Invoice upon presenting the documents for each payment. **(To be reviewed by the Finance Department of NPC)** |

## D. INTELLECTUAL PROPERTY

### 15. Copyright (GCC Clause 15)

| | |
|---|---|
| GCC 15.3 | The Purchaser may assign, license, or otherwise voluntarily transfer its contractual rights to use the Standard Software or elements of the Standard Software, without the Supplier's prior written consent, under the following circumstances:<br><br>The software license and ownership rights for standard and application software shall conform to all details as specified and elaborated in Volume II: Technical Requirements of IMMS. |
| GCC 15.4 | The Purchaser's and Supplier's rights and obligations with respect to Custom Software or elements of the Custom Software are as follows:<br><br>The Supplier's rights in relation to the Custom Software may:<br><br>• Be limited to use in order to support the Purchaser; or<br><br>• Extend to commercial exploitation by relicensing to third-party customers.<br><br>If the Supplier's rights extend to commercial exploitation, they may be limited as follows:<br><br>• There may be an interim period, designed to protect the Purchaser's competitive edge, during which the Supplier is not permitted to exploit commercially; and/or |





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| | • The Supplier may be prohibited from licensing the Custom Software to certain categories of customer (for example, direct competitors of the Purchaser) or in certain territories (for example, the Philippines), either for a limited period or indefinitely.<br><br>The Purchaser's and Supplier's rights and obligations with respect to Custom Materials or elements of the Custom Materials are as follows: |
| GCC 15.5 | The supplier shall deposit in escrow the Source Software within 30 days of the expiration of the warranty. The software shall be capable of being used to generate the latest revision of executable code at the end of the warranty period. The code kept in escrow shall be delivered to the Purchaser if the Supplier goes out of business or ceases to support the System or parts of it for any reason. |

### 16. Software License Agreements (GCC Clause 16)

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|---|---|
| GCC 16.1 (a) (iii) | The Standard Software license shall be valid throughout the territory of the Philippines. |
| GCC 16.1 (a) (iv) | Use of the software shall be subject to the following additional restrictions:<br>None |
| GCC 16.1 (b) (ii) | The Software license shall permit the Software to be used or copied for use or transferred to a replacement computer. |
| GCC 16.1 (b) (vi) | The Software license shall permit the Software to be disclosed to and reproduced for use (including a valid sublicense) by:<br><br>Support service suppliers or their subcontractors, exclusively for such suppliers or subcontractors in the performance of support service contracts, subject to the same restrictions set forth in this Contract.<br><br>There shall be no license restriction on disclosure of interface specifications or details to all others, for the designated interface points of an "open system". |
| GCC 16.1 (b) (vii) | In addition to the persons specified in GCC Clause 16.1 (b) (vi), the Software may be disclosed to, and reproduced for use by:<br><br>No other persons, except for the designated interface points of an "open system" |
| GCC 16.2 | The Supplier's right to audit the Standard Software:<br><br>None |

### 17. Confidential Information (GCC Clause 17)

| | |
|---|---|
| GCC 17.1 | There are no modifications to the confidentiality terms expressed in GCC Clause 17.1. |
| GCC 17.3 | There are no modifications to the confidentiality terms expressed in GCC Clause 17.3. |
| GCC 17.6 | The provisions of this GCC Clause 17 shall survive the termination, for whatever reason, of the Contract for a period of ten (10) years. |

## E. Supply, Installation, Testing, Commissioning, and Acceptance of the System

### 18. Representatives (GCC Clause 18)

| | |
|---|---|
| GCC 18.1 | The Purchaser's Project Manager shall have the following additional powers and/or limitations to his or her authority to represent the Purchaser in matters relating to the Contract:<br>No additional powers or limitations. |
| GCC 18.2.2 | The Supplier's Representative shall have the following additional powers and / or limitations to his or her authority to represent the Supplier in matters relating to the Contract:<br>No additional powers or limitations. |

### 19. Project Plan (GCC Clause 19)

| | |
|---|---|
| GCC 19.1 | The project plan shall address:<br>(a)Project Organization and Management Plan<br>(b) Detailed Project Schedule, Project Milestones<br>(c) Factory Acceptance Test Plan<br>(d) Site Acceptance Test Plan<br>(e) Delivery and Installation Plan<br>(f) Training Plan and Schedule<br>(g) Precommissioning and Operational Acceptance Testing Plan<br>(h) Warranty Service Plan<br>(i) Task, Time, and Resource Schedules<br>(j) Post-Warranty Service Plan<br>(k) Technical Support Plan |





| | |
|---|---|
| | Further details regarding the required contents of each of the above chapters are contained in the Technical Requirements, included in Volume II: Technical Requirements for the Interim Market Management System (IMMS) and Volume III: Technical Requirements for the Final Market Management System (MMS). |
| GCC 19.2 | Within thirty (30) days from the effective date of the Contract, the Supplier shall present a Project Plan to the Purchaser. The Purchaser shall, within seven (7) days of receipt of the Project Plan, notify the Supplier of any respects in which it considers that the Project Plan does not adequately ensure that the proposed program of work, proposed methods, and/or proposed Information Technologies will satisfy the Technical Requirements and/or the SCC (in this Clause 19.2, "non-conformities"). The Supplier shall, within ten (10) days of receipt of such notification, correct the Project Plan and resubmit to the Purchaser. The Purchaser shall, within seven (7) days of resubmission of the Project Plan, notify the Supplier of any remaining non-conformities. This procedure shall be repeated as necessary until the Project Plan is free from non-conformities. When the Project Plan is free from non-conformities, the Purchaser shall provide approval in writing to the Supplier. This approved Project Plan ("the Agreed and Finalized Project Plan") shall be contractually binding on the Purchaser and the Supplier. |
| GCC 19.5 | The Supplier shall submit to the Purchaser monthly progress reports in accordance with the Technical Requirements. |

### 20. Subcontracting (GCC Clause 20)

| | |
|---|---|
| GCC 20 | There are no Special Conditions of Contract applicable to GCC Clause 20. |

### 21. Design and Engineering (GCC Clause 21)

| | |
|---|---|
| GCC 21.2 | The Contract shall be executed in accordance with the edition or the revised version of all referenced codes and standards current at the date as specified in the GCC. |
| GCC 21.3.1 | The Supplier shall prepare and furnish to the Project Manager the following documents for which the Supplier must obtain the Project Manager's approval before proceeding with work on the System or any Subsystem covered by the documents:<br>Documents specified in Section 9 of Volume III of Bidding Document. |

### 22. Procurement, Delivery, and Transport (GCC Clause 22)

| | |
|---|---|
| GCC 22.5 | The Supplier shall provide the Purchaser with shipping and other documents as specified in the GCC. |

### 23. Product Upgrades (GCC Clause 23)

| | |
|---|---|
| GCC 23.4 | The Supplier shall provide the Purchaser with all new versions, releases, and updates to all Standard Software during the first year of the Warranty Period, for free, as specified in the GCC. |

### 24. Implementation, Installation, and Other Services (GCC Clause 24)

| | |
|---|---|
| GCC 24 | There are no Special Conditions of Contract applicable to GCC Clause 24. |

### 25. Inspections and Tests (GCC Clause 25)

| | |
|---|---|
| GCC 25 | There are no special conditions of contract applicable to GCC Clause 25. |

### 26. Installation of the System (GCC Clause 26)

| | |
|---|---|
| GCC 26 | There are no special conditions of contract applicable to GCC Clause 26. |

### 27. Commissioning and Operational Acceptance (GCC Clause 27)

| | |
|---|---|
| GCC 27.2.1 | Operational Acceptance Testing shall be conducted in accordance with Availability Test of the Technical Requirements included in Volume II: Technical Requirements for the Interim Market Management System (IMMS) and Volume III: Technical Requirements for the Final Market Management System (MMS). |
| GCC 27.2.2 | This clause is deleted. |
| GCC 27.3.1(b) | This clause is deleted. |
| GCC 27.3.1(c) | This clause is deleted. |
| GCC 27.3.5(b) | This clause is deleted. |
| GCC 27.3.6 | This clause is deleted. |

## F. GUARANTEES AND LIABILITIES

### 28. Operational Acceptance Time Guarantee (GCC Clause 28)

| | |
|---|---|
| GCC 28.2 | Liquidated damages shall be assessed with a cap of 10% of the contract price, in case of nonperformance. |





| | |
|---|---|
| GCC 28.3 | Liquidated damages shall be assessed at USD 5,000/day. The maximum liquidated damages shall be 10% of the Contract Price in case of late contract completion or non-performance of systems. |

### 29. Defect Liability (GCC Clause 29)

| | |
|---|---|
| GCC 29.1 | For Software, exceptions or limitations to the Supplier's warranty obligations shall be as follows:<br>None |
| GCC 29.3 (iii) | The Supplier warrants that the following items have been released to the market for the following specific minimum time periods:<br><br>No specific minimum time requirements are established for this Contract other than that the Information Technologies must have been previously released to the market. |
| GCC 29.4 | The Warranty Period (N) shall begin from the date of Operational Acceptance of the System or subsystem and extend for:<br>12 months |
| GCC 29.10 | During the Warranty Period, the Supplier must commence the work necessary to remedy defects or damage within 24 hours for critical problems that seriously impact the Purchaser's operations, and within 4 days for non-critical problems. |

### 30. Functional Guarantees (GCC Clause 30)

| | |
|---|---|
| GCC 30 | The Supplier shall provide logistics and technical support for an operational audit by the Trading Participants and the Market Operator to ensure that the IMMS performs as per the technical requirements in Volume II(and MMS if the MMS option has been exercised), and the Supplier shall correct all discrepancies found in such audit at no additional cost. |

### 31. Intellectual Property Rights Warranty (GCC Clause 31)

| | |
|---|---|
| GCC 31 | There are no Special Conditions of Contract applicable to GCC Clause 31. |

### 32. Intellectual Property Rights Indemnity (GCC Clause 32)

| | |
|---|---|
| GCC 32 | There are no Special Conditions of Contract applicable to GCC Clause 32. |

### 33. Limitation of Liability (GCC Clause 33)

| | |
|---|---|
| GCC 33 | There are no Special Conditions of Contract applicable to GCC Clause 33. |

## G. Risk Distribution

### 34. Transfer of Ownership (GCC Clause 34)

| | |
|---|---|
| GCC 34 | There are no Special Conditions of Contract applicable to GCC Clause 34. |

### 35. Care of the System (GCC Clause 35)

| | |
|---|---|
| GCC 35 | There are no Special Conditions of Contract applicable to GCC Clause 35. |

### 36. Loss of or Damage to Property; Accident or Injury to Workers; Indemnification (GCC Clause 36)

| | |
|---|---|
| GCC 36 | There are no Special Conditions of Contract applicable to GCC Clause 36. |

### 37. Insurances (GCC Clause 37)

| | |
|---|---|
| GCC 37.1 (c) | The Supplier shall obtain Third-Party Liability Insurance in the amount of _____ with deductible limits of no more than _____. The insured Parties shall be _____. The Insurance shall cover the period from _____ until _____. |
| GCC 37.1 (e) | The Supplier shall obtain Worker's Compensation Insurance in accordance with the statutory requirements of the Philippines. Specifically: [requirements]. The Insurance shall cover the period from _____ until _____.<br>The Supplier shall obtain Employer's Liability Insurance in accordance with the statutory requirements of the Philippines. Specifically: ***[requirements]***. The Insurance shall cover the period from _____ until _____. |

### 38. Force Majeure (GCC Clause 38)

| | |
|---|---|
| GCC 38 | There are no Special Conditions of Contract applicable to GCC Clause 38. |





## H. Change in Contract Elements

### 39. Changes to the System (GCC Clause 39)

| | |
|---|---|
| GCC 39 | There are no Special Conditions of Contract applicable to GCC Clause 39. |

**40. Extension of Time for Achieving Operational Acceptance (GCC Clause 40)**

| | |
|---|---|
| GCC 40 | There are no Special Conditions of Contract applicable to GCC Clause 40. |

**41. Termination (GCC Clause 41)**

| | |
|---|---|
| GCC 41 | There are no Special Conditions of Contract applicable to GCC Clause 41. |

**42. Assignment (GCC Clause 42)**

| | |
|---|---|
| GCC 42 | Purchaser may at any time, without concurrence by the Contractor, assign this Contract and all associated rights, and the resulting licenses to an affiliate, subsidiary, or successor company, as part of the power industry restructuring process. |





# SECTION VI. SAMPLE FORMS

## Notes to Bidders on the preparation of Sample Forms

The Purchaser has prepared the forms in this section of the Bidding Documents to suit the specific requirements of the System being procured. They are derived from the forms contained in the World Bank's Standard Bidding Documents for the Supply and Installation of Information Systems. In its bid, the Bidder must use these forms (or forms that present in the same sequence substantially the same information). Bidders should not introduce changes without the Purchaser's prior written consent (which may also require the clearance of the World Bank). If the Bidder has a question regarding the meaning or appropriateness of the contents or format of the forms and/or the instructions contained in them, these questions should be brought to the Purchaser's attention as soon as possible during the bid clarification process, either at the pre-bid meeting or by addressing them to the Purchaser in writing pursuant to ITB Clause 10.

The Purchaser has tried to provide explanatory text and instructions to help the Bidder prepare the forms accurately and completely. The instructions that appear directly on the forms themselves are indicated by use of typographical aides such as italicized text within square brackets as is shown in the following example taken from the Bid Form:

"We accept the appointment of *[ insert: **name of Adjudicator, as specified by the Purchaser in the Bid Data Sheet item for ITB Clause 38.1** ]."*

In preparing its bid, the Bidder must ensure all such information is provided and that the typographical aides are removed. Failure to do so may render the bid non-responsive.

The sample forms provide a standard set of documents that support the procurement process as it moves forward from the stage of bidding, through Contract formation and onto Contract performance. The first set of forms must be completed and submitted as part of the bid prior to the deadline for bid submission. These include: (i) the Bid Form; (ii) the Price Schedules; (iii) the Manufacturer's Authorization Forms; (iv) the List of Proposed Subcontractors; and (v) the Bid Security.

- The Bid Form: In addition to being the place where official confirmation of the Bid Price, the currency breakdown, the completion date(s), and other important Contract details are expressed, the Bid Form is also used by the Bidder to confirm its acceptance of the Purchaser's proposed Adjudicator, or to propose an alternative. If the bid is being submitted on behalf of a joint venture, it is essential that the Bid Form be signed by the partner in charge and that it be supported by the authorizations and power of attorney required pursuant to ITB Clause 6.2. Given widespread concern about illegal use of patented software, Bidders will be asked to certify in the Bid Form that either the Software included in the bid was developed and is owned by the Bidder, or, if not, the Software is covered by valid licenses with the developer of the Software.
- Price Schedules: The prices quoted in the Price Schedules should constitute full and fair compensation for supply, installation, and achieving Operational Acceptance of the System as described in the Technical Requirements based on the Implementation Schedule, and the terms and conditions of the proposed Contract as set forth in the Bidding Documents. Prices should be given for each line item provided in the Schedules, with costs carefully aggregated first at the Subsystem level and then for the entire System. If the Price Schedules provide only a summary breakdown of items and components, or do not cover some items unique to the Bidder's specific technical solution, the Bidder





may extend the Schedules to capture those items or components. If supporting price and cost tables are needed for a full understanding of the bid, they should be included. Arithmetical errors should be avoided. If they occur, the Purchaser will correct them according to ITB Clause 26.2 without consulting the Bidder. Major omissions, inconsistencies, or lack of substantiating detail can lead to rejection of a bid for commercial non-responsiveness. Presenting prices according to the breakdown prescribed in the Price Schedules is also essential for another reason. If a bid does not separate prices in the prescribed way, and, as a result, the Purchaser cannot apply the domestic preference provision described in ITB Clause 29, the Bidder will lose the benefit of the preference. Once bids are opened, none of these problems can be rectified. At that stage, Bidders are not permitted to change their Bid Prices to overcome errors or omissions.

- Manufacturer's Authorizations: In accordance with ITB Clause 6.1 (b), a Bidder must submit, as part of its bid, Manufacturer's Authorization Forms in the format provided in the Bidding Documents for all items specified in the Bid Data Sheet.
- List of Proposed Subcontractors: In accordance with ITB Clause 6.3, a Bidder must submit, as part of its bid, a list of proposed subcontracts for complex Technologies, Goods, and Service items (and those estimated to cost more than 10 percent of the Total Bid Price). The list should also include the names and places of registration of the Subcontractors proposed for each item and a summary of their qualifications.
- List of Software and Materials: In accordance with ITB Clause 15.1 (e), Bidders must submit, as part of their bids, lists of all the Software included in the bid assigned to one of the following categories: (A) System, General Purpose, or Application Software; or (B) Standard or Custom Software. Bidders must also submit a list of all Custom Materials. If provided for in the Bid Data Sheet, the Purchaser may reserve the right to reassign certain key Software to a different category.
- Qualification Information Forms: In accordance with ITB Clause 6, the Purchaser will determine whether the Bidder is qualified to undertake the Contract. This entails financial, technical as well as performance history criteria which are specified in the Bid Data for Clause 6. The Bidder must provide the necessary information for the Purchaser to make this assessment through the forms in this sub-section. The forms contain additional detailed instructions which the Bidder must follow.
- Bid Security: The Bidder shall provide the Bid Security, either in the form included in these sample forms or in another form acceptable to the Purchaser, pursuant to the provisions in the Instructions to Bidders. If a Bidder wishes to use an alternative Bid Security format, it should ensure that the revised format provides substantially the same protection as the standard format; failing that, it runs the risk of rejection for commercial non-responsiveness.

Bidders need not provide the Performance Security and Advance Payment Bank Guarantee with their bids. Only the Bidder selected for award by the Purchaser will be required to provide these securities.

The following Forms are to be completed and submitted by the successful Bidder following notification of award: (i) Contract Agreement, with all Appendices; (ii) Performance Security; and (iii) Bank Guarantee for Advance Payment.

- Contract Agreement: In addition to specifying the parties and the Contract Price, the Contract Agreement is where the: (i) Supplier Representative; (ii) agreed Adjudicator and

his/her compensation; and (iii) the List of Approved Subcontractors are specified. In addition, modifications to the successful Bidder's Bid Price Schedules are attached to the Agreement. These contain corrections and adjustments to the Supplier's Bid Prices to correct errors, adjust the Contract Price to reflect any extensions to bid validity beyond 60 days, etc.

- Performance Security: Pursuant to GCC Clause 13.3, the successful Bidder is required to provide the Performance Security in the form contained in this section of these Bidding Documents and in the amount specified in accordance with the SCC.
- Bank Guarantee for Advance Payment: Pursuant to GCC Clause 13.2, the successful Bidder is required to provide the Bank Guarantee for Advance Payment in the form contained in this section of these Bidding Documents or another form acceptable to the Purchaser. If a Bidder wishes to propose a different Advance Payment Security form, it should submit a copy to the Purchaser promptly for review and confirmation of acceptability before the bid submission deadline. The amount of the advance payment to be guaranteed is specified in SCC Clause 13.

The Purchaser and Supplier will use the following additional forms during Contract implementation to formalize or certify important Contract events: (i) the Installation and Operational Acceptance Certificates; and (ii) the various Change forms. These and the procedures for their use during performance of the Contract are included in the Bidding Documents for the information of Bidders.





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## 1. BID FORM (SINGLE-STAGE BIDDING)

Date: _____
Loan/Credit No.: _____
IFB No._____
Name of Contract:_____

To: National Power Corporation

Dear Sir or Madam:
Having examined the Bidding Documents, including Addenda Nos. _____, the receipt of which is hereby acknowledged, we, the undersigned, offer to design, manufacture, test, deliver, install, pre-commission, commission, and put into operation the Information System under the above-named Contract in full conformity with the said Bidding Documents for the sum of _____ US Dollars (US$_____). (Hereinafter called "the Total Bid Price") or such other sums as may be determined in accordance with the terms and conditions of the Contract. The above amounts are in accordance with the Price Schedules attached herewith and are made part of this bid.

We undertake, if our bid is accepted, to commence work on the Information System and to achieve Installation and Operational Acceptance within the respective times stated in the Bidding Documents.

If our bid is accepted, we undertake to provide an advance payment security and a performance security in the form, in the amounts, and within the times specified in the Bidding Documents.

We accept the appointment _____ as the Adjudicator.

We hereby certify that the Software offered in this bid and to be supplied under the Contract either (i) is owned by us, or (ii) if not, is covered by a valid license from the owner of the Software.

We agree to abide by this bid, which, in accordance with ITB Clause 13, consists of this letter, the Price Schedules, the Bid Security, the duly notarized written power of attorney, and Attachments 1 through 8 to this Bid Form, for a period of sixty (60) days from the date fixed for submission of bids as stipulated in the Bidding Documents, and it shall remain binding upon us and may be accepted by you at any time before the expiration of that period.

Until the formal final Contract is prepared and executed between us, this bid, together with your written acceptance of the bid and your notification of award, shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any bid you may receive.

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to Contract execution if we are awarded the Contract, are listed below:

| Name and Address | Amount and | Purpose of |
|---|---|---|

| of Agent | Currency | Commission or Gratuity |
|---|---|---|
| | | |
| | | |
| | | |

Dated this _____ day of _____, 20__.

Signed:
Date:

In the capacity of _____

Duly authorized to sign this bid for and on behalf of _____

Attachments

Attachment 1 Bidder's eligibility
Attachment 2 Bidder's qualifications
Attachment 3 Eligibility of Information Technologies, Materials, Goods, and Services
Attachment 4 Conformance of Information Technologies, Materials, Goods, and Services to Bidding Documents
Attachment 5 Proposed Subcontractors
Attachment 6 Software and Materials Lists
Attachment 7 Proposed Deviations
Attachment 8 Alternative Proposals





## Bid Table of Contents and Checklist

**Note:** Bidders should expand and modify (if appropriate) and complete the following table. The purpose of the table is to provide the Bidder with a summary checklist of items that must be included in the bid to be considered for Contract award, as described in ITB Clause 13.1. It also provides a summary reference scheme to ease and speed the Purchaser's bid evaluation process.

| Item | present: y/n |
|---|---|
| Bid Form | |
| Price Schedules | |
| Bid Security | |
| Power of Attorney | |
| Attachment 1 | |
| Attachment 2 | |
| Power of Attorney for Joint Venture / Partnership | |
| Manufacturer's Authorizations | |
| Attachment 3 | |
| Attachment 4 | |
| Attachment 5 | |
| Attachment 6 | |
| Attachment 7 | |
| Attachment 8 | |

# 2. PRICE SCHEDULE FORMS





## 2.1 Preamble

**General**

1. The Price Schedules are divided into separate Schedules as follows:
   - 2.2 Grand Summary Cost Table
   - 2.3 Interim MMS Cost Summary Table
   - 2.4 Final MMS Cost Summary Table
   - 2.5 Interim MMS Cost Sub-Table(s)
   - 2.6 Final MMS Cost Sub-Tables(s)
   - 2.7 Country of Origin Code Table
2. The Schedules do not generally give a full description of the information technologies to be supplied, installed, and operationally accepted, or the Services to be performed under each item. However, it is assumed that Bidders shall have read the Technical Requirements and other sections of these Bidding Documents to ascertain the full scope of the requirements associated with each item prior to filling in the rates and prices. The quoted rates and prices shall be deemed to cover the full scope of these Technical Requirements, as well as overhead and profit.
3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with the Instructions to Bidders in the Bidding Documents prior to submitting their bid.

**Pricing**

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Bidder. As specified in the Bid Data Sheet, prices shall be fixed and firm for the duration of the Contract.
5. Bid prices shall be quoted in US Dollars in the manner indicated in Clause 14 of the Instructions to Bidders in the Bidding Documents. Prices must correspond to items of the scope and quality defined in the Technical Requirements or elsewhere in these Bidding Documents.
6. The Bidder must exercise great care in preparing its calculations, since there is no opportunity to correct errors once the deadline for submission of bids has passed. A single error in specifying a unit price can therefore change a Bidder's overall Total Bid Price substantially, make the bid noncompetitive, or subject the Bidder to possible loss. The Purchaser will correct any arithmetic error in accordance with the provisions of ITB Clause 26.2.
7. Unless otherwise indicated in the BDS, where there are discrepancies between the product of quantities and unit prices (or rates) and the relevant total (or subtotals), the product of prices and quantities shall prevail, and the totals (or subtotals) shall be corrected accordingly. Similarly, where there are discrepancies between subtotals and totals (or higher aggregates), the subtotals shall prevail, and the totals (or higher aggregates) shall be corrected accordingly.
8. Payments will be made to the Supplier in US Dollars.
9. The Bidder shall provide completed forms for:
   a. Costs for the Interim Market Management System;

b. Costs for the Final Market Management System.
Each set of costs shall be stand-alone and brought to the Grand Summary Cost Table 2.2.
The reduction to the Final Market Management System cost, based on the same Bidder supplying both systems, shall be included in 2.2 where designated.





## 2.2 Grand Summary Cost Table

| | | Price (US$) |
|---|---|---|
| | | |
| 1. | Interim Market Management System (total)<br>(a) Application Software Component<br>(b) Hardware, standard software, and system implementation component | |
| | | |
| 2. | Final Market Management System (Mandatory Optional Quote, to be exercised at Purchaser's option) | |
| | | |
| 3. | Reduction to Final Market Management System | |

Name of Bidder: _____

Authorized Signature of Bidder:

## 2.3 Interim MMS Cost Summary Table

| Line Item No. | Subsystem / Item | Cost Sub-Table No. | Price (US$) |
|---|---|---|---|
| | | | |
| 1 | Hardware (total of Item 1) | 2.5 | |
| | | | |
| 2 | Standard Software (total of Item 2) | 2.5 | |
| | | | |
| 3 | Software for the IMMS (total of Item 3) | 2.5 | |
| | | | |
| 4 | System Implementation (Item 4) | 2.5 | |
| | | | |
| | TOTAL (to Grand Summary Table) | | |

Name of Bidder: _____

Authorized Signature of Bidder: _____





## 2.4 Final MMS Cost Summary Table

| Line Item No. | Subsystem / Item | Cost Sub-Table | Price (US$) |
|---|---|---|---|
| | | | |
| 1 | Hardware (total of Item1) | 2.6 | |
| | | | |
| 2 | Standard Software (total of Item 2) | 2.6 | |
| | | | |
| 3 | Software Developed for the MMS (total of Item 3) | 2.6 | |
| | | | |
| 4 | System Implementation (total of Item 4) | 2.6 | |
| | | | |
| 5 | Emergency Backup Systems (total of Item 5) | 2.6 | |
| | TOTAL (to Grand Summary Table) | | |

Name of Bidder: _____

Authorized Signature of Bidder:

## 2.5 Interim MMS Cost Sub-Table

| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| 1 | **Hardware** | | | | |
| 1.1 | Main Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.2 | Applications Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.3 | Meter Data Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.4 | Data Warehouses | | | | |
| | Processors | | | | |





| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.5 | E-Commerce Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.6 | Networking Equipment | | | | |
| 1.7 | User Interface Workstations | | | | |
| 1.8 | Rear Projection Equipment | | | | |
| 2 | **Standard Software** | | | | |
| 2.1 | Computer Supplier's System Software-List | | | | |
| 2.2 | Relational Database Management System-List | | | | |
| 2.3 | Workstation-List | | | | |
| 2.4 | Other-List | | | | |
| 3 | **Software Developed for the IMMS** | | | | |
| 3.1 | Participant Registry and Standing Data | | | | |
| 3.2 | Offer/Bid Processing | | | | |
| 3.3 | EMS Interface | | | | |

| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| 3.4 | Dispatch Engine and Market Operations | | | | |
| 3.5 | Market Participants Interface | | | | |
| 3.6 | Meter Data Collection | | | | |
| 3.7 | Settlements Processing | | | | |
| 3.8 | Security and Audit | | | | |
| **4** | **System Implementation** | | | | |
| 4.1 | Project Management | | | | |
| 4.2 | System Integration and Test | | | | |
| 4.3 | Factory Acceptance Test | | | | |
| 4.4 | Shipment | | | | |
| 4.5 | Final Documentation | | | | |
| 4.6 | Training | | | | |
| 4.7 | System Commissioning | | | | |
| 4.8 | Availability Test | | | | |
| 4.9 | On-Site Maintenance Support | | | | |
| 4.10 | Warranty Support | | | | |

1. Bidders shall enter a code representing the country of origin of all imported plant and equipment.





| | |
|---|---|
| Name of Bidder: | |
| Authorized Signature of Bidder: | |

## 2.6 Final MMS Cost Sub-Table

| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| 1 | **Hardware** | | | | |
| 1.1 | Main Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.2 | Applications Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.3 | Meter Data Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.4 | Data Warehouses | | | | |
| | Processors | | | | |





| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.5 | E-Commerce Servers | | | | |
| | Processors | | | | |
| | Main Memory | | | | |
| | Disk Memory | | | | |
| | CD-ROM | | | | |
| | Printers | | | | |
| | Other Peripherals | | | | |
| 1.6 | Networking Equipment | | | | |
| 1.7 | User Interface Workstations | | | | |
| 1.8 | Rear Projection Equipment | | | | |
| 2 | **Standard Software** | | | | |
| 2.1 | Computer Supplier's System Software-List | | | | |
| 2.2 | Relational Database Management System-List | | | | |
| 2.3 | Workstation-List | | | | |
| 2.4 | Other-List | | | | |
| 3 | **Software Developed for the MMS** | | | | |
| 3.1 | Participant Registry and Standing Data | | | | |
| 3.2 | Offer/Bid Processing | | | | |
| 3.3 | EMS Interface | | | | |

| Component No. | Component | Code[1] | Quantity | Unit Price (US$) | Total Price (US$) |
|---|---|---|---|---|---|
| 3.4 | Dispatch Engine and Market Operations | | | | |
| 3.5 | Market Participants Interface | | | | |
| 3.6 | Meter Data Collection | | | | - - |
| 3.7 | Settlements Processing | | | | |
| 3.8 | Security and Audit | | | | |
| 4 | **System Implementation** | | | | |
| 4.1 | Project Management | | | | |
| 4.2 | System Integration and Test | | | | |
| 4.3 | Factory Acceptance Test | | | | |
| 4.4 | Shipment | | | | |
| 4.5 | Final Documentation | | | | |
| 4.6 | Training | | | | |
| 4.7 | Site Acceptance Test | | | | |
| 4.8 | Availability Test | | | | |
| 4.9 | On-Site Maintenance Support | | | | |
| 4.10 | Warranty Support | | | | |
| **5** | **Emergency Backup System** | | | | |
| 5.1 | Hardware | | | | |
| 5.2 | Software | | | | |
| 5.3 | System Implementation | | | | |

1. Bidders shall enter a code representing the country of origin of all plant and equipment.





| | |
|---|---|
| Name of Bidder: | |
| Authorized Signature of Bidder: | |

## 2.7 Country of Origin Code Table

| Country of Origin | Country Code | Country of Origin | Country Code |
|---|---|---|---|
| | | | |
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# 3. Other Bid Forms and Lists

## 3.1 Manufacturer's Authorization Form

Date:
ICB No.:
Invitation for Bid No.:
Bid & Lot Nos.:

To: _____

WHEREAS _____ who are official producers of _____ and having production facilities at _____ do hereby authorize _____ located at _____ (hereinafter, the "Bidder") to submit a bid and subsequently negotiate and sign a Contract with you for resale of the following Products produced by us, for the quantities, specifications and delivery schedule called for by the Supply Requirements associated with the above Invitation for Bids:

We hereby extend to you a full guarantee and warranty in accordance with Clause 29, Defect Liability, of the General Conditions of Contract and with our own standard product warranty, and duly authorize the Bidder to act on our behalf in fulfilling all warranty obligations with respect to the above-listed products offered for resale by the Bidder in relation to this Invitation for Bids.

We also certify that the Bidder is qualified by us to provide the following maintenance, technical or help desk support, new version upgrade and/or other services related to the above-listed Products in accordance with Clause 7-Scope of the System, of the General Conditions of Contract:

Name In the capacity of

Signed

Duly authorized to sign the authorization for and on behalf of : _____

Dated on _____ day of _____, _____.





**Note:** This letter of authority must be on the letterhead of the Producer, must be signed by a person competent and having the power of attorney to bind the Producer, and must be included by the Bidder in its bid as specified in the Instructions to Bidders.

## 3.2 List of Proposed Subcontractors

| Item | Proposed Subcontractor | Place of Registration & Qualifications |
|---|---|---|
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## 3.3 Software List

| Software Item | (select one per item) | | | (select one per item) | |
|---|---|---|---|---|---|
| | System Software | General-Purpose Software | Application Software | Standard Software | Custom Software |
| | | | | | |
| | | | | | |
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## 3.4 List of Custom Materials

| Custom Materials |
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## 3.5.1 General Information Form

All individual firms and each partner of a joint venture that are bidding must complete the information in this form. Nationality information should be provided for all owners or Bidders that are partnerships or individually owned firms.
Where the Bidder proposes to use named Subcontractors for highly specialized components of the Information System, the following information should also be supplied for the Subcontractor(s), together with the information in Forms 3.5.2, 3.5.3, 3.5.3A, 3.5.4, and 3.5.5

| | | |
|---|---|---|
| 1. | Name of firm | |
| 2. | Head office address | |
| 3. | Telephone | Contact |
| 4. | Fax | Telex |
| 5. | Place of incorporation / registration | Year of incorporation / registration |

| Nationality of owners[1] | | |
|---|---|---|
| Name | | Nationality |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

1. To be completed by all owners of partnerships or individually owned firms.

### 3.5.2 General Information Systems Experience Record

| Name of Bidder or partner of a joint venture |
|---|

All individual firms and all partners of a joint venture must complete the information in this form with regard to the management of Information Systems contracts generally. The information supplied should be the annual turnover of the Bidder (or each member of a joint venture), in terms of the amounts billed to clients for each year for work in progress or completed, converted to U.S. dollars at the rate of exchange at the end of the period reported. The annual periods should be calendar years, with partial accounting for the year up to the date of submission of applications.
A brief note on each contract should be appended, describing the nature of the Information System, duration and amount of contract, managerial arrangements, purchaser, and other relevant details.
Use a separate sheet for each partner of a joint venture.
Bidders should not enclose testimonials, certificates, and publicity material with their applications; they will not be taken into account in the evaluation of qualifications.

| Annual turnover data (applicable activities related activities only) | | |
|---|---|---|
| Year* | Turnover | US$ equivalent |
| 1. | | |
| 2. | | |
| 3. | | |
| 4. | | |
| 5. | | |

* Commencing with the partial year up to the date of submission of bids





### 3.5.2a Joint Venture Summary

| Names of all partners of a joint venture |
|---|
| 1. Partner in charge |
| 2. Partner |
| 3. Partner |
| 4. Partner |
| 5. Partner |
| 6. etc. |

Total value of annual construction turnover, in terms of Information System billed to clients, in US$ equivalent, converted at the rate of exchange at the end of the period reported:

| Annual turnover data (applicable activities only; US$ equivalent) | | | | | | |
|---|---|---|---|---|---|---|
| Partner | Form 2 page no. | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| 1. Partner in charge | | | | | | |
| 2. Partner | | | | | | |
| 3. Partner | | | | | | |
| 4. Partner | | | | | | |
| 5. Partner | | | | | | |
| 6. Etc. | | | | | | |
| Totals | | | | | | |

### 3.5.3 Particular Information Systems Experience Record

| Name of Bidder or partner of a joint venture |
|---|

On separate pages, using the format of Form (3.5.3A), the Bidder is requested to list contracts of a similar nature, complexity, and requiring similar information technology and methodologies to the contract or contracts for which these Bidding Documents are issued, and which the Bidder has undertaken during the period, and of the number, specified in the Bid Data for ITB Paragraph 6.1 (a). Each partner of a joint venture should provide details of similar contracts on which they have experienced. The contract value should be based on the payment currencies of the contracts converted into U.S. dollars, at the date of substantial completion, or for ongoing contracts at the time of award. The information is to be summarized, using Form (3.5.3A), for each contract completed or under execution, by the Bidder or by each partner of a joint venture.





### 3.5.3a Details of Contracts of Similar Nature and Complexity

| Name of Bidder or partner of a joint venture |
|---|

Use a separate sheet for each contract.

| | | |
|---|---|---|
| 1. | Number of contract | |
| | Name of contract | |
| | Country | |
| 2. | Name of Purchaser | |
| 3. | Purchaser address | |
| 4. | Nature of Information Systems and special features relevant to the contract for which the Bidding Documents are issued | |
| 5. | Contract role (check one)<br>☐Prime Supplier ☐ Management Contractor ☐Subcontractor ☐Partner in a joint venture | |
| 6. | Amount of the total contract/subcontract/partner share (in specified currencies at completion, or at date of award for current contracts)<br>Currency Currency Currency | |
| 7. | Equivalent amount US$<br>Total contract: $_____; Subcontract: $_____; Partner share: $_____; | |
| 8. | Date of award/completion | |
| 9. | Contract was completed _____ months ahead/behind original schedule (if behind, provide explanation). | |
| 10. | Contract was completed US$ _____ equivalent under/over original contract amount (if over, provide explanation). | |
| 11. | Special contractual/technical requirements. | |
| 12. | Indicate the approximate percent of total contract value (and US$ amount) of Information System undertaken by subcontract, if any, and the nature of such Information System. | |

### 3.5.4 Summary Sheet: Current Contract Commitments / Work in Progress

| Name of Bidder or partner of a joint venture |
|---|

Bidders and each partner to an joint venture bid should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

| Name of contract | Purchaser, contact address/tel./fax | Value of outstanding Information System (current US$ equivalent) | Estimated completion date | Average monthly invoicing over last six months (US$/month) |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |
| 4. | | | | |
| 5. | | | | |
| etc. | | | | |





### 3.5.5 Financial Capabilities

| Name of Bidder or partner of a joint venture |
|---|

Bidders, including each partner of a joint venture, shall provide financial information to demonstrate that they meet the requirements stated in the Bid Data for ITB Paragraph 6.1 (a). Each Bidder or partner of a joint venture shall complete this form. If necessary, separate sheets shall be used to provide complete banker information. A copy of the audited balance sheets shall be attached.
Autonomous subdivisions of parent conglomerate businesses shall submit financial information related only to the particular activities of the subdivision.

| | | |
|---|---|---|
| Banker | Name of banker | |
| | Address of banker | |
| | Telephone | Contact name and title |
| | Fax | Telex |

Summarize actual assets and liabilities in U.S. dollar equivalent (at the rates of exchange current at the end of each year) for the previous five calendar years. Based upon known commitments, summarize projected assets and liabilities in U.S. dollar equivalent for the next two calendar years, unless the withholding of such information by stock market listed public companies can be substantiated by the Bidder.

| Financial information in US$ equivalent | Actual: Previous five years | | | | | Projected: Next two years | |
|---|---|---|---|---|---|---|---|
| | 5. | 4. | 3. | 2. | 1. 0 | 1 | 2 |
| 1. Total assets | | | | | | | |
| 2. Current assets | | | | | | | |
| 3. Total liabilities | | | | | | | |
| 4. Current liabilities | | | | | | | |
| 5. Profits before taxes | | | | | | | |
| 6. Profits after taxes | | | | | | | |

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as indicated in the Bid Data for ITB Paragraph 6.1(a).

| Source of financing | Amount (US$ equivalent) |
|---|---|
| 1. | |

| | |
|---|---|
| 2. | |
| 3. | |
| 4. | |

Attach audited financial statements—including, as a minimum, profit and loss account, balance sheet, and explanatory notes—for the period stated in the Bid Data for ITB Paragraph 6.1 (a) (for the individual Bidder or each partner of a joint venture).
If audits are not required by the laws of Bidders' countries of origin, partnerships and firms owned by individuals may submit their balance sheets certified by a registered accountant, and supported by copies of tax returns,





## 3.5.6 Personnel Capabilities

| Name of Bidder |
|---|

For specific positions essential to contract management and implementation (and/or those specified in the Bidding Documents, if any), Bidders should provide the names of at least two candidates qualified to meet the specified requirements stated for each position. The data on their experience should be supplied on separate sheets using one Form (3.5.6A) for each candidate.
Bidders may propose alternative management and implementation arrangements requiring different key personnel, whose experience records should be provided.

| | |
|---|---|
| 1. | Title of position |
| | Name of prime candidate |
| | Name of alternate candidate |
| 2. | Title of position |
| | Name of prime candidate |
| | Name of alternate candidate |
| 3. | Title of position |
| | Name of prime candidate |
| | Name of alternate candidate |
| 4. | Title of position |
| | Name of prime candidate |
| | Name of alternate candidate |

### 3.5.6a Candidate Summary

| Name of Bidder | |
|---|---|

| Position | | Candidate<br>☐ Prime ☐ Alternate |
|---|---|---|
| Candidate information | Name of candidate | Date of birth |
| | Professional qualifications | |
| Present employment | Name of Employer | |
| | Address of Employer | |
| | Telephone | Contact (manager / personnel officer) |
| | Fax | Telex |
| | Job title of candidate | Years with present Employer |

Summarize professional experience over the last twenty years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

| From | To | Company / Project / Position / Relevant technical and management experience |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |





### 3.5.7 Technical Capabilities

| Name of Bidder | |
|---|---|

The Bidder shall provide adequate information to demonstrate clearly that it has the technical capability to meet the requirements for the Information System. With this form, the Bidder should summarize important certifications, proprietary methodologies, and/or specialized technologies which the Bidder proposes to utilize in the execution of the Contract or Contracts.

### 3.5.8 Litigation History

| Name of Bidder or partner of a joint venture |
|---|

Bidders, including each of the partners of a joint venture, shall provide information on any history of litigation or arbitration resulting from contracts executed in the last five years or currently under execution. A separate sheet should be used for each partner of a joint venture.

| Year | Award FOR or AGAINST Bidder | Name of client, cause of litigation, and matter in dispute | Disputed amount (current value, US$ equivalent) |
|---|---|---|---|
| | | | |
| | | | |
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## 4. BID SECURITY FORM (BANK GUARANTEE).

Date:_____
Loan/Credit Number:_____
IFB:_____
Contract:_____

To: National Power Corporation
Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

WHEREAS _____ (hereinafter called "the Bidder") has submitted its Bid dated _____ for the performance of the above-named Contract (hereinafter called "the Bid")
KNOW ALL PERSONS by these present that WE _____ of _____ (hereinafter called "the Bank") are bound unto National Power Corporation (hereinafter called "the Purchaser") in the sum of: _____, for which payment well and truly to be made to the said Purchaser, the Bank binds itself, its successors, and assigns by these presents.
Sealed with the Common Seal of the said Bank this _____ day of _____, 2001.

THE CONDITIONS of this obligation are the following:

1. If, after the bid submission deadline, the Bidder withdraws its Bid during the period of bid validity specified by the Bidder in the Bid Form, or
2. If the Bidder, having been notified of the acceptance of its Bid by the Purchaser during the period of bid validity
   (a) fails or refuses to sign the Contract Agreement when required;
   (b) fails or refuses to issue the performance security in accordance with the Bidding Documents; or
   (c) fails to accept the Purchaser's corrections of arithmetic errors in the Bidder's Bid, if any,

WE undertake to pay to the Purchaser up to the above amount upon receipt of its first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser will note that the amount claimed by it is due it, owing to the occurrence of any one of the two above-named CONDITIONS, and specifying the occurred condition or conditions.
This guarantee will remain in full force up to and including the date that is 28 days after the period of bid validity, and any demand in respect thereof must reach the Bank not later than the above date.

For and on behalf of the Bank

Signed:
Date:
in the capacity of: _____

Common Seal of the Bank





## 4A—Bid Security Form (Bid Bond)

BOND NO. _____

BY THIS BOND _____ as Principal (hereinafter called "the Principal"), and ***[name, legal title, and address of surety]***, authorized to transact business in the Philippines, as Surety, are held and firmly bound unto National Power Corporation as Obligee in the sum of Two Hundred Fifty Thousand US Dollars (US$ 250,000), for the payment of which sum, well and truly to be made, we, the said Principal and Surety, bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has submitted a written Bid to the Purchaser dated the ___ day of _____, 20__, for the supply of Interim Market Management System and Market Management System (hereinafter called the "Bid").

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal:

(1) withdraws its Bid during the period of bid validity specified by the Bidder on the Bid Form; or
(2) refuses to accept the correction of errors in its Bid Price in accordance with the Instructions to Bidders; or
(3) having been notified of the acceptance of its Bid by the Purchaser during the period of Bid validity;
   (a) fails or refuses to execute the Contract Form in accordance with the Instructions to Bidders, if required; or
   (b) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

then the Surety undertakes to immediately pay to the Purchaser up to the above amount upon receipt of the Purchaser's first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

The Surety hereby agrees that its obligation will remain in full force and affect up to and including the date 30 days after the date of expiration of the Bid validity as stated in the Invitation to Bid. Any demand in respect of this Bond should reach the Surety not later than the above date.

IN TESTIMONY WHEREOF, the Principal and the Surety have caused these presents to be executed in their respective names this ____ day of _____ 20__.

Principal: _____ Surety: _____

Corporate Seal (where appropriate)

| | |
|---|---|
| _____ | _____ |
| *(Signature)* | *(Signature)* |
| _____ | _____ |
| *(Printed name and title)* | *(Printed name and title)* |





## 5. Form of Contract Agreement

THIS CONTRACT AGREEMENT is made
The _____ day of _____, 20___.

BETWEEN

(1) National Power Corporation, a corporation incorporated under the laws of the Philippines and having its principal place of business at Quezon Avenue, corner Aghan Road, Diliman, Quezon City 1104, Philippines (hereinafter called "the Purchaser"), and

(2) _____, a corporation incorporated under the laws of _____ and having its principal place of business at _____ (hereinafter called "the Supplier").

WHEREAS the Purchaser desires to engage the Supplier to design, manufacture, test, supply, deliver, install, complete commission, and put into operation the following Information System: Interim Market Management System and Final Market Management System ("the System"), and the Supplier has agreed to such engagement upon and subject to the terms and conditions appearing below in this Contract Agreement.

NOW IT IS HEREBY AGREED as follows:

**Article 1.**

**Contract Documents**

1.1 Contract Documents (Reference GCC Clause 1.1 [a] [ii])

The following documents shall constitute the Contract between the Purchaser and the Supplier, and each shall be read and construed as an integral part of the Contract:

(a) This Contract Agreement and the Appendices attached to the Contract Agreement
(b) Special Conditions of Contract
(c) General Conditions of Contract
(d) Technical Requirements (including Implementation Schedule)
(e) The Supplier's bid and original Price Schedules

1.2 Order of Precedence (Reference GCC Clause 2)
In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above, provided that Appendix 7 shall prevail over all provisions of the Contract Agreement and the other Appendices attached to the Contract Agreement and all the other Contract Documents listed in Article 1.1 above.

1.3 Definitions (Reference GCC Clause 1)
Capitalized words and phrases used in this Contract Agreement shall have the same meanings as are ascribed to them in the General Conditions of Contract.

Article 2. Contract Price and Terms of Payment

2.1 Contract Price (Reference GCC Clause 1.1(a)(vii) and GCC Clause 11)
The Purchaser hereby agrees to pay to the Supplier the Contract Price in consideration of the performance by the Supplier of its obligations under the Contract. The Contract Price shall be _____ US Dollars (US$ _____), as specified in Schedule 2.2 – Grand Summary Price Schedule.
The Contract Price shall be understood to reflect the terms and conditions used in the specification of prices in the detailed price schedules, including the terms and conditions of the associated Incoterms, and the taxes, duties and related levies specified in GCC Clause 14.

Article 3. Effective Date for Determining Time for Operational Acceptance

3.1 Effective Date (Reference GCC Clause 1.1 [e] [viii])
The time allowed for supply, installation, and achieving Operational Acceptance of the System shall be determined from the date when all of the following conditions have been fulfilled:
(a) This Contract Agreement has been duly executed for and on behalf of the Purchaser and the Supplier;
(b) The Supplier has submitted to the Purchaser the performance security and the advance payment guarantee, in accordance with GCC Clause 13.2 and GCC Clause 13.3;
(c) The Purchaser has paid the Supplier the advance payment, in accordance with GCC Clause 12.
Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.

3.2 If the conditions listed under 3.1 are not fulfilled within two (2) months from the date of this Contract Agreement because of reasons not attributable to the Supplier, the parties shall discuss and agree on an equitable adjustment to the Contract Price and the Time for Achieving Operational Acceptance and/or other relevant conditions of the Contract.

Article 4. Appendixes

4.1 The Appendixes listed in the attached List of Appendixes shall be deemed to form an integral part of this Contract Agreement.

4.2 Reference in the Contract to any Appendix shall mean the Appendixes attached to this Contract Agreement, and the Contract shall be read and construed accordingly.





IN WITNESS WHEREOF the Purchaser and the Supplier have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

For and on behalf of the Purchaser:_____

Signed:
in the capacity of _____

in the presence of:_____

For and on behalf of the Supplier: _____

Signed:
in the capacity of _____

in the presence of _____

CONTRACT AGREEMENT
dated the _____ day of _____, 20___
BETWEEN
National Power Corporation, "the Purchaser"
and
_____, "the Supplier"

APPENDIXES

| | |
|---|---|
| Appendix 1 | Supplier's Representative |
| Appendix 2 | Adjudicator |
| Appendix 3 | List of Approved Subcontractors |
| Appendix 4 | Categories of Software |
| Appendix 5 | Custom Materials |
| Appendix 6 | Revised Price Schedules (if any) |
| Appendix 7 | The Minutes of Contract Finalization Discussions and Agreed-to Contract Amendments |

## Appendix 1. Supplier's Representative

In accordance with GCC Clause 1.1 (b) (iv), the Supplier's appointed Supplier's Representative is:

Name: _____

Title: _____





## Appendix 2. Adjudicator

In accordance with GCC Clause 1.1 (b) (vi), the agreed-upon Adjudicator(s) is(are):

Name:_____

Title:_____

Address:_____

Telephone:_____

In accordance with GCC Clause 6.1.3, the agreed-upon fees and reimbursable expenses are:

Hourly Fees: US Dollars Two Hundred (US$200)

Reimbursable Expenses: travel, phone, fax and other communication costs, and lodging and boarding expenses

Pursuant to GCC Clause 6.1.4, if at the time of Contract signing, agreement has not been reached between the Purchaser and the Supplier, an Adjudicator will be appointed by the Appointing Authority named in the SCC.

## Appendix 3. List of Approved Subcontractors

The Purchaser has approved use of the following Subcontractors nominated by the Supplier for carrying out the item or component of the System indicated. Where more than one Subcontractor is listed, the Supplier is free to choose between them, but it must notify the Purchaser of its choice sufficiently in advance of the time when the subcontracted work needs to commence to give the Purchaser reasonable time for review. In accordance with GCC Clause 20.1, the Supplier is free to submit proposals for Subcontractors for additional items from time to time. No subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Purchaser and their names have been added to this list of Approved Subcontractors, subject to GCC Clause 20.3.

| Item | Approved Subcontractors | Place of Registration |
|---|---|---|
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## Appendix 4. Categories of Software

The following table assigns each item of Software supplied and installed under the Contract to one of the three categories: (i) System Software, (ii) General-Purpose Software, or (iii) Application Software; and to one of the two categories: (i) Standard Software or (ii) Custom Software (including standard software that was customized for the Purchaser).

| | (select one per item) | | | (select one per item) | |
|---|---|---|---|---|---|
| Software Item | System Software | General-Purpose Software | Application Software | Standard Software | Custom Software |
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## Appendix 5. Custom Materials

The follow table specifies the Custom Materials the Supplier will provide under the Contract.

| Custom Materials |
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## Appendix 6. Revised Price Schedules

The attached Revised Price Schedules (if any) shall form part of this Contract Agreement and, where differences exist, shall supersede the Price Schedules contained in the Supplier's Bid. These Revised Price Schedules reflect any corrections or adjustments to the Supplier's Bid Price, pursuant to the ITB Clauses 18.3, 26.2, and 33.1.

## Appendix 7. Minutes of Contract Finalization Discussions and Agreed-to Contract Amendments

The attached Contract amendments (if any) shall form part of this Contract Agreement and, where differences exist, shall supersede the relevant clauses in the GCC, SCC, Technical Requirements, or other parts of this Contract as defined in GCC Clause 1.1 (a) (ii).





## 6. Performance and Advance Payment Security Forms

## 6.1 Performance Security Bank Guarantee

(unconditional)
Date:_____
Loan/Credit Number:_____
IFB:_____
Contract:_____

To: National Power Corporation
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Dear Sir or Madam:

We refer to the Contract Agreement ("the Contract") signed on _____ between you and _____ ("the Supplier") concerning design, supply, installation, and achieving Operational Acceptance of an Interim Market Management System and a Final Market Management System. By this letter we, the undersigned, _____, a bank organized under the laws of the Philippines and having its registered/principal office at _____ (hereinafter, "the Bank") do hereby jointly and severally with the Supplier irrevocably guarantee payment owed to you by the Supplier, pursuant to the Contract, up to the sum of _____. This guarantee shall be reduced or expire as provided for by GCC Clause 13.3.

We undertake to make payment under this Letter of Guarantee upon receipt by us of your first written demand signed by your duly authorized officer declaring the Supplier to be in default under the Contract and without cavil or argument any sum or sums within the above-named limits, without your need to prove or show grounds or reasons for your demand and without the right of the Supplier to dispute or question such demand. Our liability under this Letter of Guarantee shall be to pay to you whichever is the lesser of the sum so requested or the amount then guaranteed under this Letter in respect of any demand duly made under this Letter prior to expiry of this Letter of Guarantee, without being entitled to inquire whether or not this payment is lawfully demanded.

This Letter of Guarantee shall be valid from the date of issue until the date of expiration of the guarantee, as governed by the Contract. Except for the documents herein specified, no other documents or other action shall be required, notwithstanding any applicable law or regulation. Our liability under this Letter of Guarantee shall become null and void immediately upon its expiry, whether it is returned or not, and no claim may be made under this Letter after such expiry or after the aggregate of the sums paid by us to you shall equal the sums guaranteed under this Letter, whichever is the earlier. All notices to be given under this Letter shall be given by registered (airmail) post to the addressee at the address herein set out or as otherwise advised by and between the parties hereto.

We hereby agree that any part of the Contract may be amended, renewed, extended, modified, compromised, released, or discharged by mutual agreement between you and the





Supplier, and this security may be exchanged or surrendered without in any way impairing or affecting our liabilities hereunder without notice to us and without the necessity for any additional endorsement, consent, or guarantee by us, provided, however, that the sum guaranteed shall not be increased or decreased.

No action, event, or condition that by any applicable law should operate to discharge us from liability hereunder shall have any effect and we hereby waive any right we may have to apply such law, so that in all respects our liability hereunder shall be irrevocable and, except as stated herein, unconditional in all respects.

For and on behalf of the Bank

Signed:
Date:
in the capacity of: _____

Common Seal of the Bank

## 6.2 Advance Payment Bank Guarantee

Date:_____
Loan/Credit Number:_____
IFB:_____
Contract:_____

To: National Power Corporation
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Dear Sir or Madam:

We refer to the Contract Agreement signed on _____ between you and _____ ("the Supplier") concerning design, supply, installation, and achieving Operational Acceptance of an Interim Market Management System and a Final Market Management System.
Whereas, in accordance with the terms of the said Contract, the Purchaser has agreed to pay or cause to be paid to the Supplier an Advance Payment in the amount of _____US Dollars ( US$_____) due to the Supplier.
By this letter we, the undersigned, _____, a bank organized under the laws of the Philippines and having its registered/principal office at _____, (hereinafter, "the Bank") do hereby jointly and severally with the Supplier irrevocably guarantee repayment of the said amounts upon the first demand of the Purchaser without cavil or argument in the event that the Supplier fails to commence or fulfill its obligations under the terms of the said Contract, and in the event of such failure, refuses to repay all or part (as the case may be) of the said Advance Payment to the Purchaser. Provided always that the Bank's obligation shall be limited to an amount equal to the outstanding balance of the Advance Payment, taking into account such amounts that have been repaid by the Supplier from time to time in accordance with the terms of payment of the said Contract as evidenced by appropriate shipping documents or payment certificates.

This Guarantee shall remain in full force from the date upon which the said Advance Payment is received by the Supplier until the date upon which the Supplier has fully repaid the amount so advanced to the Purchaser in accordance with the terms of the Contract. At the time at which the outstanding amount is nil, this Guarantee shall become null and void, whether the original is returned to us or not. Any claims to be made under this Guarantee must be received by the Bank during its period of validity.

For and on behalf of the Bank





Signed:
Date:
in the capacity of:_____

Common Seal of the Bank

# 7. Installation and Acceptance Certificates





## 7.1 Installation Certificate Form

Date:_____
Loan/Credit Number:_____
IFB:_____
Contract:_____

To: _____
Dear Sir or Madam:

Pursuant to GCC Clause 26 of the Contract (Installation of the System) entered into between yourselves and the National Power Corporation (hereinafter the "Purchaser") dated _____, relating to an Interim Market Management System and a Final Market Management System, we hereby notify you that the System (or a Subsystem or major component thereof) was deemed to have been correctly installed on the date specified below.

1. Description of the System (or relevant Subsystem or major component): An Interim Market Management System and a Final Market Management System for the Philippines Wholesale Electricity Spot Market (WESM) that include the following functions: market administration, market operations, and financial reconciliation.
2. Date of Installation: _____

Notwithstanding the above, you are required to complete the outstanding items listed in the attachment to this certificate as soon as practicable. This letter shall not relieve you of your obligation to achieve Operational Acceptance of the System in accordance with the Contract nor of your obligations during the Warranty Period.

For and on behalf of the Purchaser

Signed:
Date:
in the capacity of: Project Manager

## 7.2 Operational Acceptance Certificate Form

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: _____

Dear Sir or Madam:

Pursuant to GCC Clause 27.3 of the Contract (Commissioning and Operational Acceptance) entered into between yourselves and the National Power Corporation (hereinafter the "Purchaser") dated _____, relating to an Interim Market Management System and a Final Market Management System, we hereby notify you the System (or the Subsystem or major component identified below) successfully completed the Operational Acceptance Tests specified in the Contract. In accordance with the terms of the Contract, the Purchaser hereby takes over the System (or the Subsystem or major component identified below), together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the System (or Subsystem or major component): An Interim Market Management System and a Market Management System for the Philippines Wholesale Electricity Spot Market (WESM) that include the following functions: market administration, market operations, and financial reconciliation.

2. Date of Operational Acceptance: _____

This letter shall not relieve you of your remaining performance obligations under the Contract nor of your obligations during the Warranty Period.

For and on behalf of the Purchaser

Signed:
Date:
in the capacity of: Project Manager





# 8. Change Order Procedures and Forms

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

CONTENTS

General
Change Order Log
References for Changes

ANNEXES

8.1 Change Request Proposal Form
8.2 Change Estimate Proposal Form
8.3 Estimate Acceptance Form
8.4 Change Proposal Form
8.5 Change Order Form
8.6 Pending Agreement Change Order Form
8.7 Application for Change Proposal Form

General

This section provides samples of procedures and forms for carrying out changes to the System during the performance of the Contract in accordance with GCC Clause 39 of the Contract (Change to the System).

Change Order Log

The Supplier shall keep an up-to-date Change Order Log to show the current status of Change Requests and Changes Orders authorized or pending. Changes shall be entered regularly in the Change Order Log to ensure that the log is kept up-to-date. The Supplier shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Purchaser.

References to Changes

(1) Change Request Proposals shall be serially numbered CR-X-nnn.
(2) Change Estimate Proposals shall be serially numbered CN-X-nnn.
(3) Estimate Acceptances shall be serially numbered CA-X-nnn.
(4) Change Proposals shall be serially numbered CP-X-nnn.
(5) Change Orders shall be serially numbered CO-X-nnn.

**Note:** (a) Change Requests issued from the Purchaser's Home Office and the site representatives of the Purchaser shall have the following respective references:

| | |
|---|---|
| Home Office | CR-H-nnn |
| Site | CR-S-nnn |

(b) The above number "nnn" is the same for a Change Request Proposal, a Change Estimate Proposal, an Estimate Acceptance, a Change Proposal, and a Change Order.





## 8.1 Change Request Proposal Form

(Purchaser's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: _____
Attention: _____

Dear Sir or Madam:

With reference to the above-referenced Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within _____ days of the date of this letter.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Originator of Change: Purchaser: National Power Corporation
   Supplier: (by Application for Change Proposal No. _____
4. Brief Description of Change: _____
5. System: Interim Market Management System and Final Market Management System
6. Technical documents and/or drawings for the request of Change:

   Document or Drawing No. Description
7. Detailed conditions or special requirements of the requested Change: _____
8. Procedures to be followed:
   (a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.
   (b) Your estimate shall include the time it will take to complete the requested Change and the impact, if any, it will have on the date when Operational Acceptance of the entire System agreed in the Contract.
   (c) If you believe implementation of the requested Change will have a negative impact on the quality, operability, or integrity of the System, please provide a

detailed explanation, including other approaches that might achieve the same impact as the requested Change.

(d) You should also indicate what impact the Change will have on the number and mix of staff needed by the Supplier to perform the Contract.

(e) You shall not proceed with the execution of work related to the requested Change until we have accepted and confirmed the impact it will have on the Contract Price and the Implementation Schedule in writing.

For and on behalf of the Purchaser

Signed:
Date:
in the capacity of: Project Manager





## 8.2 Change Estimate Proposal Form

(Supplier's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: National Power Corporation
Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Attention: Rizalino Santos

Dear Sir or Madam:

With reference to your Change Request Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change in accordance with GCC Clause 39.2.1 of the Contract. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Clause 39.2.2, is required before we proceed to prepare an estimate of the cost of carrying out the Change work.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Brief Description of Change: _____

4. Schedule Impact of Change: _____

5. Cost for Preparation of Change Proposal: (US$_____), as detailed below in the breakdown of prices, rates, and quantities.

For and on behalf of the Supplier

Signed:
Date:
in the capacity of: _____

## 8.3 Estimate Acceptance Form

(Purchaser's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: National Power Corporation
Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Attention: Rizalino Santos

Dear Sir or Madam:

We hereby accept your Change Estimate and agree that you should proceed with the preparation of a formal Change Proposal.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Change Estimate Proposal No./Rev.: _____
4. Estimate Acceptance No./Rev.: _____
5. Brief Description of Change: _____
6. Other Terms and Conditions: _____

In the event that we decide not to order the Change referenced above, you shall be entitled to compensation for the cost of preparation of the related Change Proposal described in your Change Estimate Proposal mentioned in Paragraph. 3 above in accordance with GCC Clause 39 of the General Conditions of Contract.

For and on behalf of the Purchaser

Signed:
Date:





in the capacity of: Project Manager

## 8.4 Change Proposal Form

(Supplier's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: National Power Corporation
Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Attention: Rizalino Santos

Dear Sir or Madam:

In response to your Change Request Proposal No. _____, we hereby submit our proposal as follows:

1. Title of Change: _____
2. Change Proposal No./Rev.: _____
3. Originator of Change: Purchaser _____
   Supplier _____
4. Brief Description of Change: _____
5. Reasons for Change: _____
6. The System Subsystem, major component, or equipment that will be affected by the requested Change: _____
7. Technical documents and/or drawings for the requested Change:
   Document or Drawing No. _____ Description _____
8. Estimate of the increase/decrease to the Contract Price resulting from the proposed Change: (US$_____), as detailed below in the breakdown of prices, rates, and quantities.

   Total lump sum cost of the Change: _____





Cost to prepare the Estimate of the Change (i.e., the amount payable if the Change is not accepted)

9. Additional Time for Achieving Operational Acceptance required due to the Change: _____
10. Effect on the Functional Guarantees: _____
11. Effect on the other terms and conditions of the Contract: _____
12. Validity of this Proposal: for a period of _____ days after receipt of this Proposal by the Purchaser
13. Procedures to be followed:
    (a) You are requested to notify us of your acceptance, comments, or rejection of this detailed Change Proposal within _____ days from your receipt of this Proposal.
    (b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.
    (c) Supplier's cost for preparation of this Change Proposal (if any): US$_____

For and on behalf of the Supplier

Signed:
Date:
in the capacity of: _____

## 8.5 Change Order Form

(Purchaser's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: _____

Attention: _____

Dear Sir or Madam:

We hereby approve the Change Order for the work specified in Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion, and/or other conditions of the Contract in accordance with GCC Clause 39 of the Contract.

1. Title of Change: _____

2. Change Request No./Rev.: _____

3. Change Order No./Rev.: _____

4. Originator of Change: Purchaser: _____
   Supplier: _____

5. Authorized Price for the Change: US$_____
   Ref. No.: _____ Date: _____

6. Adjustment of Time for Achieving Operational Acceptance: _____

7. Other effects, if any: _____

For and on behalf of the Purchaser
Signed:
Date:
in the capacity of: Project Manager

For and on behalf of the Supplier

Signed:
Date:





in the capacity of: _____

## 8.6 Pending Agreement Change Order Form

(Purchaser's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: _____
Attention: _____

Dear Sir or Madam:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 39 of the Contract.

1. Title of Change: _____
2. Purchaser's Change Request Proposal No./Rev.: _____
3. Supplier's Change Proposal No./Rev.: _____
4. Brief Description of Change: _____
5. The System, Subsystem, or equipment component affected by the requested Change: _____
6. Technical documents and/or Reference Drawings for the requested Change:

   Document or Drawing No.: Description:

7. Adjustment of Time for Achieving Operational Acceptance: _____
8. Other change in the Contract terms: _____
9. Other terms and conditions: _____

For and on behalf of the Purchaser

Signed:





Date:
in the capacity of: Project Manager

## 8.7 Application for Change Proposal Form

(Supplier's Letterhead)

Date: _____
Loan/Credit Number: _____
IFB: _____
Contract: _____

To: National Power Corporation
Market Operations Group
Quezon Avenue, Corner Aghan Road
Diliman, Quezon City 1104
Philippines

Attention: Rizalino Santos

Dear Sir or Madam:

We hereby propose that the below-mentioned work be treated as a Change to the System.

1. Title of Change: _____
2. Application for Change Proposal No./Rev.: _____
3. Brief Description of Change: _____
4. Reasons for Change: _____
5. Order of Magnitude Estimation: US$ _____
6. Schedule Impact of Change: _____
7. Effect on Functional Guarantees, if any: _____
8. Appendix: _____

For and on behalf of the Supplier

Signed:
Date:
in the capacity of: _____

# Attachment H

## Pre-Qualification Document
## Letter with 3 attachments

Date

Attn:

Re: Prequalification - Philippines Market Management System

Dear _____:

The Department of Energy will be issuing a Specification for the procurement of a Market Management System, and is soliciting shows of interest and supporting information from Suppliers in order to compile a list of qualified Bidders.

Qualified Bidders will be those Suppliers who can demonstrate that they have:

- experience in completing projects of similar size and complexity;
- the system and software components required for system implementation;
- a history of on-time project delivery and good customer support; and
- strong company commitment, including financial resources, to the business and project.

Attached are:

1. PROJECT DESCRIPTION – providing an overview of the system and support requirements;
2. COMMERCIAL CONSIDERATIONS – providing guidance on the form of and requirements for a contract;
3. QUESTIONNAIRE and INFORMATION REQUEST – requesting specific information to determine your qualifications as a serious Bidder for this procurement.

Your response to this request must be received at the following address by 5:00 p.m., local Philippines time, on October 5, 2001 to be considered. Submittals received after that time will be returned unopened. Please limit your submittals to the answers to the specific questions raised. Neither proposal boilerplate nor technical detail is being solicited at this time.

Mr. Chrysanthus S. Heruela
Acting Assistant Director
Energy Planning and Monitoring Bureau
Department of Energy
Merrit Road, Fort Bonifacio
Taguig City, Metro Manila
Philippines

In addition, please submit individual copies of your submittals to:

Mr. Mario R. Pangilinan
Department Manager
Market Operations
National Power Corporation
Quezon Ave. cor. Aghan Road
Diliman, Quezon City 1104
Philippines

Edward H. P. Chan
President
Utility Consulting International
20370 Town Center Lane Suite 211
Cupertino CA 95014

Please refer all questions concerning this Prequalification questionnaire, the system itself, and/or the procurement process to the undersigned.

Regards,

[PURCHASING AGENT]

# PROJECT DESCRIPTION

## OVERVIEW

The Philippines Government has passed a bill directing the restructuring of the electricity industry and the creation of a Philippines Electricity Market (PEM). The effort to implement the restructuring has been planned and is being carried out by three agencies within the Philippines:

- Department of Energy
- Energy Regulatory Commission
- National Power Corporation

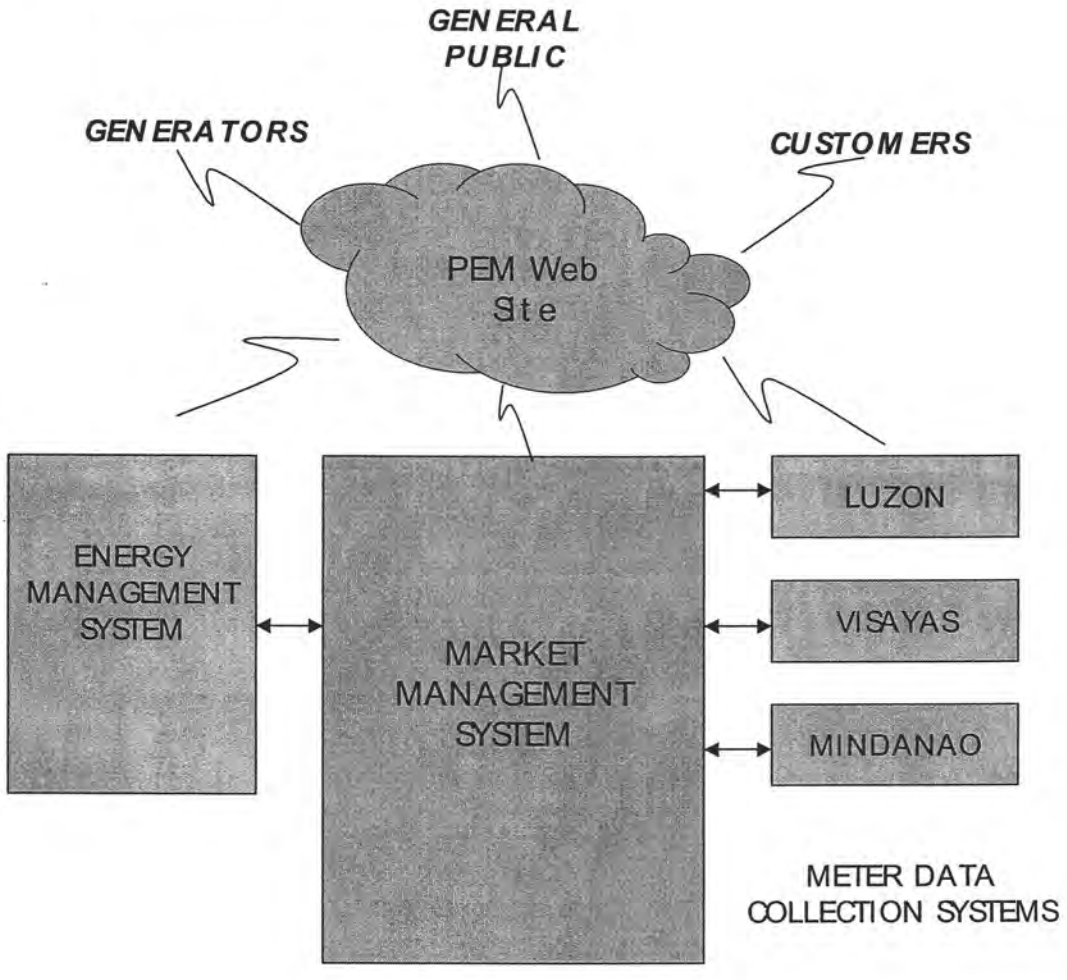
The Market Rules, which govern the creation of the market infrastructure and the ongoing management of market operations, have directed that the PEM shall be run by a Market Operator and that the necessary Information Technology infrastructure be put in place to facilitate market activities.

The Market Operator has responsibility for market pre-commencement activities, market administration, market operations and assurance of the market's conformance to the rules. The Market Management System will provide the functions and capabilities required by the MO.

The Information Technology infrastructure required to enable the Market Operator (MO) to direct the Philippines Electricity Market (PEM) in accordance with the Market Rules comprises:

- Market Management System (MMS)
- Energy Management System (EMS)
- Meter Data Collection Systems
- Communications Infrastructure

These components are shown pictorially below.




This project will consist of the Market Management System and those portions of the Communications Infrastructure required for interfacing with Market Participants as shown in blue in the diagram. Changes required to the Energy Management System and the Meter Data Collection Systems will be implemented under separate contracts. The interfaces to these other system elements will be defined in the Specification.

## *MARKET FUNCTIONS*

The MMS will provide the MO with all functions required for market creation and operations. These are in three categories:

### ***Market Administration***

The MMS will provide functions to enable the MO to set up the initial market and to administer the market in accordance with the rules. Specific functions include:

- Participant Registration – All Participants in the market, including Generators, Customers, Network Service Providers, and Metering Providers will be required to submit registration data detailing their proposed involvement in the market.
- Retention of Standing Data – The MMS will contain all relevant data regarding the market participants' entities, personnel contact information, generating unit data, load data, ancillary services and all other data necessary for operations.
- Audit – The operation of the market in accordance with the market rules and the security of the MMS will be assured by periodic, planned and spontaneous audits by authorized personnel. Audit trails of all activities will be required.

### ***Market Operations***

The operation of the PEM will require close collaboration between the MO, utilizing the MMS and the System Operator (SO), utilizing the EMS. The interface between the systems and associated operators will be key to the success of the PEM. The MO will administer the market in accordance with the market rules; the SO will dispatch energy according to schedules provided by the MO, and will maintain electric system security. The specific functions to be included in the MMS are:

- Offers/Bids Processing – All offers for generation and bids for energy, and offers for ancillary services, will be sent to the MMS by Generators and Customers. The Offers and Bids will be validated and processed and used as input data for the security-constrained dispatch.
- Information Processing – Other data required for dispatch optimization will be collected by the MMS. These include the network model, security constraints, outages, generation data, load forecasts and current operating parameters.

- Dispatch Engine - The optimization program used for determining week-ahead, day-ahead and real-time dispatch will be run in the MMS. The algorithm will be defined by the Market Rules.
- Dispatch Schedules Preparation – The MMS will provide the required dispatch schedules to the SO for each trading interval. The MMS will also provide day-ahead and week-ahead schedules to Market Participants.

### ***Financial Reconciliation***

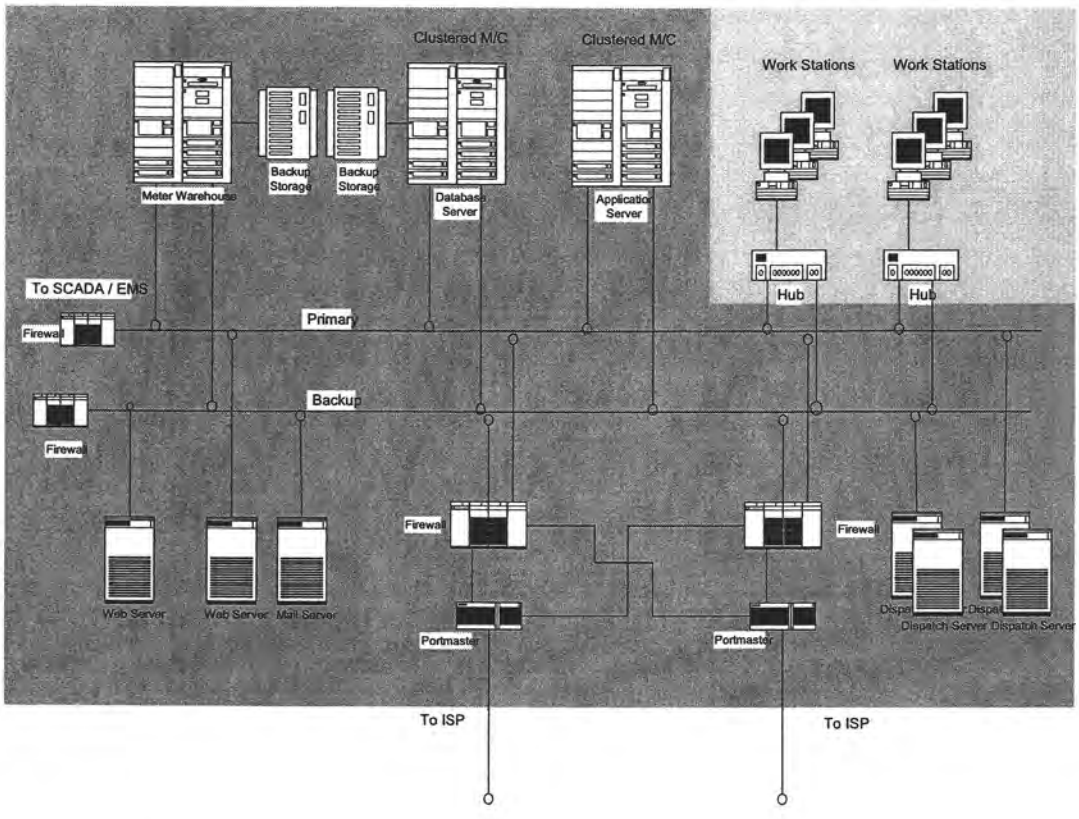
The MMS will provide for all settlements for power supplied and for power consumed for each Generator and for each Customer, per trading interval and per market trading node. The functions required will include:

- Meter Data Collection – Retrieval of metering data from collection systems in each of three regions receipt of data from alternative sources, and data validation and conversion as required for settlements processing.
- Meter Data Storage - Retention of meter data, including installation and certification data, raw values and aggregated values in historical and archival files, and all Settlements data.
- Settlements Processing – Determination and publication of preliminary and final statements for each trading interval and for each market trading node, in accordance with Market Rules.
- Statements Processing – Interface to Accounting and Electronic Funds Transfer systems for issuing bills and collection of payments.

## *SYSTEM ARCHITECTURE*

The system will be a high-availability, distributed system utilizing standard computer system components. Hardware and software will make use of standard products to the degree possible in order to minimize delivery schedules and maintenance costs.

The following diagram presents an overview of the system architecture:




## *SYSTEM INTERFACES*

The MMS will have three main interfaces:

- EMS – Interface to the existing EMS (supplied by GE-Harris) will be by a dual LAN to be provided by the MO. The detailed interface requirements including exchange protocol, periodicity and data content will be included in the Specification.
- Meter Data Collection - Interface to the three regional meter data collection systems will be dual-redundant; protocol and collection periodicity will be defined in the Specification.
- Market Participants – All other users of the PEM will interface via a PEM E-Commerce function, which will be part of this procurement. The PEM E-Commerce function will utilize the Internet (and Intranet) to provide a general interface for forms-based data transfer among Participants.

## SYSTEM SIZING

The MMS will be specified for Initial and Ultimate Sizing Parameters, with the architecture allowing expansion to accommodate Ultimate requirements. The Table below provides some representative sizing parameters to allow potential Bidders to understand the extent of the system.

| Parameter | Initial Requirement |
|---|---|
| Participants | 400 |
| Offers/Bids per Day per Participant | 10 |
| Network Model-Buses | 700 |
| User Positions | 12 |

## PROJECT MANAGEMENT AND SUPPORT

The MMS is the key component of the Information Technology infrastructure to be used for PEM operations. The demonstrated ability to manage a system of this size and complexity, and to meet schedule commitments is an important consideration in selecting Bidders for this procurement. The Purchaser intends to coordinate detailed schedules for the MMS with other activities related to preparation for the PEM.

The assurance of support to the Market Operator both during implementation and market operations is an important consideration of the procurements. This will apply to hardware and software components, documentation and training programs as well as all integration activities.

# COMMERCIAL CONSIDERATIONS

## GENERAL

The Department of Energy (DOE) is responsible for the procurement of the Market Management System, utilizing World Bank and Asian Development Bank (ADB) loans. The loans support timely creation of the PEM, which is reflected in the terms of the loans. Schedule performance will be an important consideration. The final Contract for the MMS will include provisions for satisfying all requirements of the loans.

## BID PROCESS

The Purchaser intends to take the following steps in completing a Contract for the MMS. The schedule is aggressive and reflects the importance of the MMS in bringing the PEM to operational status:

| TASK | DATE |
|---|---|
| Issue Pre-qualification Document with this transmittal. | Completed |
| Receive Pre-qualification responses | October 5, 2001 |
| Evaluate responses and select final set of Bidders | October 12, 2001 |
| Release Specification and bidding Documents to qualified Bidders | November 3, 2001 |
| Provide individual Question/Answer sessions, as requested, on the Specification in Manila | November 26-30, 2001 |
| Receive technical and price proposals from Bidders | January 11, 2002 |
| Review Proposals and select evaluated winner. Note that this process may include presentations/ demonstrations of individual Contractor offerings in Manila or at Contractor's facility | March 15, 2002 |
| Prepare final Contract documents with selected Contractor | March 18-22, 2002 |

## *USE OF CONSULTANT*

The Purchaser has contracted with Utility Consulting International to assist in preparing the MMS Specification and in evaluating submitted proposals.

## *PROJECT SCHEDULE*

The completion of this project on an accelerated schedule is of utmost importance. The system must be delivered on-site in Manila by April 15, 2003 and the PEM must be in operation by October 15, 2003.

## *TERMS AND CONDITIONS*

Contract Terms and Conditions will be in accordance with World Bank and Asian Development Bank loan requirements and Philippines Government Regulations. There will be a requirement for Liquidated Damages tied to on-time delivery and operation.

## *PAYMENT MILESTONES*

Payment milestones will be defined in the Bid Documents.

## *QUALIFICATION CRITERIA*

In determining the qualifications of the potential Bidders to provide proposals for this project, the Purchaser will evaluate Questionnaire and Information Request Responses (and only, those responses) with regard to:

- Experience in providing systems of comparable size and complexity;
- Demonstrated ability to meet project schedules;
- Availability of required functions in field installations
- Financial strength of company and operation bidding
- Capacity to perform on this project in accordance with the schedule

# QUESTIONNAIRE/INFORMATION REQUEST

The following questions have been prepared specifically to determine potential Bidders' qualifications to meet the requirements for the Market Management System. Responses to the questions should be complete but concise, and self-contained, i.e., without the need to refer to supporting materials, inasmuch as possible.

## A. COMPANY

1. Please provide the full name and contact information of the specific operation within your company which would be providing a proposal for the MMS.
2. Please provide financial data regarding your company's business, directly related to the proffering operation and to this business segment over the last five years.
3. Please provide the number of personnel employed at the proffering operation and at each supporting geographic location. Provide a summary of your plans for support in the Philippines.

## B. PROJECT MANAGEMENT

1. What processes and tools are used to monitor project progress and to identify potential obstacles to meeting commitments as early in the project as possible? Please provide a summary of the process.
2. What percentage of total personnel work in project management activities? How many projects of this size are under the responsibility of one project manager?
3. What major subcontractors do you anticipate would be used on this Contract? If they are supplying major operational functions, as opposed to computer systems hardware and software, please provide answers to C and E below for those companies.

## C. PROJECT PERFORMANCE

1. Please provide the following information for projects completed within the last three years or projects now on order, for systems of comparable size and functionality:
   a. Customer Name
   b. Location/Address
   c. Contact Person
   d. Project Designation
   e. Year Delivered

f. Present Status

g. Months from Award to Operational Status

h. Approximate Value of Contract

i. List of Functions - as relevant to the MMS

2. Please provide a comparison of months between contract award and achieving operational status:

   a. As estimated at contract award, and

   b. As actually occurred,

   for all projects greater than $2M delivered in the last three years.

3. Please comment on your ability to supply the necessary resources to the MMS project to meet the proposed schedule, considering your existing workload.

## D. SYSTEM

1. Describe those aspects of your system architecture that would qualify it as an open, distributed architecture.
2. Are there any portions of your architecture of system design that would require significant extensions for the MMS (as understood at this time)?
3. Please provide any analyses made of the general cost of ownership of your system, including maintenance, support and upgrade activities.

## E. FUNCTIONS

1. Please provide a matrix showing where each of the following functions has been supplied and where it can be demonstrated:

   a. Participant Registry

   b. Offer/Bid Processing

   c. Interface between MMS and EMS

   d. Dispatch Engine

   e. Load Forecast

   f. Meter Data Collection

   g. Meter Data Processing

   h. Data Warehouse

   i. Settlements Processing

   j. Internet-based User Interface

2. Have you implemented an Internet-based interface for Market Participants or do you have experience with any similar implementation? What portions were subcontracted?
3. What are sizing constraints and representative execution times for your standard security-constrained dispatch program? Please provide a description of the algorithm used for this function.

## F. COMMERCIAL

1. Do you have previous experience with projects involving:
   a. ADB loans; or
   b. Philippines Government Regulations?
2. Is your company willing and able to accept liquidated damages provisions on this project?
3. Please comment on the proposed schedule for implementation, and the measures necessary to ensure that it is met.

# Attachment I

# PEM Interim Market Conceptual View

# PEM Interim Market Conceptual View

**By**
**Utility Consulting International**

**29 October, 2001**

The Law RA 9136 enacted by The Republic of Philippines requires an Electricity Market to be established by June 26, 2002. The market shall entail the creation of Wholesale Electricity Spot Market (WESM) that will be managed by a Market Operator (MO) with a supporting IT infrastructure. The IT infrastructure will include the following key component systems:

- Market Management System (MMS)
- Energy Management System (EMS)
- Meter Data Collection System
- Communication system

A number of project constraints such as the level of initial funding and tight schedule make it prudent to establish an Interim Market Management System (IMMS) that would support a minimal level of required functionality for market operation. The IMMS specifications, annotations to the market rules, and a project plan provide greater detail on how this would be achieved. The purpose of this document is to provide a conceptual description of the interim market.

The Interim Market shall include the following attributes:

1. The interim market shall be designed and structured such that it can have a smooth transition to the final market.
2. The interim market shall contain a majority of the functions of the final market. The intent is to utilize a majority of the interim market software in the final market.
3. Minimal functionality required for starting the electricity market shall be completed and tested by the target date of June 26, 2002.
4. Audit trails shall be provided for all automated and/or manual actions.



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5. Trading participants' Settlements functions shall be completed for the interim market, with manual transmittal of invoices. Automated links to the Market Operator accounting system can be deferred for the final market.

6. The number of nodes for nodal pricing calculations shall be limited to ---nodes in order to contain data handling to a manageable level.

7. An automatic merit order dispatch "stack" shall be generated and presented to the SO by electronic transfer. The dispatch mechanism shall generate separate "stacks" for energy and ancillary services.

8. The trading interval shall be one hour, and the dispatch interval shall also be one hour for the interim market. However, the interim market design shall provide the flexibility to change the dispatch interval to 5 minutes (or a user specified time interval) in the final market, as dictated by the needs of the SO.

9. The ancillary services stipulated in the market rules shall be procured through fixed contracts.

10. Participation in the electricity market is mandatory for all generators whose name plate rating is greater or equal to X MW.

11. The load forecasts generated by SO shall be based upon the existing NPC load forecast procedures.

12. Meter data shall be supplied initially by the NPC Luzon MV-90 collection site for the Luzon and Visayas regions. The meter data shall be "settlement ready", although some of the underlying data may be entered manually into MV-90.

13. The SO and MO systems can be located physically at the existing NPC control center, but their market operations shall be decoupled with a "ring-fence".

14. The interim market will include only the Luzon and Visayas regions, and the Mindanao region will be added in the final market.

| Market Trading Period | Market Dispatch Period | Ancillary Service Procurement | Compliance Monitoring |
|---|---|---|---|
| 60 minutes | 60 minutes | By contract | By SO |



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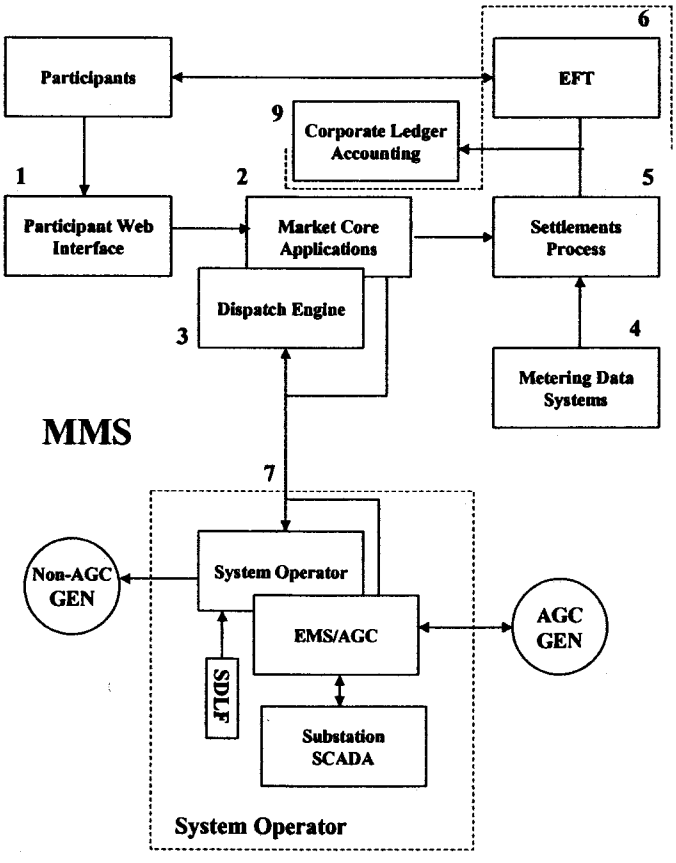
## Interim Market Functional Relationships




## Interim Market Functional Description

| Diagram Point | System or Interface | Summary Description of Interim Market Functionality |
|---|---|---|
| 1 | MMS Participant Web Interface | The Participant Interface will be provided by a web-based user-friendly internet interface; trading participants submit offers and other data for each trading period; Demand bids are not accommodated initially. |



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| Diagram Point | System or Interface | Summary Description of Interim Market Functionality |
|---|---|---|
| 2 | Market Core Applications | The interim market will provide nodal pricing on a regional basis; market processes will be performed manually for a number of functions such as prudential assessment, demand forecast data input, and real time constraints. There will be a simplified optimization of demand, constraints, prices, and ancillary services. |
| 3 | Dispatch engine | The energy resource dispatch stack shall be transferred as an electronic file to the SO; Ancillary services (A/S) will be procured primarily through fixed contracts, and evaluated to form a merit stack. The ancillary service dispatch stack may be provided to the SO in an electronic text format; Ancillary service allocation will be done by MO in consultation with the SO, by taking into account various types of generation resources; voltage and reactive power requirements will not be determined by the MO for the interim market; the dispatch engine will take into account transmission constraints in relieving transmission congestion. |



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| Diagram Point | System or Interface | Summary Description of Interim Market Functionality |
|---|---|---|
| 4 | Metering Data Systems | Meter data will be transferred automatically from the NPC MV-90 meter data collection center at Luzon, and will include market-related meter data for Luzon and Visayas that are made "settlement ready" by NPC. It will be transferred to the MO meter data warehouse. After re-validation and authorization, it will be used by the market settlement system, and stored for future use (reconciliation, disputes etc.); in the interim market, there will be a high level of manual intervention in the input process since automated meter data access will not be available for all market meters. |
| 5 | Settlements process | The interim market settlement process will be fully functional for processing each commodity charge type; Output of statements will be generated in common electronic formats; Reconciliation procedures will be established. For the interim market, the settlement data is transferred manually to the Market Operator Accounting system. The generation of EFT statements will be automated within settlements. |
| 6 | EFT | The output from the market Settlement processes (invoices and statements) will not be initially integrated with the MO accounting system, but EFT is expected to be available. Invoices / statements may be initiated manually from the Settlement system statements. |



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| Diagram Point | System or Interface | Summary Description of Interim Market Functionality |
|---|---|---|
| 7 | Market Interface With SO | The interim MMS must interface with the existing EMS or the new EMS. Similar day load forecast (SDLF) data (generated by the SO) will be provided to the MO; Once approved by the SO, outage schedules will be furnished to the MO in electronic text format, which will be reviewed and processed; Congestion tables will be created and forwarded by the SO for use by MO, either as a "standing table" for a specified period (not to exceed 24 hours) or manually as required by the congestion path update; Voltage/reactive power and reserve capacity requirements will be determined by SO and furnished to the MO electronically. |

The Philippine national grid experiences transmission congestion, and even in the interim market that condition must be managed. The final market will specify automated, user-friendly congestion management software, but that will not be available by the start of the interim market. In the interim market, congestion will be handled by "tables" created by the SO and provided to the MO in electronic format.

Bilateral transactions shall be accommodated in the interim market. Nodal pricing on a regional basis will be specified for the interim system. The number of nodes in each Region will have to be determined to ensure minimal pricing errors at different nodes.

Manual prudential assessment, reliance upon contracted ancillary services (A/S), and an impartial operation of the grid and the market must be provided in the interim market. As far as is practicable, the interim market rules, software, and IT systems must be a subset of those for the final market.



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The interim Market Participant (MP) interface will continue to serve as the interface in the final market. The templates used for the interim market will be the same as those intended for the final market. The main difference would be that in the interim market some fields need not be completed and the validation and processing will therefore be specific to the interim market.

The participant interface function will serve to submit offers, as well as to receive acknowledgement (acceptance or rejection of those submittals). Demand bids are not to be accommodated during the initial market period. Limited market reports will be available to Participants through the interface.

Both the interim and final systems will provide the necessary validation by participant, commodity type, time period, price, quantity, location, characteristics, and other data parameters such as data submittal within limits as defined in the standing (master) database. The primary difference between the interim market and the final market is that for the interim market there will be fewer charge types and lesser volume to validate. Validations, processes, and audits will be accommodated by automatic flagging and manual supervision.

The major market processes shall include the following:

(a) **Market core processes,** including full validation, pricing, and interface processes with (b), (c), and (d);

(b) **Congestion management** will be accommodated but the entry of congestion data will be from tables that are calculated every four hours and manual input of "real time" constraints. The systems will automatically process this congestion data to provide a limited level of co-optimization of demand and congestion; Load forecast data will be received from the SO and manually input daily;

(c) The **generation dispatch** function (dispatch engine) creates the merit order "stack" of resources based upon the processed data (including load forecast data) and congestion data. The market dispatch "stacks" are provided to the System Operator; The EMS-AGC system provides control of the units selected for AGC (regulation);

(d) The **Settlements/Billing/EFT** processes will produce all the market settlement data related to (1) commodities and energy use, (2) accounting of debits and credits for energy and A/S, (3) grid use uplift, (4) administrative and O&M costs, and (5) electronic



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monetary transfers between the MO and Market Participants. Statements will be provided both to the accounts department and the EFT provider.

(e) **Metering**: Meter data acquisition, processing and warehouse functions are required for settlements. The process should be automated and free of manual intervention from the viewpoint of audit and accuracy.

There will be LAN/WAN and data links as specified for the final market system in order to facilitate SO-MO data exchange and data exchanges within the MO system. The interim market will essentially utilize the same data links as the final market. They will be sized appropriately to accommodate the final market.

The interface of the market systems with the GE-Harris EMS system is important for both the interim market and final market. The output of load forecasts, unit and grid status, as well as the acceptance of dispatch stacks from the market systems are important to both markets, but is mandatory for the final market.

The interim market shall be a stepping-stone to the final market. It is a complex project and the implementation will be demanding and poses potential risks. It will most likely take longer to implement the final market, along with higher cost, because of the time required for the development, testing and implementation of the interim market. Testing must be managed carefully to prevent interference with the grid operating system.

| Function | Final Market | Interim Market | Rationale |
|---|---|---|---|
| **Registration** | Electronic | Manual | Known Participants |
| **Bid Management** | Supply Offers<br>Re-bids<br>Back up bidding<br>Demand Bids<br>Ancillary Service Bids | Supply Offers<br>Limited Re-bids<br>Back up bidding | Market can operate without Demand side bidding<br>Ancillary Services initially will be fixed contracts through SO |
| **Variable System Data** | Auto Load of Demand Forecasts<br>Auto Load of Reserve Requirements<br>Auto Load of Constraints | Manual Load of Demand Forecasts<br>Manual Load of Reserve Requirements<br>Manual Load of Constraints | Unlikely EMS functions will be available by June 2002<br>Even Less likely that communication to SCADA / EMS will be commissioned |
| **Standing System Data** | Maintain Regions / Nodes<br>Maintain C. P.'s<br>Maintain Market Fees | Fixed Regions / Nodes<br>Fixed C. P.'s<br>Fixed Market Fees | Standing Data Can be input Manually for Market Start |



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| | | | |
|---|---|---|---|
| | Maintain VoLL<br>Maintain Inter-connectors<br>Dynamic Network Model<br>Maintain Timetables<br>Report Status<br>Auto C.P. Data Update | Fixed VoLL<br>Fixed Inter-connectors<br>Fixed Timetables | Reporting / Maintenance of Standing data not Essential for Market Start |
| **Expected Conditions** | Expected Conditions Forecast | No Expected Conditions Forecast | Not Essential for Market Start |
| **Pre-Dispatch** | Hourly Pre-Dispatch*<br>Determine Ancillary Service Requirements<br>Forecast Reserves | Hourly Pre-Dispatch* | A/S and Reserves on Contract |
| **Dispatch** | 5 minute Dispatch*<br>Solve on full Nodal Basis<br>Dynamic Constraints<br>Co-optimized for Ancillary Services<br>Output regulation requirements to AGC | 60 minute dispatch<br>Solve on limited Nodal Basis<br>Manual Constraints | Unlikely EMS functions will be available by June 2002<br>Even Less likely that communication to SCADA / EMS will be commissioned<br>A/S on Contract |
| **Dispatch Monitoring** | Record Dispatcher Instructions<br>Validate Dispatcher Instructions<br>Record Non- Conforming Units | Resource stack listings outputted to SO to be manually entered into EMS and/or dispatched with conventional methods | Not Essential for Market Start |
| **Metering** | Automatic Load of Meter Data<br>Meter data Warehouse<br>Data Reporting<br>Meter Transfers<br>Meter Administration | Manual Load of Meter Data | Unlikely Meter Data Warehouse functions will be available by June 2002 |
| **Reports** | General Reports<br>Confidential Reports<br>Ad-Hoc Reports | Limited General Reports<br>Confidential Reports | Ad-Hoc Reports Not Essential for Market Start<br>Fall back position Reporting via E-mail / Fax |
| **Participant Interface** | Offer & Bid Creation<br>Offer & Bid Submission<br>Price Reporting<br>Reports<br>Market Notices<br>E-mail<br>Help | Offer Creation<br>Offer Submission<br>Price Reporting<br>Reports<br>Market Notices | E-mail / Help Not Essential for Market Start<br>Fall back position Bidding done via E-mail / Fax |
| **Settlements** | Calculate Trading Amounts<br>Calculate Excess Energy Prices<br>Handle Market Fees<br>Maintain Billing Calendar<br>Generate Reports / Statements<br>Maintain Dispute Details<br>Automatic Prudential Processing<br>Manage Participant / Market Suspension | Calculate Trading Amounts<br>Calculate Excess Energy Prices<br>Handle Market Fees<br>Fixed Billing Calendar<br>Generate Reports / Statements<br>Maintain Dispute Details<br>Manual Prudential Processing<br>Manual Participant / | APC and Force Majeure Not Essential for Market Start<br>Re-Runs can be manual (No Archive Restore) |



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| | | | |
|---|---|---|---|
| | Adjust for VoLL<br>Adjust for Administered Price / Force Majeure<br>Handle Ancillary Services<br>Online Historic Re-Runs | Market Suspension<br>Adjust manually for VoLL | |
| **General** | Auditing<br>Disaster Recovery<br>Archive / Restore<br>Management Reporting<br>Full Integration of SCADA / EMS and MMS<br>Full integration of MMS and Metering Systems | Auditing | Only Auditing Essential for Market Start<br>Limited Funds for Interim Market<br>Unlikely Meter Data Warehouse functions will be available by June 2002<br>Unlikely that communication to SCADA / EMS will be commissioned |



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LIST OF POTENTIAL BIDDERS

ABB Systems Control
451 El Camino Real
Santa Clara, California 95050
USA
Attn: System Sales

Alstom ESCA Corporation
11120 NE 33rd Place
Bellevue WA 98004
USA
Attn: System Sales

GE-Harris Corporation
P.O. Box 430
Melbourne FL 39202-0430
USA
Attn: System Sales

Hi-Q Systems Limited
The Barn, Micheldever Station
Winchester
Hampshire SO21 3AR
United Kingdom
Attn: Mr. Ray Spears, General Manager, Energy Group

Logica UK Limited
Babbage House, Station Approach
Leatherhead
Surrey KT22 7LG
United Kingdom
Attn: Mr. Mike Mockford, Operations Director

Real Time Engineering Limited
Academy House, Academy Park
Gower Street
Glasgow G51 1PR
Scotland
Attn: System Sales

Siemens Energy Management and Information Systems
7225 Northland Drive
Brooklyn Park MN 55428-1540
USA
Attn: System Sales