REQUEST FOR PROPOSALS

TECHNICAL ASSISTANCE FOR THE CENTRAL POWER RESEARCH INSTITUTE SMART GRID TEST BED PROJECT

Submission Deadline: **4:00 PM**

LOCAL TIME

March 17, 2014

Submission Place:

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SEALED PROPOSALS SHALL BE CLEARLY MARKED AND RECEIVED PRIOR TO THE TIME AND DATE SPECIFIED ABOVE. PROPOSALS RECEIVED AFTER SAID TIME AND DATE WILL NOT BE ACCEPTED OR CONSIDERED.

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Section 1: INTRODUCTION

The U.S. Trade and Development Agency (USTDA) has provided a grant in the amount of US$692,000 to the Central Power Research Institute (the "Grantee") in accordance with a grant agreement dated June 24, 2013 (the "Grant Agreement"). This Technical Assistance (Technical Assistance") grant will support the preparation of a detailed planning and procurement document for the implementation of a Smart Grid Test Bed project in Bangalore, India ("Host Country"). The test bed, which will consist of an integrated Interoperability Laboratory and Smart Grid Technology Demonstration Center, will allow the Grantee to research and perform controlled evaluations of integrated Smart Grid technologies. The Grant Agreement is attached at Annex 4 for reference. The Grantee is soliciting technical proposals from qualified U.S. firms to provide expert consulting services to perform the Technical Assistance.

1.1 BACKGROUND SUMMARY

This Technical Assistance grant to CPRI will support the preparation of a detailed planning and procurement document for the implementation of a Smart Grid Test Bed project in Bangalore, India. The test bed, which will consist of an integrated Interoperability Laboratory and Smart Grid Technology Demonstration Center, will facilitate the Grantee to research and perform controlled evaluations of integrated Smart Grid technologies including substation automation, load management, smart meters, cyber security network sensing, energy management, renewables integration, and applications for plug-in hybrid electric vehicles (PHEV). If implemented, the Smart Grid Test Bed and related facilities would be used by manufacturers, utilities, services firms and academics for various testing, certification and training activities. This Technical Assistance intends to facilitate the adoption of Smart Grid pilot projects as well as the full-scale deployment of Smart Grid technologies.

The proposed TA has been identified by CPRI as a top priority, since it would help facilitate the research and testing of commercial and pre-deployment technologies and system approaches for a variety of Smart Grid applications. Portions of a background Definitional Mission are provided for reference in Annex 2.

1.2 OBJECTIVE

The objective of the Technical Assistance is to assist the Grantee with the preparation of a blue print containing detailed planning and procurement document for the implementation of a Smart Grid Test Bed project in Bangalore, India. The Terms of Reference (TOR) for this Technical Assistance are attached as Annex 5.

1.3 PROPOSALS TO BE SUBMITTED

Technical proposals are solicited from interested and qualified U.S. firms. The administrative and technical requirements as detailed throughout the Request for Proposals (RFP) will apply. Specific proposal format and content requirements are detailed in Section 3.

The amount for the contract has been established by a USTDA grant of US$692,000. **The USTDA grant of $US692,000 is a fixed amount. Accordingly, COST will not be a factor in the evaluation and therefore, cost proposals should not be submitted**. Upon detailed evaluation of technical proposals, the Grantee shall select one firm for contract negotiations.

1.4 CONTRACT FUNDED BY USTDA

In accordance with the terms and conditions of the Grant Agreement, USTDA has provided a grant in the amount of US$692,000 to the Grantee. The funding provided under the Grant Agreement shall be used to fund the costs of the contract between the Grantee and the U.S. firm selected by the Grantee to perform the TOR. The contract must include certain USTDA Mandatory Contract Clauses relating to nationality, taxes, payment, reporting, and other matters. The USTDA nationality requirements and the USTDA Mandatory Contract Clauses are attached at Annexes 3 and 4, respectively, for reference.

Section 2: INSTRUCTIONS TO OFFERORS

2.1 PROJECT TITLE

The project is called the Central Power Research Institute Smart Grid Test Bed Project.

2.2 DEFINITIONS

Please note the following definitions of terms as used in this RFP.

The term "Request for Proposals" means this solicitation of a formal technical proposal, including qualifications statement.
The term "Offeror" means the U.S. firm, including any and all subcontractors, which responds to the RFP and submits a formal proposal and which may or may not be successful in being awarded this procurement.

2.3 DEFINITIONAL MISSION REPORT

USTDA sponsored a Definitional Mission to address technical, financial, sociopolitical, environmental and other aspects of the proposed project. Portions of the report are attached at Annex 2 for background information only. Please note that the TOR referenced in the report are included in this RFP as Annex 5.

2.4 EXAMINATION OF DOCUMENTS

Offerors should carefully examine this RFP. It will be assumed that Offerors have done such inspection and that through examinations, inquiries and investigation they have become familiarized with local conditions and the nature of problems to be solved during the execution of the Technical Assistance.

Offerors shall address all items as specified in this RFP. Failure to adhere to this format may disqualify an Offeror from further consideration.

Submission of a proposal shall constitute evidence that the Offeror has made all the above mentioned examinations and investigations, and is free of any uncertainty with respect to conditions which would affect the execution and completion of the Technical Assistance.

2.5 PROJECT FUNDING SOURCE

The Technical Assistance will be funded under a grant from USTDA. The total amount of the grant is not to exceed US$692,000.

2.6 RESPONSIBILITY FOR COSTS

Offeror shall be fully responsible for all costs incurred in the development and submission of the proposal. Neither USTDA nor the Grantee assumes any obligation as a result of the issuance of this RFP, the preparation or submission of a proposal by an Offeror, the evaluation of proposals, final selection or negotiation of a contract.

2.7 TAXES

Offerors should submit proposals that note that in accordance with the USTDA Mandatory Contract Clauses, USTDA grant funds shall not be used to pay any taxes, tariffs, duties, fees or other levies imposed under laws in effect in the Host Country.

2.8 CONFIDENTIALITY

The Grantee will preserve the confidentiality of any business proprietary or confidential information submitted by the Offeror, which is clearly designated as such by the Offeror, to the extent permitted by the laws of the Host Country.

2.9 ECONOMY OF PROPOSALS

Proposal documents should be prepared simply and economically, providing a comprehensive yet concise description of the Offeror's capabilities to satisfy the requirements of the RFP. Emphasis should be placed on completeness and clarity of content.

2.10 OFFEROR CERTIFICATIONS

The Offeror shall certify (a) that its proposal is genuine and is not made in the interest of, or on behalf of, any undisclosed person, firm, or corporation, and is not submitted in conformity with, and agreement of, any undisclosed group, association, organization, or corporation; (b) that it has not directly or indirectly induced or solicited any other Offeror to put in a false proposal; (c) that it has not solicited or induced any other person, firm, or corporation to refrain from submitting a proposal; and (d) that it has not sought by collusion to obtain for itself any advantage over any other Offeror or over the Grantee or USTDA or any employee thereof.

2.11 CONDITIONS REQUIRED FOR PARTICIPATION

Only U.S. firms are eligible to participate in this tender. However, U.S. firms may utilize subcontractors from the Host Country for up to 20 percent of the amount of the USTDA grant for

specific services from the TOR identified in the subcontract. USTDA's nationality requirements, including definitions, are detailed in Annex 3.

2.12 LANGUAGE OF PROPOSAL

All proposal documents shall be prepared and submitted in English, and only English.

2.13 PROPOSAL SUBMISSION REQUIREMENTS

The **Cover Letter** in the proposal must be addressed to:

Mr. V. Arunachalam
Additional Director
Utility Automation Research Centre
Central Power Research Institute
Prof. Sir C.V. Raman Road, Post Box No: 8066,
Sadasiva Nagar (p.o.),
Bangalore, Karnataka State
India
Pin code: 560 080

Phone: +91(80) - 2360 2920, 2360 0045,
Fax: +91(80) -2360 1213, 2360 2920
E-Mail: varun@cpri.in

An Original and four (4) copies of your proposal must be received at the above address no later than 4:00 PM on March 17, 2014.

Proposals may be either sent by mail, overnight courier, or hand-delivered. Whether the proposal is sent by mail, courier or hand-delivered, the Offeror shall be responsible for actual delivery of the proposal to the above address before the deadline. Any proposal received after the deadline will be returned unopened. The Grantee will promptly notify any Offeror if its proposal was received late.

Upon timely receipt, all proposals become the property of the Grantee.

2.14 PACKAGING

The original and each copy of the proposal must be sealed to ensure confidentiality of the information. The proposals should be individually wrapped and sealed, and labeled for content including the name of the project and designation of "original" or "copy number x." The original and four (4) copies should be collectively wrapped and sealed, and clearly labeled, including the contact name and the name of the project.

Neither USTDA nor the Grantee will be responsible for premature opening of proposals not properly wrapped, sealed and labeled.

2.15 OFFEROR'S AUTHORIZED NEGOTIATOR

The Offeror must provide the name, title, address, telephone number, e-mail address and fax number of the Offeror's authorized negotiator. The person cited shall be empowered to make binding commitments for the Offeror and its subcontractors, if any.

2.16 AUTHORIZED SIGNATURE

The proposal must contain the signature of a duly authorized officer or agent of the Offeror empowered with the right to bind the Offeror. The authorization letter from the competent authority of the offeror shall be enclosed.

2.17 EFFECTIVE PERIOD OF PROPOSAL

The proposal shall be binding upon the Offeror for [NINETY (90) days after the proposal due date, and Offeror may withdraw or modify this proposal at any time prior to the due date upon written request, signed in the same manner and by the same person who signed the original proposal.

2.18 EXCEPTIONS

All Offerors agree by their response to this RFP announcement to abide by the procedures set forth herein. No exceptions shall be permitted.

2.19 OFFEROR QUALIFICATIONS

As provided in Section 3, Offerors shall submit evidence that they have relevant past experience and have previously delivered advisory, feasibility study and/or other services similar to those required in the TOR, as applicable.

2.20 RIGHT TO REJECT PROPOSALS

The Grantee reserves the right to reject any and all proposals without assigning any reasons.

2.21 PRIME CONTRACTOR RESPONSIBILITY

Offerors have the option of subcontracting parts of the services they propose. The Offeror's proposal must include a description of any anticipated subcontracting arrangements, including the name, address, and qualifications of any subcontractors. USTDA nationality provisions apply to the use of subcontractors and are set forth in detail in Annex 3. The successful Offeror shall cause appropriate provisions of its contract, including all of the applicable USTDA

Mandatory Contract Clauses, to be inserted in any subcontract funded or partially funded by USTDA grant funds.

2.22 AWARD

The Grantee shall make an award resulting from this RFP to the best qualified Offeror, on the basis of the evaluation factors set forth herein. The Grantee reserves the right to reject any and all proposals received.

2.23 COMPLETE SERVICES

The successful Offeror shall be required to (a) provide local transportation, office space and secretarial support required to perform the TOR if such support is not provided by the Grantee; (b) provide and perform all necessary labor, supervision and services; and (c) in accordance with best technical and business practice, and in accordance with the requirements, stipulations, provisions and conditions of this RFP and the resultant contract, execute and complete the TOR to the satisfaction of the Grantee and USTDA.

2.24 INVOICING AND PAYMENT

Deliverables under the contract shall be delivered on a schedule to be agreed upon in a contract with the Grantee. The Contractor may submit invoices to the designated Grantee Project Director in accordance with a schedule to be negotiated and included in the contract. After the Grantee's approval of each invoice, the Grantee will forward the invoice to USTDA. If all of the requirements of USTDA's Mandatory Contract Clauses are met, USTDA shall make its respective disbursement of the grant funds directly to the U.S. firm in the United States. All payments by USTDA under the Grant Agreement will be made in U.S. currency. Detailed provisions with respect to invoicing and disbursement of grant funds are set forth in the USTDA Mandatory Contract Clauses attached in Annex 4.

Section 3: PROPOSAL FORMAT AND CONTENT

To expedite proposal review and evaluation, and to assure that each proposal receives the same orderly review, all proposals must follow the format described in this section.

Proposal sections and pages shall be appropriately numbered and the proposal shall include a Table of Contents. Offerors are encouraged to submit concise and clear responses to the RFP. Proposals shall contain all elements of information requested without exception. Instructions regarding the required scope and content are given in this section. The Grantee reserves the right to include any part of the selected proposal in the final contract.

The proposal shall consist of a technical proposal only. A cost proposal is NOT required because the amount for the contract has been established by a USTDA grant of US$692,000, which is a fixed amount.

Offerors shall submit one (1) original and four (4) copies of the proposal. Proposals received by fax cannot be accepted.

Each proposal must include the following:

Transmittal Letter,
Cover/Title Page,
Table of Contents,
Executive Summary,
Firm Background Information,
Completed U.S. Firm Information Form,
Organizational Structure, Management Plan, and Key Personnel,
Technical Approach and Work Plan, including a statement confirming that the Offeror shall complete all the tasks outlined in the Terms of Reference , and
Experience and Qualifications.

Detailed requirements and directions for the preparation of the proposal are presented below.

3.1 EXECUTIVE SUMMARY

An Executive Summary should be prepared describing the major elements of the proposal, including any conclusions, assumptions, and general recommendations the Offeror desires to make. Offerors are requested to make every effort to limit the length of the Executive Summary to no more than five (5) pages.

3.2 U.S. FIRM INFORMATION

A U.S. Firm Information Form in .pdf fillable format is attached at the end of this RFP in Annex 6. The Offeror must complete the U.S. Firm Information Form and include the completed U.S. Firm Information Form with its proposal.

3.3 ORGANIZATIONAL STRUCTURE, MANAGEMENT, AND KEY PERSONNEL

Describe the Offeror's proposed project organizational structure. Discuss how the project will be managed including the principal and key staff assignments for this Technical Assistance. Identify the Project Manager who will be the individual responsible for this project. The Project Manager shall have the responsibility and authority to act on behalf of the Offeror in all matters related to the Technical Assistance.

Provide a listing of personnel (including subcontractors) to be engaged in the project, including both U.S. and local subcontractors, with the following information for key staff: position in the project; pertinent experience, curriculum vitae; other relevant information. If subcontractors are to be used, the Offeror shall describe the organizational relationship, if any, between the Offeror and the subcontractor.

A manpower schedule and the level of effort for the project period, by activities and tasks, as detailed under the Technical Approach and Work Plan shall be submitted. A statement confirming the availability of the proposed project manager and key staff over the duration of the project must be included in the proposal.

3.4 TECHNICAL APPROACH AND WORK PLAN

Describe in detail the proposed Technical Approach and Work Plan (the "Work Plan"). Discuss the Offeror's methodology for completing the project requirements. Include a brief narrative of the Offeror's methodology for completing the tasks within each activity series. Begin with the information gathering phase and continue through delivery and approval of all required reports.

Prepare a detailed schedule of performance that describes all activities and tasks within the Work Plan, including periodic reporting or review points, incremental delivery dates, and other project milestones.

Based on the Work Plan, and previous project experience, describe any support that the Offeror will require from the Grantee. Detail the amount of staff time required by the Grantee or other participating agencies and any work space or facilities needed to complete the Technical Assistance.

3.5 EXPERIENCE AND QUALIFICATIONS

Provide a discussion of the Offeror's experience and qualifications that are relevant to the objectives and TOR for the Technical Assistance. If a subcontractor(s) is being used, similar

information must be provided for the prime and each subcontractor firm proposed for the project. The Offeror shall provide information with respect to relevant experience and qualifications of key staff proposed. The Offeror shall include letters of commitment from the individuals proposed confirming their availability for contract performance.

As many as possible but not more than six (6) relevant and verifiable project references must be provided for each of the Offeror and any subcontractor, including the following information:

Project name,
Name and address of client (indicate if joint venture),
Client contact person (name/ position/ current phone and fax numbers, email id),
Period of Contract,
Description of services provided,
Dollar amount of Contract, and
Status and comments.

Offerors are strongly encouraged to include in their experience summary primarily those projects that are similar to the Technical Assistance as described in this RFP.

Section 4: AWARD CRITERIA

Individual proposals will be initially evaluated by a Procurement Selection Committee of representatives from the Grantee. The Committee will then conduct a final evaluation and completion of ranking of qualified Offerors. The Grantee will notify USTDA of the best qualified Offeror, and upon receipt of USTDA's no-objection letter, the Grantee shall promptly notify all Offerors of the award and negotiate a contract with the best qualified Offeror. If a satisfactory contract cannot be negotiated with the best qualified Offeror, negotiations will be formally terminated. Negotiations may then be undertaken with the second most qualified Offeror and so forth.

The selection of the Contractor will be based on the following criteria:

Technical Proposal 40 points

Technical approach for performing the analysis and developing overall recommendations for a multi-disciplinary Smart Grid Test Bed, including developing the project design concept, technical specification and costs, and bidding documents for the Project (20).

Technical approach for developing the workshop and study tour (10)

Description and approach for developing a financing plan, developmental impact and environmental impact assessments for the Project. (10)

Personnel and Management Plan 40

Experience and expertise of the Project Manager in designing and supervising the planning, design, and implementation of Smart Grid Test Bed related projects (15).

Experience and expertise of the Team Personnel in handling the management of complex technical assistance projects in the electric power sector in developing countries (15).

Expertise and capabilities of staff to fulfill the various functions of each component of the feasibility study as spelled out in the terms of reference (10).

Firm or Consortium Technical Capability and Past Performance 20

Experience and years of performance in consulting in the area of Smart Grid sector projects, including the planning, design, and/or construction of such projects (10).

Experience working on complex electric power sector projects in developing countries (10).

Proposals that do not include all requested information may be considered non-responsive.

Price will not be a factor in contractor selection.

ANNEX 1

Mr. V. Arunachalam
Additional Director
Utility Automation Research Centre
Central Power Research Institute
Prof. Sir C.V. Raman Road, Post Box No: 8066,
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TECHNICAL ASSISTANCE FOR THE CENTRAL POWER RESEARCH INSTITUTE SMART GRID TEST BED PROJECT

USTDA Activity No.: 2013-31022A
POC: Jennifer Van Renterghem, USTDA, 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901, Tel: (703) 875-4357, Fax: (703) 875-4009, Email: RFPQuestions@ustda.gov. **CENTRAL POWER RESEARCH INSTITUTE SMART GRID TEST BED PROJECT**: The Grantee invites submission of qualifications and proposal data (collectively referred to as the "Proposal") from interested U.S. firms that are qualified on the basis of experience and capability to develop a feasibility study for a Technical Assistance grant to CPRI , which will support the preparation of a detailed planning and procurement document for the implementation of a Smart Grid Test Bed project in Bangalore, India. The test bed, which will consist of an integrated Interoperability Laboratory and Smart Grid Technology Demonstration Center, will facilitate the Grantee to research and perform controlled evaluations of integrated Smart Grid technologies including substation automation, load management, smart meters, cyber security network sensing, energy management, renewables integration, and applications for plug-in hybrid electric vehicles (PHEV). If implemented, the Smart Grid Test Bed and related facilities would be used by manufacturers, utilities, services firms and academics for various testing, certification and training activities. This Technical Assistance intends to facilitate the adoption of Smart Grid pilot projects as well as the full-scale deployment of Smart Grid technologies.

The proposed TA has been identified by CPRI as a top priority, since it would help facilitate the research and testing of commercial and pre-deployment technologies and system approaches for a variety of Smart Grid applications.

CPRI (www.cpri.in) is an autonomous society (organization) under the Ministry of Power. It was established by the Government of India in 1960 and was reorganized into an autonomous society in 1978. It serves as the national level electric power research organization and undertakes and sponsors research and development projects in generation, transmission, distribution, and operation of electricity supply systems. CPRI also serves as a testing and

certification authority at the national level to ensure availability of quality equipment for use under conditions prevalent in Indian power systems.

Over the last few years, CPRI has taken advantage of the paradigm shift in the power sector outlook and has diversified and expanded its capabilities and ventured into advanced technology areas like protocol testing, automation, real time digital simulation of power systems, diagnostic studies, advanced materials, influence of earthquakes, PMUs, SCADA, smart metering and Smart Grid among others. CPRI has already established a number of laboratories including but not limited to Short Circuit Laboratory, Electric Appliance Testing Facility, High Voltage Laboratory, Energy Meter Testing Laboratory, Calibration Laboratory, Substation Automation System Laboratory, Metering Protocol Laboratory, Insulation Diagnostic Laboratory, Power Capacitors Laboratory, Heat Run Test Laboratory, Vibration Laboratory, Structural material Testing Laboratory, and Real Time Digital Simulator system. Some of these facilities could easily be integrated into the proposed Smart Grid Test Center at CPRI's campus in Bangalore. CPRI also operates a number of facilities in other locations, several mobile laboratories, and has also been providing consulting services to the state-owned utilities, USAID, and international firms active in India's electric power market. CPRI's work in the following key Smart Grid areas places it as the ideal beneficiary for the proposed Smart Grid Test Bed Project:

Metering: CPRI has been working in the area of energy metering since 1990. CPRI set up the Energy Meter Testing Lab in 1994. It created awareness of the need for adopting an open protocol for metering for successful implementation of AMI since 2002 as the electricity meter is an essential building block for Smart Grid. CPRI organized an international workshop on metering protocols in 2004 in India and established the laboratory for metering protocols in 2003 as per IEC 62056. This is the first such laboratory established in Asia. CPRI played a significant role in formulation of the Indian Companion Specification in 2010 for IEC 62056 - the data exchange standard, augmenting the metering protocol laboratory for ICS (Indian Companion Standard) in 2010.

Sub Station Automation: CPRI organized an international workshop on IEC 61850 - the standard for Communication Networks and Systems in Substations (another building block of Smart Grid). CPRI established the conformance test laboratory in 2008 for IEC 61850. This is the second independent and internationally accredited laboratory in the World. The laboratory is well utilized by stakeholders from India and abroad.

Distribution Automation: Since 2005 CPRI has diversified into power system automation. It has been offering consultancy for SCADA and DA projects. Some of the important projects are (i) Leader of the committee to draft specification for Karnataka Power Transmission Company Limited (KPTCL) Integrated extended SCADA for transmission network covering about 1300 substations and 16 control centers. Later, CPRI service was availed by KPTCL for supervision of implementation as per design and standards - a quality control measure; (ii) Consortium partner with KEMA for Bangalore city Distribution Automation funded by JAICO (Japanese International Co-operation); and (iii) Consultant to seven towns of Andhra Pradesh and one town of Puducherry for a SCADA projects under the national R-APDRP scheme.

Smart Grid: The decade long experience in protocols and automation has enabled CPRI to develop capabilities with regard to the evolving Smart Grid. CPRI was awarded the consultancy for Design and Development of a Smart Grid pilot for Bangalore Electricity Supply Company (BESCOM). The project was supported by USAID. This was the first comprehensive Smart Grid pilot in India. This was followed by another assignment for similar work from Andhra Pradesh Central Power Distribution Company Ltd (AP-CPDCL). CPRI is assigned with lead role at national level for pilot projects to study various facets of Smart Grid. It is also leading the working group on metering - CPRI is identified as a resource institute for training on SCADA and Smart Grid.

Other Areas: CPRI has rich expertise in HVDC, non-conventional energy, HV/UHV domain, power system studies using RTDS, RLA studies, earthquake influence, and material property studies. It also has testing laboratories for cables, capacitors, switchgear, transformers and many other components.

The U.S. firm selected will be paid in U.S. dollars from a US$692,000 grant to the Grantee from the U.S. Trade and Development Agency (USTDA).

A detailed Request for Proposals (RFP), which includes requirements for the Proposal, the Terms of Reference, and portions of a background definitional mission report are available from USTDA, at 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901. To request the RFP in PDF format, please go to: https://www.ustda.gov/businessopps/rfpform.asp. Requests for a mailed hardcopy version of the RFP may also be faxed to the IRC, USTDA at 703-875-4009. In the fax, please include your firm's name, contact person, address, and telephone number. Some firms have found that RFP materials sent by U.S. mail do not reach them in time for preparation of an adequate response. Firms that want USTDA to use an overnight delivery service should include the name of the delivery service and your firm's account number in the request for the RFP. Firms that want to send a courier to USTDA to retrieve the RFP should allow one hour after faxing the request to USTDA before scheduling a pick-up. Please note that no telephone requests for the RFP will be honored. Please check your internal fax verification receipt. Because of the large number of RFP requests, USTDA cannot respond to requests for fax verification. Requests for RFPs received before 4:00 PM will be mailed the same day. Requests received after 4:00 PM will be mailed the following day. Please check with your courier and/or mail room before calling USTDA.

Only U.S. firms and individuals may bid on this USTDA financed activity. Interested firms, their subcontractors and employees of all participants must qualify under USTDA's nationality requirements as of the due date for submission of qualifications and proposals and, if selected to carry out the USTDA-financed activity, must continue to meet such requirements throughout the duration of the USTDA-financed activity. All goods and services to be provided by the selected firm shall have their nationality, source and origin in the U.S. or host country. The U.S. firm may use subcontractors from the host country for up to 20 percent of the USTDA grant amount. Details of USTDA's nationality requirements and mandatory contract clauses are also included in the RFP.

Interested U.S. firms should submit their Proposal in English directly to the Grantee by **4:00 PM on March 17, 2014** at the above address. Evaluation criteria for the Proposal are included in the RFP. Price will not be a factor in contractor selection, and therefore, cost proposals should NOT be submitted. The Grantee reserves the right to reject any and/or all Proposals. The Grantee also reserves the right to contract with the selected firm for subsequent work related to the project. The Grantee is not bound to pay for any costs associated with the preparation and submission of Proposals.

ANNEX 2

EXCERPTS FROM THE DEFINITIONAL MISSION REPORT[1]

[1] Please note that the Central Power Research Institute has corrected and edited the excerpts from the Definitional Mission report.

CENTRAL POWER RESEARCH INSTITUTE (CPRI) SMART GRID TEST BED PROJECT

A. Executive Summary

The electricity grid system in India has been operating for many years with certain pockets getting automated in the entire value chain. The IT has found its way in a few applications in Distribution. Nevertheless there is scope for improvement in respect of outage management and loss reduction by leveraging automation and smart grid.
Smart Grid technologies can reduce power outages by anticipating equipment failures. It can also help improve the entire system (generation, transmission, distribution) in terms of reliability, security, efficiency and integration of renewables.

The Government of India as well as state owned and private utilities in India are making significant investments to deploy Smart Grid technologies in order to improve their systems and capture the claimed benefits. However, in the open and interconnected environment where Smart Grid technologies are deployed, there is a risk that system components do not properly operate in an integrated system, resulting in interoperability issues, even though these devices normally undergo individual quality control and operability tests. The Central Power Research Institute (CPRI) of India is proposing to construct a Smart Grid Test Bed for testing Smart Grid technologies and systems as well as establishing quality and performance standards for such equipment and systems. CPRI, the proposed Grantee, is an Indian Government Agency located in Bangalore, India. CPRI has been operating for over 50 years and already has test facilities for some of the building blocks of Smart Grid, including protocol laboratories for SCADA, Meters and IEDs and is uniquely positioned to cater to utilities' and manufacturers' Smart Grid requirements in the area of third party, testing, validation, training, consulting and research and development.

The proposed Technical Assistance (TA) would assist CPRI to prepare a detailed planning and procurement document for implementing a Smart Grid Test Bed Project. The Project will consist of an integrated "Interoperability Laboratory and Smart Grid Technology Demonstration Center". The Project will allow for the research of technologies and systems for a wide range of Smart Grid applications and will allow the Grantee to perform specialized, controlled laboratory evaluations of integrated Smart Grid technologies including substation automation, load management, smart meters, cyber security, network sensing, energy management, renewables integration, and plug in hybrid electric vehicles (PHEV). If implemented, the Test Bed would be used by manufacturers, utilities, integrators, consulting firms and academics for various activities including testing, certification and training. The TA is intended to facilitate in this endeavor of evolving the blue print for SG test bed which will go a long way in the implementation of Smart Grid pilot projects and full scale deployment of Smart Grid technologies across India.

CPRI is a member of India Smart Grid Forum (ISGF), whose members, in addition to a number of Indian Government Agencies and utilities include leading U.S. companies such as GE, HP, Honeywell, IBM, Trilliant, and EC Infosystems. The DM team has held discussions with ISGF and some of its U.S. member companies and they are supportive of development of the proposed facility at CPRI. We estimate that U.S. exports of $8.5 million could come from implementation of the Smart Grid Test Bed and at least $64.6 million in U.S. exports would come from the Smart Grid technology deployment throughout India which benefited from the Smart Grid Test Bed.

The Project has strong potential developmental impacts and fits well with the Government of India's ambitions to modernize generation, transmission and distribution infrastructure in the country. The DM team recommends USTDA funding for the Smart Grid Test Bed at CPRI in the amount of $692,000.

B. Project Description

Indian Electric Power Sector

In India's power sector, policy setting and implementation is divided between five ministries: Ministry of Coal, Ministry of Petroleum and Natural Gas, Ministry of New and Renewable Energies (MNRE), Ministry of Power (MoP), and the Department of Atomic Energy. Within MoP, the Bureau of Energy Efficiency (BEE) coordinates energy efficiency and energy conservation measures and the Central Electricity Authority (CEA) advises the government on issues related to national electricity policy, specific standards and norms for national grid operation and maintenance. MNRE is responsible for developing and supporting various renewable energy activities across the nation. State governments also have significant influence on implementation of power and/or energy efficiency projects as they are responsible for the implementation of national laws. They also set their own power and energy laws and regulations within their own territory, which is the reason for varying power sector reform processes in each state.

The bulk of India's retail and commercial electricity sales are undertaken by State Electricity Boards (SEBs) and distribution companies (DISCOM). Apart from state owned DISCOMs there are a few private utilities also in power business in India.

With a population of over 1.2 billion, 15 percent of the world's population, and a growing economy, India's demand for electricity continues to grow. These trends necessitate the addition of new power generation capacity to meet the ever increasing demand. In addition, India has some of the highest transmission and distribution losses in the world. India's electricity consumption is expected to grow at about 6% annually with an expected peak load of about 778GW by 2031-32. India will require about 347 GW of additional capacity by 2020 and 1,300 GW by 2050.

In 2012 India generated about 1,218TWh of electric power while the demand was estimated to be 1,764TWh. That is an 11% shortfall in overall average demand with

peak demand deficits of as high as 18%. However, about 400 million people in the country remain without electricity so demand projections are difficult to make as this unmet demand is not accounted for.

Historically, coal-fired power plants have generated more than half of India's power. Coal is projected to account for about 56% of the country's power mix in 2012 and is expected to continue to play a significant role in the next decade as a resource for electric power generation because coal power projects tend to have the least generation cost in India due to India's significant coal reserves and low prices. Natural gas accounts for about 9% of electric power generation while nuclear and oil account for 1% each, large hydropower for about 20%, and renewables including small hydro for the remaining 12% of power generation mix.

The total renewable generation capacity (small hydro, biomass, wind, solar, and waste-to-energy) is expected to increase from the current level of 24 GW to 55 GW by 2022, the end of the 13th Five-Year Plan, according to MoP. Most of this capacity increase is expected to come from solar and wind power. The Jawaharlal Nehru National Solar Mission (JNNSM), also known as the National Solar Mission, a major cooperative initiative between the National Government and State Governments, has set a target of increasing its combined solar capacity to 20 GW by 2022. The Government launched JNNSM recognizing the strategic long-term role that solar power can play in India.

Current Environment for Smart Grid in India

India's transmission and distribution losses average about 24% and in some states losses are as high as 62%. Smart Grid technologies can reduce power outages by anticipating equipment failures. It can also help improve the entire system (generation, transmission, distribution) in terms of reliability, security, efficiency and integration of renewables. Smart grid technologies provide for two-way data communications among the generation, transmission, and distribution elements of the grid system, enabling system operators to share information about the grid's condition and act upon that data in a timely manner. As of now, Indian utilities in many cases lack the basic hardware or software which would be required to deploy a Smart Grid. With a few exceptions, most utilities have not yet adopted on a large scale what are considered basic enterprise IT systems (i.e., Geographical Information System (GIS), Outage Management System (OMS), Supervisory Control and Data Acquisition (SCADA), Distribution Automation, and Management Information System (MIS)).
The Government of India has and continues to introduce sector reforms to encourage investments to improve the conditions of the grid. Despite these attempts few Smart Grid projects have actually been implemented.

Recognizing the significant gains to be captured in this area, MoP initiated the $10 billion Restructured Accelerated Power Development and Reforms Program (R-APDRP - www.apdrp.gov) in 2008, a successor to the successful APDRP, which began in 2003. MoP's efforts have resulted in creation of independent evaluating agencies at all states

to verify the initial baseline transmission and distribution losses. MoP expects that upon successful completion of the program transmission and distribution losses will be reduced by at least 30 per cent. Under this program, government has also earmarked more than $2.7 billion for implementation of information and operational technologies including supervisory control and data acquisition (SCADA) and substation automation in 775 out of 1,100 eligible towns in the country.

The GOI established several organization to advice on Smart Grid developments in India – the India Smart Grid Task Force and the India Smart Grid Forum. The India Smart Grid Task Force (ISGTF) is an inter-ministerial group that serves as the Government of India's focal point for activities related to Smart Grid. The main functions of ISGTF pertaining to Smart Grid are:

- To ensure awareness coordination and integration of diverse activities related to Smart Grid Technologies.
- Promote research and development for Smart Grid.
- Coordination and integration of relevant intergovernmental activities.
- Collaborate on an interoperability framework.
- Review and validate recommendations from the India Smart Grid Forum

Five working groups have been constituted under ISGTF to take up the different tasks related to Smart Grid activities: trials/pilot on new technologies; loss reduction and theft, data gathering and analysis; power to rural areas and reliability and quality of power to urban areas; distributed generation and renewables; physical cyber security, standards and spectrum management.

The India Smart Grid Forum (ISGF) is a Public Private Partnership (PPP) initiative of Ministry of Power, Government of India for accelerated development of Smart Grid technologies in the Indian power sector. The main objectives of ISGF are:

- To help the Indian power sector deploy Smart Grid technologies in an efficient, cost effective, innovative and scalable manner by bringing together all key stakeholders and enabling technologies.
- To create a platform for public and private stakeholder members, research institutions and power utilities to drive down myths on Smart Grids, and create innovation through information exchanges.
- To bring together stakeholders specializing in regulation, policy, and business case with a view to building up broad-based support for Smart Grid policies.
- To undertake research work and other efforts such as scoping the capabilities of Smart Grids in the Indian context through case studies, cost-benefit framework, technical advancements in the renewable energy sources and other ancillary activities.
- To provide advice to Government, regulators, utilities and consumers in the form of reports and white papers, technical seminars, etc.

Critical Issues for Applying Smart Grid Solutions in India

Smart Grid technology is implemented to create an automated, widely distributed energy delivery network characterized by a two-way flow of electricity and information, capable of monitoring and responding to changes in everything from power plants to customer preferences to individual appliances. Building a 'smarter' grid is an incremental process of applying information and communications technologies to the electricity system, enabling more dynamic 'real-time' flows of information on the network and more interaction between suppliers and consumers. These technologies can help deliver electricity more efficiently and reliably. Operators will get more detailed information about supply and demand, improving their ability to manage the system and shift demand to off-peak times. Consumers are offered for more information about their electricity use and time of the day costs, and control by providing them a tool for reducing their costs and carbon emissions.

A smarter grid applies technologies, tools and techniques available now to bring knowledge to power sector operation -- knowledge capable of making the grid work far more efficiently by:

- Ensuring its reliability to degrees never before possible;
- Maintaining its affordability;
- Fully accommodating renewable and traditional energy sources;
- Potentially reducing the carbon footprint;
- Introducing advancements and efficiencies yet to be envisioned; and
- Reinforcing competitiveness

Transforming a country's power grids can be compared in significance with building the interstate highway system or the development of the internet. In much the same way, full implementation of the Smart Grid will evolve over time. However, countless positive steps are needed to realize the full potential of Smart Grid operations in India. The evolution of the power grid into the Smart Grid will involve the expansion and integration of advanced communications and information technology into all aspects of utility operations, from power generation to the point at which power is used. Utilities will have a whole new level of visibility and control applications and devices that will help improve grid reliability and efficiency. Massive amounts of data will be available that can be used to benefit customers and utilities. Availability of real-time data enables system operators to make more real-time and effective decisions and help increase overall grid reliability and availability. Application of Smart Grid technology also vastly increases volumes of highly distributed data, making a utility's approach to security more challenging.

The backbone of the Smart Grid is the integration of two-way communications between utilities and consumers through advanced metering infrastructure (AMI) and sensors that provide real- or nearly real-time energy information regarding where and to what degree electricity is being consumed. However, the Smart Grid is more than just metering (or any single application) and it needs a flexible platform that is open to all communications technologies to allow a utility to build a two-way digital communication system that offers a comprehensive Smart Grid solution specific to the utility's specific needs. Utilities need a flexible and scalable multi-purpose platform with

a two-way digital communications infrastructure and applications platform to receive end-to-end Smart Grid benefits. The Smart Grid is an adoption of technologies to transform the existing electricity grid—which is fitted largely with 20th-century infrastructure—to 21st-century standards to create greater efficiencies, reliability and the integration of renewable energy sources.

The challenges faced in India to implement Smart Grid solutions include:

- Integration of existing control and data systems along with new applications in a common, cyber secure, interoperable control platform;
- Demonstration of seamless integration of renewable energy resources and Smart Grid technologies, such as electric car charging stations, distributed generation, building management systems, and home area networks into utilities distribution control center systems.
- Demonstration of the potential to improve the reliability and decrease losses within the electric system in order to promote further investment.

The key drivers for Smart Grid solutions in India are:

- Reduce utility operating costs;
- Improve grid reliability;
- Increase energy efficiency
- Increase inter-regional trading
- Overall demand reduction
- Reduce end-to-end system losses
- Peak-demand shifting
- Integration of renewable generation
- Intermittent, bulk generation
- Distributed Renewable Generation (DRG)
- Support electric transportation transition
- Commercial and personal vehicles (PHEV)

Data Management and Security

Smart Grid technology is essential and crucial for obtaining timely and accurate market information about the grid network. One of the critical advancements of the Indian electric power sector is inter-regional power trading. To promote power trading, the Central Electricity Regulatory Commission (CERC) approved the setting up of the Indian Energy Exchange (IEX), which is the first power exchange in India, in June 2008. At present, two power exchanges are operating in India, IEX and Power Exchange India Limited (PXIL). These exchanges have been developed as market based institutions for providing price discovery and price risk management to the electricity generators, distribution licensees, electricity traders, consumers and other stakeholders. At present, exchanges offers day-ahead operations whose time line is set in accordance with the operations of regional load dispatch centers (RLDCs). Power exchanges coordinate with the national load dispatch centers, RLDCs and state load dispatch centers (SLDCs) for scheduling of traded contracts to get up-to-date network information.

Future market data forecasting as these exchanges become more active and provide shorter trading periods can be very complicated due to the increased number of market players and complexity of market operations. The two-way metering data may be voluminous. Hence, there is a need for standardizing the information exchange and data formats. It requires a focus on adopting the developed standards and improving the standards according to the new requirements. Data standards and data management of market data must be taken care of in a proper manner.

Smart Grid technology must provide for communication and infrastructure security as the growing threat of cyber-attacks with the implementation of Smart Grid. Because the grid is critical infrastructure and increasingly central to the daily lives of people and businesses, it is important to protect it from malicious cyber-attacks. Unlike most power system failure risks that can be modeled probabilistically, cyber security requires a shift in thinking to accommodate the possibility of a coordinated attack on multiple facilities by an intelligent attacker over a network. While Smart Grid security standards are still being developed, critical cyber asset protection and stakeholders' interests' places regulatory compliance requirements on utilities and system operators. The utility implementing a Smart Grid must understand the security implications and plan accordingly.

There is a need to establish and verify data standards and management and test equipment for communication and infrastructure security in areas such as the following:

Data Standards: Usually, data sources do not communicate via common standards. However, the two dominant standards existing today are the common information model (CIM).which define a standard data interface that supports batch and real-time data exchange.

Secure communication and standard protocols: Communications among regional market operators, utilities, service providers and consumers are necessary. There should be interoperability. In view of supporting all the data sources on the grid, a high-bandwidth communication infrastructure must be in place. A wide range of wired and wireless communications technologies are available to transport data, but there is no one best choice. Any Smart Grid initiative will have to pick two or three communications methods and mix and match as required to achieve the required level of coverage.

Cyber Security of Critical Infrastructure Protection (CIP): Today's utility operations are highly dependent on integrated systems to manage complex resources in order to capture data, as well as deliver, bill and service millions of customers. The need to protect all assets, components, and data within a finite physical and logical boundary is critical to the daily operations of every utility.

Smart Grid Test Bed Project Description

In view of developments taking place in India in the area of Smart Grid, there is a need for testing the emerging Smart Grid devices and components like Smart Meters, Advanced Distribution Automation components, IT components, plug in-electric vehicles, communications systems, roof top solar photovoltaic systems and integration of other renewable energy sources (wind and solar power generating systems) into the distribution and transmission networks. There is also a need for educating utility engineers and young professionals in this area. CPRI already has a number of test facilities such as Smart Meter and Intelligent Electronic Device (IED) for communication protocol conformance and is the only institute to introduce these type facilities in the region.

In a very open and interconnected environment where Smart Grid technologies are deployed, there is a risk that system components do not properly operate in an integrated system, resulting in interoperability issues, even though these devices normally undergo individual quality control and operability tests. Problem solving at this stage is critical since there is always a chance of integration issues with other systems so interoperability testing is necessary. Interoperability testing provides a controlled and live environment at the system interface level to verify and fix problems related to interoperability. Testing components with existing systems during the procurement stage helps to correct any possible integration issues to ensure interoperability, increasing the confidence level of both operators and manufacturers. The platform would also help to train the utility and manufacturer's engineers. The manufacturers can also make use of facility during the developmental phase of products and final testing.

CPRI is a member and holds chairmanship in many of national and international standard making bodies and technical committees. The combined knowledge of testing and consulting professionals of CPRI provides an unbiased quality assurance to all the stakeholders. In view of the above, CPRI has proposed to establish the Smart Grid Test Bed Project, consisting of an Integrated Interoperability Laboratory and Smart Grid Technology Demonstration. The Smart Grid Test Bed would allow research on and testing of commercial and pre-commercial technologies and system approaches for a wide range of Smart Grid applications. CPRI could use the Smart Grid Test Bed to provide testing, certification, developmental assistance and training services to manufacturers, utilities, system integrators, consultancy organizations and academia.

Fourteen state-owned utilities have been selected to pilot test Smart Grid technology and many more may be taken up during the Government of India's XII plan period. GOI is partially funding these demonstration projects through the Restructured Accelerated Power Development and Reforms Program (R-APDRP). CPRI is the leading government-owned research institution is expected to play a key role in the implementation of these projects. Many government-owned utilities look to CPRI for technical support and guidance through this SG test bed.. Successful implementation of these pilot projects could lead to large scale commercial rollouts of Smart Grid projects.

The Smart Grid Test Bed would serve as a basic demonstration center for Smart Grid technology devices and components and is expected to include the following features:

- Advanced Distribution Automation systems;
- Advanced Metering Infrastructure and Smart Metering systems;
- Home Automation System;
- Advanced Communication systems;
- Distributed Energy Resources and Renewable source integration on the grid;
- Study of grid interconnectivity, controls, security, safety, performance, reliability and interoperability;
- Simulation of real world for operating Smart Grid technologies and systems;
- EMS and SCADA facilities;
- Testing for cyber security and vulnerability of Smart Grid and devices to cyber-attack; and
- Plug-in hybrid vehicles and charging facilities.

The Smart Grid Test Bed is expected to include a range of testing equipment for establishing interoperability of the Smart Grid devices and components used in the transmission and distribution network. The facility offers utilities, manufacturers, vendors, and regulatory bodies a place to evaluate and understand the readiness of technologies for integration into the Smart Grid in a rapidly evolving environment.

The facility would provide a platform for utilities and manufacturers to evaluate products and solutions of mutual interest by a third party and in a neutral territory. The Smart Grid Test Bed infrastructure would allow multiple vendors to participate in an interoperability work session in an independent and neutral laboratory environment to resolve integration problems before going to deployment. It would provide manufacturers the opportunity to evaluate new designs and products in compliance with national and international standards and interoperability with other manufacturers' devices and equipment. Following is a partial list of standards and systems that are expected to be covered in the Smart Grid Test Bed:

- SCADA / EMS & SCADA / DMS, IEC 60870 series, Modbus, ICCP, CIM, DNP 3 & other aspects of Automation and Distribution Line optimization ;
- Security impact assessment of systems/ devices, penetration testing, vulnerability assessments, security interoperability, security audit, IEC 62351, NERC, etc.
- IEC 62056 and Energy meter related items including metrology & protocol, Renewable integration -Roof top solar, wind, storage, biomass (for injection at 11 kV and below), CIM, Energy optimization packages, ABT, unit commitment/economic dispatch etc.
- IEC 61850 and related items, merging units, optical CT / PT, PMU, POC, SNTP, time Synch, power quality and emerging standards in this areas, Transmission Network optimization, power trading etc.

- Communications standards (communication medium and technology), ZigBee, PLC / BPL, Communication network optimization, communication network simulation , RF technology for power sector (low power / high power), satellite communications systems.

Utilities have to gear up to adopt new technologies to meet the customer expectations within the regulatory regime. However, the time lag in development of standards and coexistence of many of the legacy systems needs to be taken into account. Development of a Smart Grid Test Bed at CPRI would help with establishing interoperability standards and minimize the delay in development of new standards in India.

The new CPRI Smart Grid Test Bed will be a dynamic testing center for Smart Grid technologies in India and in the subcontinent region (Sri Lanka, Burma, Thailand, etc.). It will be designed to simulate real-world conditions and test end-to-end functionality of Smart Grid elements, such as electric vehicles charging, high, medium and low voltage substation automation, in-home displays, smart meters, smart switching operations in the grid network systems, and customer information portals. The Smart Grid Test Bed will provide independent testing of specific designs within a specific environment, enabling flexibility and innovation within existing Smart Grid programs and configurations in India.

Smart Grid Test Bed Infrastructure and Costs

The preliminary estimated cost of this Lab is in the range of $10 million to $17 million based on the extent to which HV, MV, and LV automated equipment will be tested for Smart Grid operation. The Smart Grid Interoperability Laboratory and Research Center will require establishment of the following sub laboratories:

- Situational Awareness Lab
- Communications and Computing Lab
- Power Systems Lab
- Distributed Energy Resources Lab
- Substation Automation Lab
- Distribution Automation Lab
- Home Area Network Lab
- Garage of the Future Lab

The Situational Awareness Lab (estimated cost $1 to $2 million) will allow utilities to monitor the status of the electric grid and display test data from adjacent labs. Utilizing Hiper Wall technology, a scalable video wall of this facility will be used to analyze historical outage data using system modeling tools.

The Communications and Computing Lab (estimated cost $1 million) will provide a platform to test and evaluate Smart Grid Communications and cyber-security hardware, software, and systems. Understanding the properties of high-speed, low latency and

wireless communications networks is critical to the development of a digitally networked grid.

Inverter-based generators and loads - such as residential solar panels, batteries and air conditioners –will be tested and evaluated in CPRI's Distributed Energy Resources Lab (estimated cost $1-2 million). Understanding the behavior of these devices during grid faults and voltage and frequency transients will help utilities to find technology solutions to maintain reliability of the grid.

The Substation Automation Lab (estimated cost $3 to $5 million) will be designed for interconnecting and testing next generation substation communications, automation and protection equipment. Incorporating these secure and open standards based systems will help utilities in India continue to maintain smarter, safer and more reliable substations.

The Distribution Automation Lab (estimated cost $2 to $3 million) is where CPRI will evaluate the performance of advanced field devices to develop an integrated, scalable and fully automated distribution system. These efforts will help utilities in India safely and reliably manage the integration of distributed energy resources such as residential solar panels and plug-in electric vehicles.

The Home Area Network Lab (estimated cost $1 to $2 million) will help to provide customers with advanced tools and resources that will enable informed and responsible energy use. The lab will evaluate third-party smart energy devices to ensure compatibility with Indian utilities' smart meters and utilities' rate programs and services.

The Garage of the Future Lab (estimated cost $1 to $2 million) will demonstrate and evaluate the synergy of various technologies including distributed energy storage, renewable energy resources, plug-in electric vehicle charging infrastructure and meter communication.

The CPRI Smart Grid Test Bed will also be used for:

- R & D and product development;
- Pre-commercial testing and characterization;
- Protocol and standards development
- Demonstration

The Lab will be able to test various scenarios that can be simulated including:

- Grid-connected and off-grid;
- Controllable loads to simulate residential and commercial;
- Multiple sources;
- Energy storage
- Home/building/network EMS

C. Project Sponsor- Central Power Research Institute (CPRI)

CPRI (www.cpri.in) is an autonomous society (organization) under the Ministry of Power. It was established by the Government of India in 1960 and was reorganized into an autonomous society in 1978. It serves as the national level electric power research organization and undertakes and sponsors research and development projects in generation, transmission, distribution, and operation of electricity supply systems. CPRI also serves as a testing and certification authority at the national level to ensure availability of quality equipment for use under conditions prevalent in Indian power systems.

Over the last few years, CPRI has taken advantage of the paradigm shift in the power sector outlook and has diversified and expanded its capabilities and ventured into advanced technology areas like protocol testing, automation, real time digital simulation of power systems, diagnostic studies, advanced materials, influence of earthquakes, PMUs, SCADA, smart metering and Smart Grid among others. CPRI has already established a number of laboratories including but not limited to Short Circuit Laboratory, Electric Appliance Testing Facility, High Voltage Laboratory, Energy Meter Testing Laboratory, Calibration Laboratory, Substation Automation System Laboratory, Metering Protocol Laboratory, Insulation Diagnostic Laboratory, Power Capacitors Laboratory, Heat Run Test Laboratory, Vibration Laboratory, Structural material Testing Laboratory, and Real Time Digital Simulator system. Some of these facilities could easily be integrated into the proposed Smart Grid Test Center at CPRI's campus in Bangalore. CPRI also operates a number of facilities in other locations, several mobile laboratories, and has also been providing consulting services to the state-owned utilities, USAID, and international firms active in India's electric power market. CPRI's work in the following key Smart Grid areas places it as the ideal beneficiary for the proposed Smart Grid Test Bed Project:

Metering: CPRI has been working in the area of energy metering since 1990. CPRI set up the Energy Meter Testing Lab in 1994. It created awareness of the need for adopting an open protocol for metering for successful implementation of AMI since 2002 as the electricity meter is an essential building block for Smart Grid. CPRI organized an international workshop on metering protocols in 2004 in India and established the laboratory for metering protocols in 2003 as per IEC 62056. This is the first such laboratory established in Asia. CPRI played a significant role in formulation of the Indian Companion Specification in 2010 for IEC 62056 - the data exchange standard, augmenting the metering protocol laboratory for ICS (Indian Companion Standard) in 2010.

Sub Station Automation: CPRI organized an international workshop on IEC 61850 - the standard for Communication Networks and Systems in Substations (another building block of Smart Grid). CPRI established the conformance test laboratory in 2008 for IEC 61850. This is the second independent and internationally accredited laboratory in the World. The laboratory is well utilized by stakeholders from India and abroad.

Distribution Automation: Since 2005 CPRI has diversified into power system automation. It has been offering consultancy for SCADA and DA projects. Some of the important projects are (i) Leader of the committee to draft specification for Karnataka Power Transmission Company Limited (KPTCL) Integrated extended SCADA for transmission network covering about 1300 substations and 16 control centers. Later, CPRI service was availed by KPTCL for supervision of implementation as per design and standards - a quality control measure; (ii) Consortium partner with KEMA for Bangalore city Distribution Automation funded by JAICO (Japanese International Co-operation); and (iii) Consultant to seven towns of Andhra Pradesh and one town of Puducherry for a SCADA projects under the national R-APDRP scheme.

Smart Grid: The decade long experience in protocols and automation has enabled CPRI to develop capabilities with regard to the evolving Smart Grid. CPRI was awarded the consultancy for Design and Development of a Smart Grid pilot for Bangalore Electricity Supply Company (BESCOM). The project was supported by USAID. This was the first comprehensive Smart Grid pilot in India. This was followed by another assignment for similar work from Andhra Pradesh Central Power Distribution Company Ltd (AP-CPDCL). CPRI is assigned with lead role at national level for pilot projects to study various facets of Smart Grid. It is also leading the working group on metering - CPRI is identified as a resource institute for training on SCADA and Smart Grid.

Other Areas: CPRI has rich expertise in HVDC, non-conventional energy, HV/UHV domain, power system studies using RTDS, RLA studies, earthquake influence, and material property studies. It also has testing laboratories for cables, capacitors, switchgear, transformers and many other components.

ANNEX 3

U.S. TRADE AND DEVELOPMENT AGENCY
Arlington, VA 22209-2131

NATIONALITY, SOURCE, AND ORIGIN REQUIREMENTS

The purpose of USTDA's nationality, source, and origin requirements is to assure the maximum practicable participation of American contractors, technology, equipment and materials in the prefeasibility, feasibility, and implementation stages of a project.

USTDA STANDARD RULE (GRANT AGREEMENT STANDARD LANGUAGE):

Except as USTDA may otherwise agree, each of the following provisions shall apply to the delivery of goods and services funded by USTDA under this Grant Agreement: (a) for professional services, the Contractor must be either a U.S. firm or U.S. individual; (b) the Contractor may use U.S. subcontractors without limitation, but the use of subcontractors from host country may not exceed twenty percent (20%) of the USTDA Grant amount and may only be used for specific services from the Terms of Reference identified in the subcontract; (c) employees of U.S. Contractor or U.S. subcontractor firms responsible for professional services shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the U.S.; (d) goods purchased for implementation of the Study and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and (e) goods and services incidental to Study support (e.g., local lodging, food, and transportation) in host country are not subject to the above restrictions. USTDA will make available further details concerning these standards of eligibility upon request.

NATIONALITY:

1) Rule

Except as USTDA may otherwise agree, the Contractor for USTDA funded activities must be either a U.S. firm or a U.S. individual. Prime contractors may utilize U.S.

subcontractors without limitation, but the use of host country subcontractors is limited to 20% of the USTDA grant amount.

2) Application

Accordingly, only a U.S. firm or U.S. individual may submit proposals on USTDA funded activities. Although those proposals may include subcontracting arrangements with host country firms or individuals for up to 20% of the USTDA grant amount, they may not include subcontracts with third country entities. U.S. firms submitting proposals must ensure that the professional services funded by the USTDA grant, to the extent not subcontracted to host country entities, are supplied by employees of the firm or employees of U.S. subcontractor firms who are U.S. individuals.

Interested U.S. firms and consultants who submit proposals must meet USTDA nationality requirements as of the due date for the submission of proposals and, if selected, must continue to meet such requirements throughout the duration of the USTDA-financed activity. These nationality provisions apply to whatever portion of the Terms of Reference is funded with the USTDA grant.

3) Definitions

A "U.S. individual" is (a) a U.S. citizen, or (b) a non-U.S. citizen lawfully admitted for permanent residence in the U.S. (a green card holder).

A "U.S. firm" is a privately owned firm which is incorporated in the U.S., with its principal place of business in the U.S., and which is either (a) more than 50% owned by U.S. individuals, or (b) has been incorporated in the U.S. for more than three (3) years prior to the issuance date of the request for proposals; has performed similar services in the U.S. for that three (3) year period; employs U.S. citizens in more than half of its permanent full-time positions in the U.S.; and has the existing capability in the U.S. to perform the work in question.

A partnership, organized in the U.S. with its principal place of business in the U.S., may also qualify as a "U.S. firm" as would a joint venture organized or incorporated in the United States consisting entirely of U.S. firms and/or U.S. individuals.

A nonprofit organization, such as an educational institution, foundation, or association may also qualify as a "U.S. firm" if it is incorporated in the United States and managed by a governing body, a majority of whose members are U.S. individuals.

SOURCE AND ORIGIN:

1) Rule

In addition to the nationality requirement stated above, any goods (e.g., equipment and materials) and services related to their shipment (e.g., international transportation and insurance) funded under the USTDA Grant Agreement must have their source and origin in the United States, unless USTDA otherwise agrees. However, necessary purchases of goods and project support services which are unavailable from a U.S. source (e.g., local food, housing and transportation) are eligible without specific USTDA approval.

2) Application

Accordingly, the prime contractor must be able to demonstrate that all goods and services purchased in the host country to carry out the Terms of Reference for a USTDA Grant Agreement that were not of U.S. source and origin were unavailable in the United States.

3) Definitions

"Source" means the country from which shipment is made.

"Origin" means the place of production, through manufacturing, assembly or otherwise.

Questions regarding these nationality, source and origin requirements may be addressed to the USTDA Office of General Counsel.

ANNEX 4

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GRANT AGREEMENT

This Grant Agreement is entered into between the Government of the United States of America, acting through the U.S. Trade and Development Agency ("USTDA") and the Central Power Research Institute ("Grantee"). USTDA agrees to provide the Grantee under the terms of this Grant Agreement US$692,000 ("USTDA Grant") to fund the cost of goods and services required for a Technical Assistance ("TA") on the proposed Smart Grid Test Bed Project ("Project") in India ("Host Country").

1. USTDA Funding

The funding to be provided under this Grant Agreement shall be used to fund the costs of a contract between the Grantee and the U.S. firm selected by the Grantee ("Contractor") under which the Contractor will perform the TA ("Contract"). Payment to the Contractor will be made directly by USTDA on behalf of the Grantee with the USTDA Grant funds provided under this Grant Agreement.

2. Terms of Reference

The Terms of Reference for the TA ("Terms of Reference") are attached as Annex I and are hereby made a part of this Grant Agreement. The TA will examine the technical, financial, environmental, and other critical aspects of the proposed Project. The Terms of Reference for the TA shall also be included in the Contract.

3. Standards of Conduct

USTDA and the Grantee recognize the existence of standards of conduct for public officials and commercial entities in their respective countries. Therefore, USTDA, the Grantee, and the Contractor shall not directly or indirectly provide, offer or promise to provide money or anything of value to any public official in violation of any United States or Host Country laws relating to corruption or bribery.

4. Grantee Responsibilities

The Grantee shall undertake its best efforts to provide reasonable support for the Contractor, such as local transportation, office space, and secretarial support.

5. Contract Matters and USTDA's Rights as Financier

(A) Grantee Competitive Selection Procedures

Selection of the U.S. Contractor shall be carried out by the Grantee according to its established procedures for the competitive selection of contractors with advance notice of the

procurement published online through *Federal Business Opportunities (www.fedbizopps.gov)*. Upon request, the Grantee will submit these contracting procedures and related documents to USTDA for information and/or approval.

(B) USTDA's Right to Approve Contractor Selection

The Grantee shall notify USTDA at the address of record set forth in Article 16 below upon selection of the Contractor to perform the TA. USTDA then shall notify the Grantee whether or not USTDA approves the Grantee's Contractor selection. Upon USTDA approval of the Grantee's Contractor selection, the Grantee shall notify in writing the U.S. firms that submitted unsuccessful proposals to perform the TA that they were not selected. The Grantee and the Contractor then shall enter into a contract for performance of the TA.

(C) USTDA's Right to Approve Contract Between Grantee and Contractor

(1) Contract

The Grantee and the Contractor shall enter into a contract for performance of the TA. The Grantee (or the Contractor on the Grantee's behalf) shall transmit to USTDA, at the address set forth in Article 16 below, a photocopy of an English language version of the signed contract or a final negotiated draft version of the contract. USTDA then shall notify the Grantee and the Contractor whether or not USTDA approves the contract.

(2) Amendments and Assignments

The Grantee or the Contractor may submit any proposed amendment to the contract, including any proposed amendment to any annex thereto, or any proposed assignment of the contract, to USTDA at the address set forth in Article 16 below. USTDA then shall notify the Grantee and the Contractor whether or not USTDA approves the proposed amendment or assignment.

(D) USTDA Not a Party to the Contract

It is understood by the parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of the contract and any amendments thereto, including assignments, the selection of all contractors, the Terms of Reference, the Final Report, and any and all documents related to any contract funded under the Grant Agreement. The parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and that any decision by USTDA to exercise or refrain from exercising these approval rights shall be made as a financier in the course of funding the TA and shall not be construed as making USTDA a party to the contract. The parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters related to these rights and the Project with the parties to the contract

or any subcontract, jointly or separately, without thereby incurring any responsibility or liability to such parties. Any approval or failure to approve by USTDA shall not bar the Grantee or USTDA from asserting any right they might have against the Contractor, or relieve the Contractor of any liability which the Contractor might otherwise have to the Grantee or USTDA.

(E) Grant Agreement Controlling

Regardless of USTDA approval, the rights and obligations of any party to the contract or any subcontract thereunder must be consistent with this Grant Agreement. In the event of any inconsistency between the Grant Agreement and the contract or any subcontract funded by the Grant Agreement, the Grant Agreement shall control.

6. Disbursement Procedures

(A) USTDA Approval of Contract Required

USTDA will make disbursements of Grant funds directly to the Contractor only after USTDA approves the Grantee's contract with the Contractor.

(B) Contractor Invoice Requirements

The Grantee should request disbursement of funds by USTDA to the Contractor for performance of the TA by submitting invoices in accordance with the procedures set forth in the USTDA Mandatory Clauses in Annex II.

7. Effective Date

The effective date of this Grant Agreement ("Effective Date") shall be the date of signature by both parties or, if the parties sign on different dates, the date of the last signature. In the event that only one signature is dated, such date shall constitute the Effective Date.

8. TA Schedule

(A) TA Completion Date

The completion date for the TA, which is December 31, 2014, is the date by which the parties estimate that the TA will have been completed.

(B) Time Limitation on Disbursement of USTDA Grant Funds

Except as USTDA may otherwise agree, (i) no USTDA funds may be disbursed under this Grant Agreement for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (ii) no USTDA funds may be disbursed more than four (4) years after the Effective Date of the Grant Agreement.

9. USTDA Mandatory Contract Clauses

All contracts funded under this Grant Agreement shall include the USTDA Mandatory Contract Clauses set forth in Annex II to this Grant Agreement. All subcontracts funded or partially funded with USTDA Grant funds shall include the USTDA Mandatory Contract Clauses, except for clauses B(1), G, H, I, and J.

10. Use of U.S. Carriers

(A) Air

Transportation by air of persons or property funded under this Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

(B) Marine

Transportation by sea of property funded under this Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

11. Nationality, Source and Origin

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and professional services funded by USTDA under this Grant Agreement:

(a) the Contractor must be a U.S. firm;

(b) the Contractor may use U.S. subcontractors without limitation;

(c) employees of U.S. Contractor or U.S. subcontractor firms shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the United States, except as provided pursuant to subpart (d) below;

(d) up to twenty percent (20%) of the USTDA Grant amount may be used to pay for services performed by (i) Host Country subcontractors, and/or (ii) Host Country nationals who are employees of the Contractor;

(e) a Host Country subcontractor may only be used for specific services from the Terms of Reference identified in the subcontract;

(f) subcontractors from countries other than the United States or Host Country may not be used;

(g) goods purchased for performance of the TA and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and

(h) goods and services incidental to TA support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions.

USTDA will make available further details concerning these provisions upon request.

12. Taxes

USTDA funds provided under this Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees or other levies imposed under laws in effect in Host Country, except for taxes of a de minimis nature imposed on local lodging, food, transportation, or airport arrivals or departures. Neither the Grantee nor the Contractor will seek reimbursement from USTDA for taxes, tariffs, duties, fees or other levies, except for taxes of a de minimis nature referenced above.

13. USTDA Project Evaluation

The parties will cooperate to assure that the purposes of the Grant Agreement are accomplished. For five (5) years following receipt by USTDA of the Final Report, the Grantee agrees to respond to any reasonable inquiries from USTDA about the status of the Project. Inquiries will include, but not be limited to, whether the Final Report recommendations have been or will be used to implement the Project, anticipated Project implementation timeline, and likely source of financing. The Grantee also agrees to keep a record of any U.S. companies who utilize the Smart Grid Test bed, and provide USTDA with the name of any such companies as well as contact information (email and phone number) of the primary point of contact. In addition, the Grantee agrees to notify USTDA any time the Grantee selects a new primary contact person for this Project during the five-year period referenced above.

14. Recordkeeping and Audit

The Grantee agrees to maintain books, records, and other documents relating to the TA and this Grant Agreement adequate to demonstrate implementation of its responsibilities under this Grant Agreement, including the selection of contractors, receipt and approval of contract deliverables, and approval or disapproval of contractor invoices for payment by USTDA. Such books, records, and other documents shall be separately maintained for three (3) years after the date of the final disbursement by USTDA. The Grantee shall afford USTDA or its authorized representatives the opportunity at reasonable times to review books, records, and other documents relating to the TA and the Grant Agreement.

15. Representation of Parties

For all purposes relevant to this Grant Agreement, the Government of the United States of America will be represented by the U. S. Ambassador to Host Country or USTDA and Grantee will be represented by its Director General. The parties hereto may, by written notice, designate additional representatives for all purposes under this Grant Agreement.

16. Addresses of Record for Parties

Any notice, request, document, or other communication submitted by either party to the other under the Grant Agreement shall be in writing or through an electronic medium that produces a tangible record of the transmission, such as a facsimile or e-mail message, and will be deemed duly given or sent when delivered to such party at the following:

To: Central Power Research Institute
Prof.Sir C.V.Raman Road, Post Box No: 8066,
Sadasiva Nagar (p.o),
Bangalore, India , Pincode: 560 080

Phone: +91(80) - 2360 1263, 2360 1755, 2360 2457, 2360 2920
Fax: +91(80) -2360 1213, 2360 2920
E-Mail: dgcpri@cpri.in

To: U.S. Trade and Development Agency
1000 Wilson Boulevard, Suite 1600
Arlington, Virginia 22209-3901
USA

Phone: (703) 875-4357
Fax: (703) 875-4009
E-Mail: grantnotices@ustda.gov and
south_southeast_asia@ustda.gov

All such communications shall be in English, unless the parties otherwise agree in writing. In addition, the Grantee shall provide the Commercial or Economic Section of the U.S. Embassy in Host Country with a copy of each communication sent to USTDA.

Any communication relating to this Grant Agreement shall include the following fiscal data:

Appropriation No.: 11 13/141001
Activity No.: 2013-31022A
Reservation No.: 2013195
Grant No.: GH201331195

17. Implementation Letters

To assist the Grantee in the implementation of the TA, USTDA may, from time to time, issue implementation letters that will provide additional information about matters covered by this Grant Agreement. USTDA may also issue implementation letters to (i) extend the estimated completion date set forth in Article 8(A) above, or (ii) change the fiscal data set forth in Article 16 above. The parties may also use jointly agreed upon implementation letters to confirm and record their mutual understanding of matters covered by this Grant Agreement.

18. Grant Agreement Amendments

Either party may submit to the other party at any time a proposed amendment to the Grant Agreement. A Grant Agreement amendment shall be effective only if it has been signed by both parties.

19. Termination Clause

Either party may terminate this Grant Agreement by giving the other party written notice thereof. The termination of the Grant Agreement will end any obligations of the parties to provide financial or other resources for the TA, except for payments that may be made pursuant to Clause I of the USTDA Mandatory Contract Clauses set forth in Annex II to this Grant Agreement. This article and Articles 5, 12, 13, 14, and 21 of the Grant Agreement shall survive termination of the Grant Agreement.

20. Non-waiver of Rights and Remedies

No delay in exercising any right or remedy accruing to either party in connection with the Grant Agreement shall be construed as a waiver of such right or remedy.

21. U.S. Technology and Equipment

By funding this TA, USTDA seeks to promote the project objectives of the Host Country through the use of U.S. technology, goods, and services. In recognition of this purpose, the Grantee agrees that it will allow U.S. suppliers to compete in the procurement of technology, goods and services needed for Project implementation.

22. Governing Law

This Grant Agreement shall be governed by, and construed in accordance with, the applicable laws of the United States of America. In the absence of federal law, the laws of the State of New York shall apply.

23. Counterparts

This Grant Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same agreement. Counterparts may be delivered via electronic mail or other transmission method and any counterpart so delivered shall be deemed to be valid and effective for all purposes.

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IN WITNESS WHEREOF, the Government of the United States of America and the Central Power Research Institute, each acting through its duly authorized representative, have caused this Grant Agreement to be signed in the English language in their names and delivered as of the day and year written below. In the event that this Grant Agreement is signed in more than one language, the English language version shall govern.

For the Government of the United States of America

By: _____

Date: June 24, 2013

Witnessed:

By: _____

For the Central Power Research Institute

By: _____

Date: 24·06·13

Witnessed:

By: _____

Annex I -- Terms of Reference

Annex II -- USTDA Mandatory Clauses

Annex I

Terms of Reference

The objective of this Technical Assistance (TA) is for a contractor (Contractor) to assist Central Power Research Institute (Grantee) to prepare a detailed planning and procurement document for implementing a Smart Grid Test Bed (Project). The Project will consist of an integrated Interoperability Laboratory and Smart Grid Technology Demonstration Center. The Project will allow research of technologies and systems for a wide range of Smart Grid applications and will allow the Grantee to perform specialized, controlled laboratory evaluations of integrated Smart Grid technologies including substation automation, load management, smart meters, cyber security, network sensing, energy management, renewables integration, and plug in hybrid electric vehicles (PHEV). If implemented, the Test Bed would be used by manufacturers, utilities, integrators, consulting firms and academicians for various activates including testing, certification and training. The TA is intended to facilitate the implementation of Smart Grid pilot projects and full scale deployment of Smart Grid technologies across India.

Task 1: Develop a Work Plan and Define Overall TA Parameters

Subtask 1.1: Assess Grantee's Present Facilities, Laboratories, Capabilities and Smart Grid Test Bed Requirements

The Contractor shall visit the Grantee's campus and hold discussions with managers, engineers, and researchers to establish an in-depth understanding of the Grantee's existing facilities, laboratories, capabilities and requirements for procuring and implementing a modern Smart Grid Test Bed. As part of these discussions, the Contractor shall:

- Identify and discuss the Project with other Project stakeholders such as India Smart Grid Forum (ISGF), Ministry of Power, and U.S. equipment suppliers, including those in the Energy Cooperation Program at the American Chamber of Commerce, interested in the establishment of a Smart Grid Test Bed at the CPRI campus. The Contractor shall identify and communicate to the Grantee the stakeholders' needs and requirements, and shall take them into account in developing a detailed Project Work Plan.
- Identify the U.S. and Indian equipment suppliers who may be interested to contribute equipment to or have their equipment tested at the Smart Grid Test Bed at no cost to the Grantee.
- Identify the Grantee's requirements for a Smart Grid Test Bed Workshop including the number of participants, topics to be covered, and timing for the five (5) day program;
- Identify with the Grantee the Grantee and stakeholder personnel who will participate in a Study Tour of U.S. Smart Grid Test Beds and potential sites for the participants to visit. The Study Tour shall be planned for not more than 10 participants and not for more than 10 working days.

Sub-task 1.2 Kickoff Meeting and Detailed Work Plan

The Contractor shall develop a detailed Work Plan including a schedule and milestones based on these Terms of Reference and the work performed in Sub-task 1.1. The Contractor shall conduct a series of kickoff meetings with the Grantee and other stakeholders at the Grantee's facilities or at another appropriate venue agreed upon by the Contractor and the Grantee. The Contractor and Grantee shall identify appropriate personnel and other relevant stakeholders to participate in these kickoff meetings.

During the kickoff meetings, the Contractor shall present the goals and objectives of the Project, Workshop, and Study Tour and review the tasks to be performed under these Terms of Reference; review the Contractor's existing work plan to perform the tasks under these Terms of Reference; and solicit Grantee's input as to whether any changes to the Contractor's work plan for the Study are warranted. The Contractor and Grantee may agree to modify the work plan and in that case, the Contractor shall prepare a revised work plan. Any work provided for in the work plan that goes beyond these Terms of Reference will be performed at Contractor's cost. In the event of any inconsistency between the Terms of Reference and the Contractor's work plan, the Terms of Reference shall control.

The Contractor shall obtain Grantee approval for the Contractor's Work Plan. This Work Plan shall be updated monthly to show the Contractor's progress towards meeting established milestones and performance.

The Grantee shall provide a preliminary estimated budget for the implementation of the Smart Grid Test Lab, including costs for detail design, procurement, construction, and initial operation and testing as well as a timetable for Project implementation.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 1. This shall include a detailed draft Work Plan and a Task 1 report to the Grantee. The Task 1 report shall include: (1) a report describing the discussions held with the Grantee and key stakeholders; (2) a discussion of the constraints and requirements for planning, developing and implementing a modern Smart Grid Test Bed taking into consideration all related applications and needs, including but not limited to equipment, devices, software, hardware, installation, and operator training; and (3) preliminary plans for the Workshop and Study Tour.

Task 2: Conduct Workshop

Based on the Contractor's understanding of the Grantee's present status of knowledge of Smart Grid technology as established in Task 1 and input from U.S. companies, the Contactor shall plan, organize, and conduct a five (5) day Workshop to improve the knowledge of the Grantee and stakeholder personnel and to provide them with

information relevant to modern Smart Grid Test Bed Center design and performance evaluation practices.

The Contractor Workshop will be held at the Grantee's facilities or at another appropriate venue agreed upon by the Contractor and the Grantee and shall provide training for at least 30 and not more than 40 people.

The Workshop shall cover areas agreed to by the Grantee and Contractor under Task 1. Prospective topics to be covered include the following:

- Smart Grid and interoperability requirements and Evaluation;
- Renewable energy integration and grid behavior;
- Electrical network simulation -- advanced distribution automation, network optimization and visualization;
- Communication network optimization; and
- Cyber security assessment in an integrated environment.

The Contractor shall prepare a detailed outline of the Workshop presentation material for review by the Grantee's management and obtain their approval before developing a detailed set of complete handouts and/or presentation material for the Workshop.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 2, including: a Workshop for at least 30 personnel for 5 days; Workshop materials including handouts and presentation material, case studies, best practices, etc.; and a report summarizing the outcomes of the Workshop including a list of attendees and contact information.

Task 3: Conduct a Legal, Regulatory and Institutional Review for Project Implementation and Smart Grid Standards

The Contractor shall review the host country laws, permitting requirements, local building requirements and ordinance constraints that need to be taken into account before the Smart Grid Test Bed can be implemented.

The Contractor shall review and assess the Grantee's work in developing and recommending standards for Smart Grid in India. This shall include a review and assessment of standards recommended and adopted to date and the process by which the Grantee and other stakeholders develop, recommend and implement standards for Smart Grid in India. The Contractor shall make recommendations regarding the Smart Grid standards-making process and the current Smart Grid standards regime based on international best practice.

The Contractor shall pay special attention to cyber security standards. Cyber security threats to the utility industry are increasing in number and sophistication. Because of this challenge, the North American Electric Reliability Council (NERC) is increasing the

critical infrastructure protection (CIP) regulatory requirements to ensure organizations (e.g. power trading centers) and facilities are meeting basic standards in this area. The Indian Electricity Regulatory Commissions or other statutory bodies/organizations have yet to provide such directives for utilities in India. The Contractor shall make an assessment of the current standards in India addressing the convergence of IT and operational technologies and practices and the CIP compliance requirements under India's Smart Grid technology implementation program.

Specifically, the Contractor shall provide information on NERC CIP standards and how the Grantee, Indian regulatory bodies, standard making bodies, and policy makers should proceed with developing similar standards for electric utilities in India. The Contractor shall also review the standard making work in progress in this area in India and recommend adaptation of standards for Indian utilities.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 3. This shall include: a review of legal regulatory and institutional requirements for the implementation of the Project; a review, assessment and recommendation of the Smart Grid standards making process and standards regime in India; and a review, assessment and recommendation regarding India's adoption of cyber security related standards for Smart Grid.

Task 4. Plan, Organize, and Conduct Study Tour

The Contractor shall plan, organize, and conduct a Study Tour of U.S. Smart Grid Test Bed Centers. The Study Tour shall be for up to ten (10) Grantee and other stakeholder personnel for 10 business days. However, the Contractor shall only cover the costs of up to five (5) personnel; the Grantee shall have the option to nominate up to five (5) additional personnel at its own cost for a total of ten (10) personnel. The Study Tour shall cover best practices in Smart Grid test bed system design; performance evaluation of Smart Grid components and systems; operational and business models (including fee structures and other financing mechanisms); and adherence to interoperability, security and other standards.

Potential U.S. facilities for the Study Tour may include, but are not limited to:

- Pacific Northwest National Laboratory GridWise™ Test Bed Demonstration, Electricity Infrastructure Operations Center, Smart Grid Demonstration Project;
- Oak Ridge National Lab Power Deliver Research Center;
- National Renewable Energy Laboratory (NREL);
- Sandia National Laboratory (SNL) Distributed Energy Technology Lab;
- Idaho National Laboratory (INL) National SCADA Test Bed;
- Southern California Advance Technology Laboratory;
- Pacific Gas & Electric Applied Technology Services;
- AEP-Dolan Technology Center;
- KEMA Smart Grid Interoperability Laboratory;

- ENERNEX Smart Grid Laboratory;
- EPRI Electric Lab; and
- National Insitute of Standards and Technology Laboratory.

The Contractor, taking into account the Grantee's needs, shall determine the most appropriate facilities to visit. The Contractor shall also arrange meetings for the Grantee with U.S. Smart Grid technology suppliers at the request of the Grantee and or U.S. suppliers. The Contractor shall develop a preliminary travel itinerary including site visits and rationale for visiting each site and obtain the Grantee approval at least two weeks prior to the Grantee personnel departure from India. The Contractor shall provide for international travel, U.S. domestic travel, hotels and meals for the visitors.

Prior to the trip, the Contractor shall also prepare a report (Pre-trip Report) consisting of two parts. Part one should introduce the Project and visitors to the U.S. participants in the Study Tour. It should provide background information on the Project (e.g. goal and objective of the Study Tour and the scope of Smart Grid Test Bed Center to be implemented at the Grantee's campus) and professional biographical sketches of each one of the visitors. Part two of the report should provide background information on each site to be visited. The objective of part two of the Pre-Trip Report is to familiarize the visitors to attributes of each site before they arrive at the site.

Upon completion of the visit, the Contractor shall also prepare a brief report (Post-trip Report) summarizing the outcome of each visit and technology areas of interest to the visitors, a list of attendees and contact information from each site visit/meeting.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 4. This shall include: a Final approved itinerary, Pre-trip Report, Post-trip Report, and a report on best practices in Smart Grid test bed system design; and performance evaluation of Smart Grid components and systems; operational and business models (including fee structures and other financing mechanisms); and adherence to interoperability, security and other standards.

Task 5:Develop Project Design Concept

The Contractor shall develop a preliminary Project design concept for the Grantee. The design concept shall integrate an Interoperability Laboratory and Smart Grid Test Center with the following features (note: adjustments to the desired features may change to conform to the Grantee's requirements at the time of the performance of this task based on the work performed by the Grantee and Contractor to define the requirements of the Project through Tasks 1-4):

1. Interoperability Laboratory:
   - Interoperability testing capabilities;
   - Security assessments in an integrated environment;

- Renewable integration, including grid behavioral study facilities;
- Electrical network simulation (including study facilities for network optimization and visualization); and
- Communication network optimization and test facilities.

2. Smart Grid Technology Demonstration Center

- CPRI campus distribution network automation including advanced metering infrastructure, smart metering systems, energy management systems, home automation systems, and advanced communication systems;
- Distributed energy and renewable energy resource integration with the grid and ability for remote data exchange and control;
- Micro grid interconnectivity, controls, security, safety, performance, reliability, and interoperability;
- Energy Management System (EMS) and supervisory control and data acquisition (SCADA) facilities
- Ability to simulate cyber attacks to test vulnerability of Smart Grid and devices; and
- Plug in hybrid electric vehicle (PHEV) charging center.

The Contractor is expected to modify and/or enhance these features to meet or exceed design specifications and operability features of similar systems exiting elsewhere in the world based on a global review of Smart Grid test beds and specific requirements in India, if any, and make a set of recommendations for the Grantee's consideration.

The Contractor shall work with the Grantee's engineers to determine applications and technical specifications for selected modules and sub-systems, including but not limited to:

- The necessary hardware and software required for IEDs (Intelligent Electronic devices), AMI (Advanced Metering Infrastructure), Smart Meters, home automation systems, grid connected inverters, etc. for the interoperability tests in the integrated environment with different makes of products and systems;
- Communication system studies/ Protocol Analyzers / simulators, optimization tools and security aspects evaluation tools and systems specifications;
- Automation components including; Remote Terminal Units (RTUs), Feeder Remote Terminal Units (FRTUs), IEDs, Sectionalizers, Fault Passage Indicators (FPIs), etc.;
- Control center with interconnectivity interface for Interoperability Lab and Smart Grid Technology Demonstration Center including control center design; and
- Any other subsystem / module identified by the Contactor or the Grantee to meet the objectives of the Project.

The Contractor shall prepare a conceptual design for the new building which will house the Interoperability Lab and the real time control center. It is expected that some of the components will be in physical and some in emulation mode. The design document shall

include a detailed bill of quantities (BOQ) for the Smart Grid Test Bed including hardware, software, and the building, as well as the site conditions under which the Smart Grid Test Bed will be operating. The BOQ will include requirements for connectivity to the CPRI campus network for real time system interoperability and security. The BOQ will include budgetary estimates for all requirements. The Contractor shall group and prioritize the equipment and sub-systems based on the Grantee's and other Stakeholders' requirements and constraints established in Task 1.

Based on considerations such as budget, cost, functionality, and Grantee requirements, the Contractor and Grantee shall jointly finalize a list of equipment, systems, hardware, and software to be included in the Smart Grid Test Bed and any provisions for future expansion.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 5. This shall include a preliminary design concept for the Interoperability Laboratory and Smart Grid Test Center. The Contractor shall deliver a prioritized list of equipment, software, tools, benefits, costs, and technical specifications.

Task 6: Develop Detailed Technical Specifications and Costs

Based on the work performed in Task 5, in particular the list of equipment and systems, the Contractor shall provide a detailed list of:

- hardware, software, equipment, modules, subsystems, and systems;
- building, hardware, software, equipment, modules, subsystems, and system specification and function; and
- and capital costs including detailed design, procurement, construction, and initial operation and testing of all deliverable assets (hardware, software, equipment, control center etc.).

The estimate shall include the cost of materials, labor, training, logistics and contingencies for full implementation. The Contractor shall also prepare a list of prospective suppliers, detail the climatic conditions at the Grantee's campus, and test procedures and required certifications for equipment acceptance.

The Grantee shall provide any existing cost estimates based on previous projects as well as costs for the local components (e.g. labor, material, logistics, etc.). These estimates shall be independently assessed and verified by the Contractor.

The equipment list and specifications shall be sufficiently detailed for inclusion in procurement documents.

The cost data in conjunction with information gathered in Task 1 and other input from the Grantee shall be used by the Contractor to develop a preliminary investment plan for the

implementation of the Smart Grid Test Bed. The investment plan shall include annual expenditures required for completion of the Project based on Grantee's proposed timeline for Project implementation.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 6. The Contractor shall provide detailed report based on the work conducted in Task 6 including: technical specifications, including a detailed list of equipment with specifications and functionality; a preliminary budget and investment plan for implementation of the Project.

Task 7. Prepare Financing Plan

The Contractor shall develop a Financing Plan for the capital and operating expenditures for the Project over a 10 year period based on detailed discussions with the Grantee, stakeholders and prospective financing institutions, including, but not limited to: U.S. Export-Import Bank, the World Bank, and the Asia Development Bank. The Financing Plan shall include a recommended operational and business model (including fee structures, public private partnerships, and other financing mechanisms), with the goal of achieving financial self-sustainability for the Smart Grid Test Bed facility, based on a review of Smart Grid test beds in the U.S. and other countries.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 7.

Task 8: Prepare Specification for Bidding Documents

The Contractor, with input from the Grantee, shall prepare technical specifications and evaluation criteria for tender documents to be used by the Grantee to solicit bids for the Project. The Contractor shall provide, at a minimum, the following:

- Specifications for all identified equipment / hardware / software/ test tools / integration services to be tendered;
- Operational requirements of the equipment and buildings;
- Operations / functionalities desired for the Smart Grid Test Bed; and
- A description of the criteria to be used in evaluating the bids and award of the contract.

Note: the Contractor shall not be responsible for producing any documentation beyond the technical specifications and evaluation criteria for the tender documents such as procurement procedures and restrictions to be followed by the Grantee by law or governmental administrative procedures.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 8. This shall include: technical specifications and evaluation criteria for the tender documents.

Task 9: Prepare Preliminary Environmental Impact Assessment

The Contractor shall conduct a preliminary review of the Project's anticipated impact on the environment with reference to local requirements and those of multilateral lending agencies (such as the World Bank). This review shall identify potential negative impacts, discuss the extent to which they can be mitigated, and develop plans for a full environmental impact assessment if and when the Project moves forward to the implementation stage. This includes the identification of steps that will need to be undertaken by the Grantee subsequent to completion of this TA and prior to Project implementation and an outline for a full environmental impact assessment if required for such a test facility and if and when the project moves forward to full scale deployment.

The Contractor shall also identify and describe any environmental benefits that would result from implementation of the Smart Grid technologies including, but not limited to:

- Potential lower fossil fuel development requirements as existing resources will be utilized more efficiently, including through enhanced power trading between regions;
- Potential air emission reductions due to less fossil fuel generation and reduced transmission and distribution losses;
- Potential fewer transmission and distribution infrastructure requirements as existing resources will be utilized more efficiently; and
- Potential promotion of renewable energy resources development.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 9. The Contractor shall prepare a preliminary environmental impact assessment report based on the work conducted in Task 9.

Task 10: Conduct Developmental Impact Assessment

The Contractor shall report on the potential developmental impact of the implementation of the Project. While specific focus shall be paid to the immediate impact of the Project, the Contractor shall include, where appropriate, any additional developmental benefits, including how the Smart Grid Test Bed will help to promote implementation of future Smart Grid projects. The analysis of potential benefits of the Project shall be as concrete and detailed as possible. The Contractor shall provide estimates of the Project's potential benefits in the following areas:

Infrastructure: The Contractor shall provide a description of the infrastructure impact, including construction of the Interoperability Laboratory and Smart Grid Test Center and implementation of Smart Grid infrastructure projects in India.

Human Capacity Building: The Contractor shall address the number and type of positions that would be needed to construct and operate the Project as well as the number of people who will be trained over a 10 year period and a brief description of the training programs.

Technology Transfer and Productivity Enhancement: The Contractor shall provide a description of any advanced technologies that could be potentially implemented as a result of the Project, including at the Interoperability Laboratory and Smart Grid Test Center and through implementation of Smart Grid projects in India. The Contractor shall provide a description of the energy savings and efficiency gains that could be achieved through the Smart Grid technologies implemented as a result of the Project.

Other: The Contractor shall identify any other potential developmental benefits to the Project, including any potential regulatory reform and/or development-related environmental benefits, some or all of which may have been discussed in Task 9.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 10. The Contractor shall prepare a developmental impact assessment report based on the work conducted in Task 10.

Task 11: Develop U.S. Sources of Supply

The Contractor shall conduct an assessment of the availability of potential U.S. sources of supply for the hardware, software, equipment and services needed for the implementation of the Project as well as how the Project would impact the future sales of Smart Grid equipment and technology by U.S. suppliers in India. The Contractor shall provide a list of potential U.S. suppliers including business name, point of contact, address, telephone number, e-mail, and fax numbers.

The Contractor shall also contact at least 30 leading U.S. Smart Grid technology suppliers, including those belonging to the Energy Cooperation Program, to discuss the Project and gauge interest by the U.S. suppliers in demonstrating or having their technology tested or certified at CPRI's Smart Grid Test Bed. The Contractor will exchange information regarding the Project and the U.S. company technology for those suppliers that express an interest.

Deliverable: The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 11. The Contractor shall deliver a report on Task 11 that shall include a list of U.S. sources of supply by type of hardware and software and a report on outreach to U.S. suppliers' and

suppliers' interest in demonstrating or having their technology tested or certified at CPRI's Smart Grid Test Bed.

Task 12: Final Report

The Contractor shall prepare and deliver to the Grantee a substantive and comprehensive draft Final Report of all work performed under these Terms of Reference in accordance with Clause J of Annex II of the Grant Agreement. Each of the above tasks in this Terms of Reference must be distinctly set forth in the draft Final Report in a substantive and comprehensive manner, and shall include all corresponding deliverables. The Final Report shall contain an executive summary.

The Grantee is expected to provide comments on the draft Final Report within an agreed period. Once the Grantee has provided the comments and approved the revisions of the draft Final Report, the Contractor shall prepare and submit the Final Report to the Grantee and to USTDA in accordance with requirements of the Grant agreement.

The Contractor shall provide both the Grantee with 6 copies and USTDA with 1 copy of the Final Report on CD-ROM. The CD-ROM version of the Final Report will include:

- Adobe Acrobat readable copies of all documents;
- Source files for all drawings in AutoCAD or Visio format; and
- Source files for all documents in MS Office 2000 or later formats.

Notes:

1. The Contractor is responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.
2. The Contractor and the Grantee shall be careful to ensure that the public version of the Final Report contains no security or confidential information.
3. USTDA and the Grantee shall have an irrevocable, worldwide, royalty-free, non-exclusive right to use and distribute the Final Report and all work products that is developed under these Terms of Reference.

Annex II

USTDA Mandatory Contract Clauses

A. USTDA Mandatory Clauses Controlling

The parties to this Contract acknowledge that this Contract is funded in whole or in part by the U.S. Trade and Development Agency ("USTDA") under the Grant Agreement between the Government of the United States of America acting through USTDA and Central Power Research Institute ("Client"), dated _____ ("Grant Agreement"). The Client has selected _____ ("Contractor") to perform the technical assistance ("TA") for the Smart Grid Test Bed project ("Project") in India ("Host Country"). The Client and the Contractor are the parties to this Contract, and they hereinafter are referred to collectively as the "Contract Parties." Notwithstanding any other provisions of this Contract, the following USTDA Mandatory Contract Clauses shall govern. All subcontracts entered into by Contractor funded or partially funded with USTDA Grant funds shall include these USTDA Mandatory Contract Clauses, except for clauses B(1), G, H, I, and J. In addition, in the event of any inconsistency between the Grant Agreement and the Contract or any subcontract thereunder, the Grant Agreement shall be controlling.

B. USTDA as Financier

(1) USTDA Approval of Contract

This Contract, and any amendment thereto, including any amendment to any annex thereto, and any proposed assignment of this Contract, must be approved by USTDA in writing in order to be effective with respect to the expenditure of USTDA Grant funds. USTDA will not authorize the disbursement of USTDA Grant funds until the Contract conforms to modifications required by USTDA during the Contract review process and the Contract has been formally approved by USTDA. To make this review in a timely fashion, USTDA must receive from either the Client or the Contractor an English language version of a final negotiated draft Contract or a signed Contract to the attention of the General Counsel's office at USTDA's address listed in Clause N below.

(2) USTDA Not a Party to the Contract

It is understood by the Contract Parties that USTDA has reserved certain rights such as, but not limited to, the right to approve the terms of this Contract and amendments thereto, including assignments, the selection of all contractors, the Terms of Reference, the Final Report, and any and all documents related to any contract funded under the Grant Agreement. The Contract Parties hereto further understand and agree that USTDA, in reserving any or all of the foregoing approval rights, has acted solely as a financing entity to assure the proper use of United States Government funds, and that any decision by USTDA to exercise or refrain from exercising these approval

rights shall be made as a financier in the course of financing the TA and shall not be construed as making USTDA a party to the Contract. The Contract Parties hereto understand and agree that USTDA may, from time to time, exercise the foregoing approval rights, or discuss matters related to these rights and the Project with the Contract Parties or the parties to any subcontract, jointly or separately; and in consideration of USTDA's role as financier, the Contract Parties further agree that USTDA's rights may be exercised without thereby incurring any responsibility or liability, in contract, tort, or otherwise, to the Contract Parties or the parties to any subcontract. Any approval or failure to approve by USTDA shall not bar the Client or USTDA from asserting any right they might have against the Contractor, or relieve the Contractor of any liability which the Contractor might otherwise have to the Client or USTDA.

C. Nationality, Source and Origin

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and professional services funded by USTDA under the Grant Agreement:

(a) the Contractor must be a U.S. firm;

(b) the Contractor may use U.S. subcontractors without limitation;

(c) employees of U.S. Contractor or U.S. subcontractor firms shall be U.S. citizens or non-U.S. citizens lawfully admitted for permanent residence in the United States, except as provided pursuant to subpart (d) below;

(d) up to twenty percent (20%) of the USTDA Grant amount may be used to pay for services performed by (i) Host Country subcontractors, and/or (ii) Host Country nationals who are employees of the Contractor;

(e) a Host Country subcontractor may only be used for specific services from the Terms of Reference identified in the subcontract;

(f) subcontractors from countries other than the United States or Host Country may not be used;

(g) goods purchased for performance of the TA and associated delivery services (e.g., international transportation and insurance) must have their nationality, source and origin in the United States; and

(h) goods and services incidental to TA support (e.g., local lodging, food, and transportation) in Host Country are not subject to the above restrictions.

USTDA will make available further details concerning these provisions upon request.

D. Recordkeeping and Audit

The Contractor and subcontractors funded under the Grant Agreement shall maintain, in accordance with generally accepted accounting procedures, books, records, and other documents, sufficient to reflect properly all transactions under or in connection with the Contract. These books, records, and other documents shall clearly identify and track the use and expenditure of USTDA funds, separately from other funding sources. Such books, records, and documents shall be maintained during the period of performance of work provided for by this Contract, and for a period of three (3) years after final disbursement by USTDA. The Contractor and subcontractors shall afford USTDA, or its authorized representatives, the opportunity at reasonable times for inspection and audit of such books, records, and other documentation.

E. U.S. Carriers

(1) Air

Transportation by air of persons or property funded under the Grant Agreement shall be on U.S. flag carriers in accordance with the Fly America Act, 49 U.S.C. 40118, to the extent service by such carriers is available, as provided under applicable U.S. Government regulations.

(2) Marine

Transportation by sea of property funded under the Grant Agreement shall be on U.S. carriers in accordance with U.S. cargo preference law.

F. Workman's Compensation Insurance

The Contractor shall provide adequate Workman's Compensation Insurance coverage for work performed under this Contract.

G. Reporting Requirements

The Contractor shall advise USTDA by letter as to the status of the Project on March 1st annually for a period of two (2) years after completion of the TA. In addition, if at any time the Contractor receives follow-on work from the Client, the Contractor shall so notify USTDA and designate the Contractor's contact point including name, telephone, fax number, and e-mail address. Since this information may be made publicly available by USTDA, any information which is confidential shall be designated as such by the Contractor and provided separately to USTDA. USTDA will maintain the confidentiality of such information in accordance with applicable law.

H. Disbursement Procedures

(1) USTDA Approval of Contract

Disbursement of Grant funds will be made only after USTDA approval of this Contract.

(2) Payment Schedule Requirements

A payment schedule for disbursement of Grant funds to the Contractor shall be included in this Contract. Such payment schedule must conform to the following USTDA requirements: (1) up to twenty percent (20%) of the total USTDA Grant amount may be used as a mobilization payment; (2) all other payments, with the exception of the final payment, shall be based upon Contract performance milestones; and (3) the final payment may be no less than fifteen percent (15%) of the total USTDA Grant amount, payable upon approval by USTDA of a Final Report that has been (i) prepared and submitted in accordance with the requirements set forth in Clause I below, and (ii) approved in writing by the Client in the manner provided for by Clause H(3)(b)(iii) below. Invoicing procedures for all payments are described below.

(3) Contractor Invoice Requirements

USTDA will make all disbursements of USTDA Grant funds directly to the Contractor. The Contractor must provide USTDA with an ACH Vendor Enrollment Form (available from USTDA) with the first invoice. The Client shall request disbursement of funds by USTDA to the Contractor for performance of the Contract by submitting the following to USTDA:

(a) Contractor's Invoice

The Contractor's invoice shall include reference to an item listed in the Contract payment schedule, the requested payment amount, and an appropriate certification by the Contractor, as follows:

(i) For a mobilization payment (if any):

"As a condition for this mobilization payment, the Contractor certifies that it will perform all work in accordance with the terms of its Contract with the Client. To the extent that the Contractor does not comply with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA. "

(ii) For Contract performance milestone payments:

"The Contractor has performed the work described in this invoice in accordance with the terms of its Contract with the Client and is entitled to payment thereunder. To the extent the Contractor has not complied with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(iii) For final payment:

"The Contractor has performed the work described in this invoice in accordance with the terms of its Contract with the Client and is entitled to payment thereunder. Specifically, the Contractor has submitted the Final Report to the Client, as required by the Contract, and received the Client's approval of the Final Report. To the extent the Contractor has not complied with the terms and conditions of the Contract, including the USTDA Mandatory Contract Clauses contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

(b) Client's Approval of the Contractor's Invoice

(i) The invoice for a mobilization payment must be approved in writing by the Client.

(ii) For Contract performance milestone payments, the following certification by the Client must be provided on the invoice or separately:

"The services for which disbursement is requested by the Contractor have been performed satisfactorily, in accordance with applicable Contract provisions and the terms and conditions of the USTDA Grant Agreement."

(iii) For final payment, the following certification by the Client must be provided on the invoice or separately:

"The services for which disbursement is requested by the Contractor have been performed satisfactorily, in accordance with applicable Contract provisions and the terms and conditions of the USTDA Grant Agreement. The Final Report submitted by the Contractor has been reviewed and approved by the Client. "

(c) USTDA Address for Disbursement Requests

Requests for disbursement shall be submitted to the attention of the Finance Department at USTDA's address listed in Clause N below, or by e-mail to invoices@ustda.gov.

I. Termination

(1) Method of Termination

Either Contract Party may terminate this Contract upon giving written notice to the other party and USTDA. This notice shall be effective after either 30 days, or any other period set forth elsewhere in this Contract. Furthermore, this Contract shall terminate immediately upon notification of USTDA's termination of the Grant Agreement or the term of availability of any funds thereunder.

(2) Ramifications of Termination

In the event that this Contract is terminated prior to completion, the Contractor will be eligible, subject to USTDA approval, for payment for the value of the work performed pursuant to the terms of this Contract. Likewise, in the event of such termination, USTDA is entitled to receive from the Contractor all USTDA Grant funds previously disbursed to the Contractor (including but not limited to mobilization payments) which exceed the value of the work performed pursuant to the terms of this Contract.

(3) Survivability

Clauses B, D, G, H, I, and O of the USTDA Mandatory Contract Clauses shall survive the termination of this Contract.

J. USTDA Final Report

(1) Definition

"Final Report" shall mean the Final Report described in the attached Annex I Terms of Reference or, if no such "Final Report" is described therein, "Final Report" shall mean a substantive and comprehensive report of work performed in accordance with the attached Annex I Terms of Reference, including any documents delivered to the Client.

(2) Final Report Submission Requirements

The Contractor shall provide the following to USTDA:

(a) One (1) complete hard copy of the Final Report for USTDA's records. This version shall have been approved by the Client in writing and must be in the English language. It is the responsibility of the Contractor to ensure that confidential information, if any, contained in this version be clearly marked. USTDA will maintain the confidentiality of such information in accordance with applicable law.

and

(b) One (1) hard copy of the Final Report suitable for public distribution ("Public Version"). The Public Version shall have been approved by the Client in writing and must be in the English language. As this version will be available for public distribution, it must not contain any confidential information. If the report in (a) above contains no confidential information, it may be used as the Public Version. In any event, the Public Version must be informative and contain sufficient Project detail to be useful to prospective equipment and service providers.

and

(c) Two (2) CD-ROMs, each containing a complete copy of the Public Version of the Final Report. The electronic files on the CD-ROMs shall be submitted in a commonly accessible read-only format. As these CD-ROMs will be available for public distribution, they must not contain any confidential information. It is the responsibility of the Contractor to ensure that no confidential information is contained on the CD-ROMs.

The Contractor shall also provide one (1) hard copy of the Public Version of the Final Report to the Commercial or Economic Section of the U.S. Embassy in Host Country for informational purposes.

(3) Final Report Presentation

All Final Reports submitted to USTDA must be paginated and include the following:

(a) The front cover of every Final Report shall contain the name of the Client, the name of the Contractor who prepared the report, a report title, USTDA's logo, and USTDA's address. If the complete version of the Final Report contains confidential information, the Contractor shall be responsible for labeling the front cover of that version of the Final Report with the term "Confidential Version." The Contractor shall be responsible for labeling the front cover of the Public Version of the Final Report with the term "Public Version." The front cover of every Final Report shall also contain the following disclaimer:

> "This report was funded by the U.S. Trade and Development Agency (USTDA), an agency of the U.S. Government. The opinions, findings, conclusions or recommendations expressed in this document are those of the author(s) and do not necessarily represent the official position or policies of USTDA. USTDA makes no representation about, nor does it accept responsibility for, the accuracy or completeness of the information contained in this report."

(b) The inside front cover of every Final Report shall contain USTDA's logo, USTDA's address, and USTDA's mission statement. Camera-ready copy of USTDA Final Report specifications will be available from USTDA upon request.

(c) The Contractor shall affix to the front of the CD-ROM a label identifying the Host Country, USTDA Activity Number, the name of the Client, the name of the Contractor who prepared the report, a report title, and the following language:

> "The Contractor certifies that this CD-ROM contains the Public Version of the Final Report and that all contents are suitable for public distribution."

(d) The Contractor and any subcontractors that perform work pursuant to the Grant Agreement must be clearly identified in the Final Report. Business name, point of contact, address, telephone and fax numbers, and e-mail address shall be included for Contractor and each subcontractor.

(e) The Final Report, while aiming at optimum specifications and characteristics for the Project, shall identify the availability of prospective U.S. sources of supply. Business name, point of contact, address, telephone and fax numbers, and e-mail address shall be included for each commercial source.

(f) The Final Report shall be accompanied by a letter or other notation by the Client which states that the Client approves the Final Report. A certification by the Client to this effect provided on or with the invoice for final payment will meet this requirement.

(g) The Client, USTDA, and the Commercial and/or Economic Section(s) of the U.S. Embassy in Host Country shall have irrevocable, worldwide, royalty-free, non-exclusive rights to use and distribute the Final Report.

K. Modifications

All changes, modifications, assignments or amendments to this Contract, including the appendices, shall be made only by written agreement by the Contract Parties hereto, subject to written USTDA approval.

L. TA Schedule

(1) TA Completion Date

The completion date for the TA, which is December 31, 2014, is the date by which the Contract Parties estimate that the TA will have been completed.

(2) Time Limitation on Disbursement of USTDA Grant Funds

Except as USTDA may otherwise agree, (a) no USTDA funds may be disbursed under this Contract for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (b) no USTDA funds may be disbursed more than four (4) years after the Effective Date of the Grant Agreement.

M. Business Practices

The Contract Parties recognize the existence of standards of conduct for public officials and commercial entities in their respective countries. Therefore, the Contract Parties shall fully comply with all United States and Host Country laws relating to corruption or bribery. For example, the Contractor and its subcontractors shall fully comply with the requirements of the Foreign Corrupt Practices Act, as amended (15 U.S.C. §§ 78dd-1 et seq.). Each Contract Party agrees that it shall require that any agent or representative hired to represent it in connection with the TA will comply with this paragraph and all laws which apply to activities and obligations of that Contract Party, including, but not limited to, those laws and obligations referenced above.

N. USTDA Address and Fiscal Data

Any communication with USTDA regarding this Contract shall be sent to the following address and include the fiscal data listed below:

U.S. Trade and Development Agency
1000 Wilson Boulevard, Suite 1600
Arlington, Virginia 22209-3901
USA

Phone: (703) 875-4357
Fax: (703) 875-4009

Fiscal Data:

Appropriation No.:	11 13/141001
Activity No.:	2013-31022A
Reservation No.:	2013195
Grant No.:	GH201331195

O. Taxes

USTDA funds provided under the Grant Agreement shall not be used to pay any taxes, tariffs, duties, fees or other levies imposed under laws in effect in Host Country, except for taxes of a de minimis nature imposed on local lodging, food, transportation, or airport arrivals or departures. Neither the Client nor the Contractor will seek reimbursement from USTDA for taxes, tariffs, duties, fees or other levies, except for taxes of a de minimis nature referenced above.

P. Export Licensing

The Contractor and all subcontractors are responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.

Q. Contact Persons

The Client designates the following person as the contact person for matters concerning this Contract:

Name: V. Shivakumar
Title: Engineering Officer
Phone: +91 (80) 2360 2920; 2360 0045
Fax: +91 (80) 2360 2920; 2360 1213
E-Mail: shiva@cpri.in

The Contractor designates the following person as the contact person for matters concerning this Contract:

Name:
Title:
Phone:
Fax:
E-Mail:

If anyone designated by a Contract Party as a contact person ceases service as a contact person at any point during the ten-year period following the date of signing of this Contract, the Contract Party that had designated that contact person shall provide USTDA and the other Contract Party with the name and contact information of a replacement contact person.

R. Liability

This Contract may include a clause that limits the liability of the Contract Parties, provided that such a clause does not (i) disclaim liability for special, incidental, general, or punitive damages, or (ii) limit the total amount of damages recoverable to an amount less than the total amount disbursed to the Contractor pursuant to this Contract.

S. Arbitration

If the Contract Parties submit any dispute arising under this Contract for arbitration, the scope of any such arbitration shall be limited to the Contract Parties' rights and/or obligations under this Contract and may not extend to any right or obligation of USTDA. The arbitrator(s) shall not arbitrate issues directly affecting the rights or obligations of USTDA.

ANNEX 5

Terms of Reference

The objective of this Technical Assistance (TA) is for a contractor (Contractor) to assist Central Power Research Institute (Grantee) to prepare a detailed planning and procurement document for implementing a Smart Grid Test Bed (Project). The Project will consist of an integrated Interoperability Laboratory and Smart Grid Technology Demonstration Center. The Project will allow research of technologies and systems for a wide range of Smart Grid applications and will allow the Grantee to perform specialized, controlled laboratory evaluations of integrated Smart Grid technologies including substation automation, load management, smart meters, cyber security, network sensing, energy management, renewables integration, and plug in hybrid electric vehicles (PHEV). If implemented, the Test Bed would be used by manufacturers, utilities, integrators, consulting firms and academicians for various activates including testing, certification and training. The TA is intended to facilitate the implementation of Smart Grid pilot projects and full scale deployment of Smart Grid technologies across India.

Task 1: Develop a Work Plan and Define Overall TA Parameters

Subtask 1.1: Assess Grantee's Present Facilities, Laboratories, Capabilities and Smart Grid Test Bed Requirements

The Contractor shall visit the Grantee's campus and hold discussions with managers, engineers, and researchers to establish an in-depth understanding of the Grantee's existing facilities, laboratories, capabilities and requirements for procuring and implementing a modern Smart Grid Test Bed. As part of these discussions, the Contractor shall:

- Identify and discuss the Project with other Project stakeholders such as India Smart Grid Forum (ISGF), Ministry of Power, and U.S. equipment suppliers, including those in the Energy Cooperation Program at the American Chamber of Commerce, interested in the establishment of a Smart Grid Test Bed at the CPRI campus. The Contractor shall identify and communicate to the Grantee the stakeholders' needs and requirements, and shall take them into account in developing a detailed Project Work Plan.
- Identify the U.S. and Indian equipment suppliers who may be interested to contribute equipment to or have their equipment tested at the Smart Grid Test Bed at no cost to the Grantee.
- Identify the Grantee's requirements for a Smart Grid Test Bed Workshop including the number of participants, topics to be covered, and timing for the five (5) day program;
- Identify with the Grantee the Grantee and stakeholder personnel who will participate in a Study Tour of U.S. Smart Grid Test Beds and potential sites for the participants to visit. The Study Tour shall be planned for not more than 10 participants and not for more than 10 working days.

Sub-task 1.2 Kickoff Meeting and Detailed Work Plan

The Contractor shall develop a detailed Work Plan including a schedule and milestones based on these Terms of Reference and the work performed in Sub-task 1.1. The Contractor shall conduct a series of kickoff meetings with the Grantee and other stakeholders at the Grantee's facilities or at another appropriate venue agreed upon by the Contractor and the Grantee. The Contractor and Grantee shall identify appropriate personnel and other relevant stakeholders to participate in these kickoff meetings.

During the kickoff meetings, the Contractor shall present the goals and objectives of the Project, Workshop, and Study Tour and review the tasks to be performed under these Terms of Reference; review the Contractor's existing work plan to perform the tasks under these Terms of Reference; and solicit Grantee's input as to whether any changes to the Contractor's work plan for the Study are warranted. The Contractor and Grantee may agree to modify the work plan and in that case, the Contractor shall prepare a revised work plan. Any work provided for in the work plan that goes beyond these Terms of Reference will be performed at Contractor's cost. In the event of any inconsistency between the Terms of Reference and the Contractor's work plan, the Terms of Reference shall control.

The Contractor shall obtain Grantee approval for the Contractor's Work Plan. This Work Plan shall be updated monthly to show the Contractor's progress towards meeting established milestones and performance.

The Grantee shall provide a preliminary estimated budget for the implementation of the Smart Grid Test Lab, including costs for detail design, procurement, construction, and initial operation and testing as well as a timetable for Project implementation.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 1. This shall include a detailed draft Work Plan and a Task 1 report to the Grantee. The Task 1 report shall include: (1) a report describing the discussions held with the Grantee and key stakeholders; (2) a discussion of the constraints and requirements for planning, developing and implementing a modern Smart Grid Test Bed taking into consideration all related applications and needs, including but not limited to equipment, devices, software, hardware, installation, and operator training; and (3) preliminary plans for the Workshop and Study Tour.

Task 2: Conduct Workshop

Based on the Contractor's understanding of the Grantee's present status of knowledge of Smart Grid technology as established in Task 1 and input from U.S. companies, the Contactor shall plan, organize, and conduct a five (5) day Workshop to improve the knowledge of the Grantee and stakeholder personnel and to provide them with

information relevant to modern Smart Grid Test Bed Center design and performance evaluation practices.

The Contractor Workshop will be held at the Grantee's facilities or at another appropriate venue agreed upon by the Contractor and the Grantee and shall provide training for at least 30 and not more than 40 people.

The Workshop shall cover areas agreed to by the Grantee and Contractor under Task 1. Prospective topics to be covered include the following:

- Smart Grid and interoperability requirements and Evaluation;
- Renewable energy integration and grid behavior;
- Electrical network simulation -- advanced distribution automation, network optimization and visualization;
- Communication network optimization; and
- Cyber security assessment in an integrated environment.

The Contractor shall prepare a detailed outline of the Workshop presentation material for review by the Grantee's management and obtain their approval before developing a detailed set of complete handouts and/or presentation material for the Workshop.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 2, including: a Workshop for at least 30 personnel for 5 days; Workshop materials including handouts and presentation material, case studies, best practices, etc.; and a report summarizing the outcomes of the Workshop including a list of attendees and contact information.

Task 3: Conduct a Legal, Regulatory and Institutional Review for Project Implementation and Smart Grid Standards

The Contractor shall review the host country laws, permitting requirements, local building requirements and ordinance constraints that need to be taken into account before the Smart Grid Test Bed can be implemented.

The Contractor shall review and assess the Grantee's work in developing and recommending standards for Smart Grid in India. This shall include a review and assessment of standards recommended and adopted to date and the process by which the Grantee and other stakeholders develop, recommend and implement standards for Smart Grid in India. The Contractor shall make recommendations regarding the Smart Grid standards-making process and the current Smart Grid standards regime based on international best practice.

The Contractor shall pay special attention to cyber security standards. Cyber security threats to the utility industry are increasing in number and sophistication. Because of this challenge, the North American Electric Reliability Council (NERC) is increasing the

critical infrastructure protection (CIP) regulatory requirements to ensure organizations (e.g. power trading centers) and facilities are meeting basic standards in this area. The Indian Electricity Regulatory Commissions or other statutory bodies/organizations have yet to provide such directives for utilities in India. The Contractor shall make an assessment of the current standards in India addressing the convergence of IT and operational technologies and practices and the CIP compliance requirements under India's Smart Grid technology implementation program.

Specifically, the Contractor shall provide information on NERC CIP standards and how the Grantee, Indian regulatory bodies, standard making bodies, and policy makers should proceed with developing similar standards for electric utilities in India. The Contractor shall also review the standard making work in progress in this area in India and recommend adaptation of standards for Indian utilities.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 3. This shall include: a review of legal regulatory and institutional requirements for the implementation of the Project; a review, assessment and recommendation of the Smart Grid standards making process and standards regime in India; and a review, assessment and recommendation regarding India's adoption of cyber security related standards for Smart Grid.

Task 4. Plan, Organize, and Conduct Study Tour

The Contractor shall plan, organize, and conduct a Study Tour of U.S. Smart Grid Test Bed Centers. The Study Tour shall be for up to ten (10) Grantee and other stakeholder personnel for 10 business days. However, the Contractor shall only cover the costs of up to five (5) personnel; the Grantee shall have the option to nominate up to five (5) additional personnel at its own cost for a total of ten (10) personnel. The Study Tour shall cover best practices in Smart Grid test bed system design; performance evaluation of Smart Grid components and systems; operational and business models (including fee structures and other financing mechanisms); and adherence to interoperability, security and other standards.

Potential U.S. facilities for the Study Tour may include, but are not limited to:

- Pacific Northwest National Laboratory GridWise™ Test Bed Demonstration, Electricity Infrastructure Operations Center, Smart Grid Demonstration Project;
- Oak Ridge National Lab Power Deliver Research Center;
- National Renewable Energy Laboratory (NREL);
- Sandia National Laboratory (SNL) Distributed Energy Technology Lab;
- Idaho National Laboratory (INL) National SCADA Test Bed;
- Southern California Advance Technology Laboratory;
- Pacific Gas & Electric Applied Technology Services;
- AEP-Dolan Technology Center;
- KEMA Smart Grid Interoperability Laboratory;

- ENERNEX Smart Grid Laboratory;
- EPRI Electric Lab; and
- National Insitute of Standards and Technology Laboratory.

The Contractor, taking into account the Grantee's needs, shall determine the most appropriate facilities to visit. The Contractor shall also arrange meetings for the Grantee with U.S. Smart Grid technology suppliers at the request of the Grantee and or U.S. suppliers. The Contractor shall develop a preliminary travel itinerary including site visits and rationale for visiting each site and obtain the Grantee approval at least two weeks prior to the Grantee personnel departure from India. The Contractor shall provide for international travel, U.S. domestic travel, hotels and meals for the visitors.

Prior to the trip, the Contractor shall also prepare a report (Pre-trip Report) consisting of two parts. Part one should introduce the Project and visitors to the U.S. participants in the Study Tour. It should provide background information on the Project (e.g. goal and objective of the Study Tour and the scope of Smart Grid Test Bed Center to be implemented at the Grantee's campus) and professional biographical sketches of each one of the visitors. Part two of the report should provide background information on each site to be visited. The objective of part two of the Pre-Trip Report is to familiarize the visitors to attributes of each site before they arrive at the site.

Upon completion of the visit, the Contractor shall also prepare a brief report (Post-trip Report) summarizing the outcome of each visit and technology areas of interest to the visitors, a list of attendees and contact information from each site visit/meeting.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 4. This shall include: a Final approved itinerary, Pre-trip Report, Post-trip Report, and a report on best practices in Smart Grid test bed system design; and performance evaluation of Smart Grid components and systems; operational and business models (including fee structures and other financing mechanisms); and adherence to interoperability, security and other standards.

Task 5:Develop Project Design Concept

The Contractor shall develop a preliminary Project design concept for the Grantee. The design concept shall integrate an Interoperability Laboratory and Smart Grid Test Center with the following features (note: adjustments to the desired features may change to conform to the Grantee's requirements at the time of the performance of this task based on the work performed by the Grantee and Contractor to define the requirements of the Project through Tasks 1-4):

1. Interoperability Laboratory:
   - Interoperability testing capabilities;
   - Security assessments in an integrated environment;

- Renewable integration, including grid behavioral study facilities;
- Electrical network simulation (including study facilities for network optimization and visualization); and
- Communication network optimization and test facilities.

2. Smart Grid Technology Demonstration Center

- CPRI campus distribution network automation including advanced metering infrastructure, smart metering systems, energy management systems, home automation systems, and advanced communication systems;
- Distributed energy and renewable energy resource integration with the grid and ability for remote data exchange and control;
- Micro grid interconnectivity, controls, security, safety, performance, reliability, and interoperability;
- Energy Management System (EMS) and supervisory control and data acquisition (SCADA) facilities
- Ability to simulate cyber attacks to test vulnerability of Smart Grid and devices; and
- Plug in hybrid electric vehicle (PHEV) charging center.

The Contractor is expected to modify and/or enhance these features to meet or exceed design specifications and operability features of similar systems exiting elsewhere in the world based on a global review of Smart Grid test beds and specific requirements in India, if any, and make a set of recommendations for the Grantee's consideration.

The Contractor shall work with the Grantee's engineers to determine applications and technical specifications for selected modules and sub-systems, including but not limited to:

- The necessary hardware and software required for IEDs (Intelligent Electronic devices), AMI (Advanced Metering Infrastructure), Smart Meters, home automation systems, grid connected inverters, etc. for the interoperability tests in the integrated environment with different makes of products and systems;
- Communication system studies/ Protocol Analyzers / simulators, optimization tools and security aspects evaluation tools and systems specifications;
- Automation components including; Remote Terminal Units (RTUs), Feeder Remote Terminal Units (FRTUs), IEDs, Sectionalizers, Fault Passage Indicators (FPIs), etc.;
- Control center with interconnectivity interface for Interoperability Lab and Smart Grid Technology Demonstration Center including control center design; and
- Any other subsystem / module identified by the Contactor or the Grantee to meet the objectives of the Project.

The Contractor shall prepare a conceptual design for the new building which will house the Interoperability Lab and the real time control center. It is expected that some of the components will be in physical and some in emulation mode. The design document shall

include a detailed bill of quantities (BOQ) for the Smart Grid Test Bed including hardware, software, and the building, as well as the site conditions under which the Smart Grid Test Bed will be operating. The BOQ will include requirements for connectivity to the CPRI campus network for real time system interoperability and security. The BOQ will include budgetary estimates for all requirements. The Contractor shall group and prioritize the equipment and sub-systems based on the Grantee's and other Stakeholders' requirements and constraints established in Task 1.

Based on considerations such as budget, cost, functionality, and Grantee requirements, the Contractor and Grantee shall jointly finalize a list of equipment, systems, hardware, and software to be included in the Smart Grid Test Bed and any provisions for future expansion.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 5. This shall include a preliminary design concept for the Interoperability Laboratory and Smart Grid Test Center. The Contractor shall deliver a prioritized list of equipment, software, tools, benefits, costs, and technical specifications.

Task 6: Develop Detailed Technical Specifications and Costs

Based on the work performed in Task 5, in particular the list of equipment and systems, the Contractor shall provide a detailed list of:

- hardware, software, equipment, modules, subsystems, and systems;
- building, hardware, software, equipment, modules, subsystems, and system specification and function; and
- and capital costs including detailed design, procurement, construction, and initial operation and testing of all deliverable assets (hardware, software, equipment, control center etc.).

The estimate shall include the cost of materials, labor, training, logistics and contingencies for full implementation. The Contractor shall also prepare a list of prospective suppliers, detail the climatic conditions at the Grantee's campus, and test procedures and required certifications for equipment acceptance.

The Grantee shall provide any existing cost estimates based on previous projects as well as costs for the local components (e.g. labor, material, logistics, etc.). These estimates shall be independently assessed and verified by the Contractor.

The equipment list and specifications shall be sufficiently detailed for inclusion in procurement documents.

The cost data in conjunction with information gathered in Task 1 and other input from the Grantee shall be used by the Contractor to develop a preliminary investment plan for the

implementation of the Smart Grid Test Bed. The investment plan shall include annual expenditures required for completion of the Project based on Grantee's proposed timeline for Project implementation.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 6. The Contractor shall provide detailed report based on the work conducted in Task 6 including: technical specifications, including a detailed list of equipment with specifications and functionality; a preliminary budget and investment plan for implementation of the Project.

Task 7. Prepare Financing Plan

The Contractor shall develop a Financing Plan for the capital and operating expenditures for the Project over a 10 year period based on detailed discussions with the Grantee, stakeholders and prospective financing institutions, including, but not limited to: U.S. Export-Import Bank, the World Bank, and the Asia Development Bank. The Financing Plan shall include a recommended operational and business model (including fee structures, public private partnerships, and other financing mechanisms), with the goal of achieving financial self-sustainability for the Smart Grid Test Bed facility, based on a review of Smart Grid test beds in the U.S. and other countries.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 7.

Task 8: Prepare Specification for Bidding Documents

The Contractor, with input from the Grantee, shall prepare technical specifications and evaluation criteria for tender documents to be used by the Grantee to solicit bids for the Project. The Contractor shall provide, at a minimum, the following:

- Specifications for all identified equipment / hardware / software/ test tools / integration services to be tendered;
- Operational requirements of the equipment and buildings;
- Operations / functionalities desired for the Smart Grid Test Bed; and
- A description of the criteria to be used in evaluating the bids and award of the contract.

Note: the Contractor shall not be responsible for producing any documentation beyond the technical specifications and evaluation criteria for the tender documents such as procurement procedures and restrictions to be followed by the Grantee by law or governmental administrative procedures.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 8. This shall include: technical specifications and evaluation criteria for the tender documents.

Task 9: Prepare Preliminary Environmental Impact Assessment

The Contractor shall conduct a preliminary review of the Project's anticipated impact on the environment with reference to local requirements and those of multilateral lending agencies (such as the World Bank). This review shall identify potential negative impacts, discuss the extent to which they can be mitigated, and develop plans for a full environmental impact assessment if and when the Project moves forward to the implementation stage. This includes the identification of steps that will need to be undertaken by the Grantee subsequent to completion of this TA and prior to Project implementation and an outline for a full environmental impact assessment if required for such a test facility and if and when the project moves forward to full scale deployment.

The Contractor shall also identify and describe any environmental benefits that would result from implementation of the Smart Grid technologies including, but not limited to:

- Potential lower fossil fuel development requirements as existing resources will be utilized more efficiently, including through enhanced power trading between regions;
- Potential air emission reductions due to less fossil fuel generation and reduced transmission and distribution losses;
- Potential fewer transmission and distribution infrastructure requirements as existing resources will be utilized more efficiently; and
- Potential promotion of renewable energy resources development.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 9. The Contractor shall prepare a preliminary environmental impact assessment report based on the work conducted in Task 9.

Task 10: Conduct Developmental Impact Assessment

The Contractor shall report on the potential developmental impact of the implementation of the Project. While specific focus shall be paid to the immediate impact of the Project, the Contractor shall include, where appropriate, any additional developmental benefits, including how the Smart Grid Test Bed will help to promote implementation of future Smart Grid projects. The analysis of potential benefits of the Project shall be as concrete and detailed as possible. The Contractor shall provide estimates of the Project's potential benefits in the following areas:

Infrastructure: The Contractor shall provide a description of the infrastructure impact, including construction of the Interoperability Laboratory and Smart Grid Test Center and implementation of Smart Grid infrastructure projects in India.

Human Capacity Building: The Contractor shall address the number and type of positions that would be needed to construct and operate the Project as well as the number of people who will be trained over a 10 year period and a brief description of the training programs.

Technology Transfer and Productivity Enhancement: The Contractor shall provide a description of any advanced technologies that could be potentially implemented as a result of the Project, including at the Interoperability Laboratory and Smart Grid Test Center and through implementation of Smart Grid projects in India. The Contractor shall provide a description of the energy savings and efficiency gains that could be achieved through the Smart Grid technologies implemented as a result of the Project.

Other: The Contractor shall identify any other potential developmental benefits to the Project, including any potential regulatory reform and/or development-related environmental benefits, some or all of which may have been discussed in Task 9.

Deliverable: - The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 10. The Contractor shall prepare a developmental impact assessment report based on the work conducted in Task 10.

Task 11: Develop U.S. Sources of Supply

The Contractor shall conduct an assessment of the availability of potential U.S. sources of supply for the hardware, software, equipment and services needed for the implementation of the Project as well as how the Project would impact the future sales of Smart Grid equipment and technology by U.S. suppliers in India. The Contractor shall provide a list of potential U.S. suppliers including business name, point of contact, address, telephone number, e-mail, and fax numbers.

The Contractor shall also contact at least 30 leading U.S. Smart Grid technology suppliers, including those belonging to the Energy Cooperation Program, to discuss the Project and gauge interest by the U.S. suppliers in demonstrating or having their technology tested or certified at CPRI's Smart Grid Test Bed. The Contractor will exchange information regarding the Project and the U.S. company technology for those suppliers that express an interest.

Deliverable: The Contractor shall prepare and deliver to the Grantee a report that contains all information collected, work performed and analysis provided under Task 11. The Contractor shall deliver a report on Task 11 that shall include a list of U.S. sources of supply by type of hardware and software and a report on outreach to U.S. suppliers' and

suppliers' interest in demonstrating or having their technology tested or certified at CPRI's Smart Grid Test Bed.

Task 12: Final Report

The Contractor shall prepare and deliver to the Grantee a substantive and comprehensive draft Final Report of all work performed under these Terms of Reference in accordance with Clause J of Annex II of the Grant Agreement. Each of the above tasks in this Terms of Reference must be distinctly set forth in the draft Final Report in a substantive and comprehensive manner, and shall include all corresponding deliverables. The Final Report shall contain an executive summary.

The Grantee is expected to provide comments on the draft Final Report within an agreed period. Once the Grantee has provided the comments and approved the revisions of the draft Final Report, the Contractor shall prepare and submit the Final Report to the Grantee and to USTDA in accordance with requirements of the Grant agreement.

The Contractor shall provide both the Grantee with 6 copies and USTDA with 1 copy of the Final Report on CD-ROM. The CD-ROM version of the Final Report will include:

- Adobe Acrobat readable copies of all documents;
- Source files for all drawings in AutoCAD or Visio format; and
- Source files for all documents in MS Office 2000 or later formats.

Notes:

1. The Contractor is responsible for compliance with U.S. export licensing requirements, if applicable, in the performance of the Terms of Reference.
2. The Contractor and the Grantee shall be careful to ensure that the public version of the Final Report contains no security or confidential information.
3. USTDA and the Grantee shall have an irrevocable, worldwide, royalty-free, non-exclusive right to use and distribute the Final Report and all work products that is developed under these Terms of Reference.

ANNEX 6

USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant

U.S. Firm Information Form

This form is designed to enable the U.S. Trade and Development Agency ("USTDA") to obtain information about entities and individuals proposed for participation in USTDA-funded activities. Information in this form is used to conduct screening of entities and individuals to ensure compliance with legislative and executive branch prohibitions on providing support or resources to, or engaging in transactions with, certain individuals or entities with which USTDA must comply.

USTDA Activity Number [*To be completed by USTDA*]	2013-31022A				
Activity Type [*To be completed by USTDA*]	☐ Feasibility Study	☑ Technical Assistance	☐ Other (specify)		
Activity Title [*To be completed by USTDA*]	Central Power Research Institute Smart Grid Test Bed Project				
Full Legal Name of U.S. Firm					
Business Address (street address only)					
Telephone		Fax		Website	
Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary.					
Type of Ownership	☐ Publicly Traded Company				
	☐ Private Company				
	☐ Other (please specify)				
Please provide a list of directors and principal officers as detailed in Attachment A. Attached? (Not Applicable for U.S. Publicly Traded Company)	☐ Yes				
If Private Company or Other (if applicable), provide a list of shareholders and the percentage of their ownership. In addition, for each shareholder that owns 15% or more shares in U.S. Firm, please complete Attachment B.					
Is the U.S. Firm a wholly-owned or partially owned subsidiary?	☐ Yes				
	☐ No				
If so, please provide the name of the U.S. Firm's parent company(ies). In addition, for any parent identified, please complete Attachment B.					
Is the U.S. Firm proposing to subcontract some of the proposed work to another firm?	☐ Yes				
	☐ No				
If yes, U.S. Firm shall complete Attachment C for each subcontractor. Attached?	☐ Yes				
	☐ Not applicable				
Project Manager					
Name	Surname				
	Given Name				
Address					
Telephone					
Fax					
Email					
Negotiation Prerequisites					
Discuss any current or anticipated commitments which may impact the ability of the U.S. Firm or its subcontractors to complete the Activity as proposed and reflect such impact within the project schedule.					
Identify any specific information which is needed from the Grantee before commencing negotiations.					

U.S. Firm may attach additional sheets, as necessary.

U.S. Firm's Representations
U.S. Firm shall certify to the following (or provide an explanation as to why any representation cannot be made):
1. U.S. Firm is a *[check one]* ☐ Corporation ☐ LLC ☐ Partnership ☐ Sole Proprietor ☐ Other: duly organized, validly existing and in good standing under the laws of the State of: *[insert state]* . The U.S. Firm has all the requisite corporate power and authority to conduct its business as presently conducted, to submit this proposal, and if selected, to execute and deliver a contract to the Grantee for the performance of the USTDA Activity. The U.S. Firm is not debarred, suspended, or to the best of its knowledge or belief, proposed for debarment or ineligible for the award of contracts by any federal or state governmental agency or authority.
2. The U.S. Firm has included herewith, a copy of its Articles of Incorporation (or equivalent charter or document issued by a designated authority in accordance with applicable laws that provides information and authentication regarding the legal status of an entity) and a Certificate of Good Standing (or equivalent document) issued within 1 month of the date of signature below by the State of: *[insert state]* . The U.S. Firm commits to notify USTDA and the Grantee if it becomes aware of any change in its status in the state in which it is incorporated. USTDA retains the right to request an updated certificate of good standing. **(U.S. publicly traded companies need not include Articles of Incorporation or Good Standing Certificate)**
3. Neither the U.S. Firm nor any of its principal officers have, within the ten-year period preceding the submission of this proposal, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a federal, state or local government contract or subcontract; violation of federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating federal or state criminal tax laws, or receiving stolen property.
4. Neither the U.S. Firm, nor any of its principal officers, is presently indicted for, or otherwise criminally or civilly charged with, commission of any of the offenses enumerated in paragraph 3 above.
5. There are no federal or state tax liens pending against the assets, property or business of the U.S. Firm. The U.S. Firm, has not, within the three-year period preceding the submission of this proposal, been notified of any delinquent federal or state taxes in an amount that exceeds US$3,000 for which the liability remains unsatisfied. Taxes are considered delinquent if (a) the tax liability has been fully determined, with no pending administrative or judicial appeals; and (b) a taxpayer has failed to pay the tax liability when full payment is due and required.
6. The U.S. Firm has not commenced a voluntary case or other proceeding seeking liquidation, reorganization or other relief with respect to itself of its debts under any bankruptcy, insolvency or other similar law. The U.S. Firm has not had filed against it an involuntary petition under any bankruptcy, insolvency or similar law.
7. The U.S. Firm certifies that it complies with USTDA Nationality, Source, and Origin Requirements and shall continue to comply with such requirements throughout the duration of the USTDA-funded activity. The U.S. Firm commits to notify USTDA and the Grantee if it becomes aware of any change which might affect U.S. Firm's ability to meet the USTDA Nationality, Source, and Origin Requirements.
The U.S. Firm shall notify USTDA if any of the representations are no longer true and correct.
U.S. Firm certifies that the information provided in this form is true and correct. U.S. Firm understands and agrees that the U.S. Government may rely on the accuracy of this information in processing a request to participate in a USTDA-funded activity. If at any time USTDA has reason to believe that any person or entity has willfully and knowingly provided incorrect information or made false statements, USTDA may take action under applicable law. The undersigned represents and warrants that he/she has the requisite power and authority to sign on behalf of the U.S. Firm.

Name		Signature	
Title			
Organization		Date	

ATTACHMENT A

USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant

U.S. Firm Information Form – Directors and Principal Officers

(Not Applicable for U.S. Publicly Traded Company)

Provide a list of all directors and principal officers (e.g., President, Chief Executive Officer, Vice-President(s), Secretary and Treasurer). Please provide full names including surname and given name.

USTDA Activity Number [*To be completed by USTDA*]	2013-31022A
Activity Title [*To be completed by USTDA*]	Central Power Research Institute Smart Grid Test Bed Project
Full Legal Name of Entity	

Title	Name		
(e.g., Director, President, Chief Executive Officer, Vice-President(s), Secretary, Treasurer) **** Please place an asterisk (*) next to the names of those principal officers who will be involved in the USTDA-funded activity***	**Surname**	**Given Name**	**Middle Name**

ATTACHMENT B

USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant

U.S. Firm Information Form – Shareholder(s) and Parent Company(ies)

If applicable, U.S. Firm provided a list of shareholders and the percentage of their ownership. This form shall be completed for each shareholder that owns 15% or more shares in U.S. Firm, as well as any parent corporation of the U.S. Firm ("Shareholder"). In addition, this form shall be completed for each shareholder identified in Attachment B that owns 15% or more shares in any Shareholder, as well as any parent identified in Attachment B.

USTDA Activity Number [*To be completed by USTDA*]	2013-31022A
Activity Title [*To be completed by USTDA*]	Central Power Research Institute Smart Grid Test Bed Project
Full Legal Name of U.S. Firm	
Full Legal Name of Shareholder	
Business Address of Shareholder (street address only)	
Telephone number	Fax Number
Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary.	
Country of Shareholder's Principal Place of Business	
Please provide a list of directors and principal officers as detailed in Attachment A. Attached?	☐ Yes
Type of Ownership	☐ Publicly Traded Company ☐ Private Company ☐ Other
If applicable, provide a list of shareholders and the percentage of their ownership. In addition, for each shareholder that owns 15% or more shares in Shareholder, please complete Attachment B.	
Is the Shareholder a wholly-owned or partially owned subsidiary?	☐ Yes ☐ No
If so, please provide the name of the Shareholder's parent(s). In addition, for any parent identified, please complete Attachment B.	

Shareholder may attach additional sheets, as necessary.

ATTACHMENT C

USTDA-Funded Feasibility Study, Technical Assistance, or Training Grant

Subcontractor Information Form

This form is designed to enable the U.S. Trade and Development Agency ("USTDA") to obtain information about entities and individuals proposed for participation in USTDA-funded activities. Information in this form is used to conduct screening of entities and individuals to ensure compliance with legislative and executive branch prohibitions on providing support or resources to, or engaging in transactions with, certain individuals or entities with which USTDA must comply.

USTDA Activity Number [*To be completed by USTDA*]	2013-31022A
Activity Title [*To be completed by USTDA*]	Central Power Research Institute Smart Grid Test Bed Project
Full Legal Name of Prime Contractor U.S. Firm ("U.S. Firm")	
Full Legal Name of Subcontractor	
Business Address of Subcontractor (street address only)	
Telephone Number	
Fax Number	
Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary.	

Subcontractor Point of Contact		
Name	Surname	
	Given Name	
Address		
Telephone		
Fax		
Email		

Subcontractor's Representations											
Subcontractor shall provide the following (or any explanation as to why any representation cannot be made), made as of the date of the proposal:											
1.	Subcontractor is a *[check one]*	☐	Corporation	☐	LLC	☐	Partnership	☐	Sole Proprietor	☐	Other
	duly organized, validly existing and in good standing under the laws of:	*[insert state (if U.S.) or country]*	.								
	The subcontractor has all the requisite corporate power and authority to conduct its business as presently conducted, to participate in this proposal, and if the U.S. Firm is selected, to execute and deliver a subcontract to the U.S. Firm for the performance of the USTDA Activity and to perform the USTDA Activity. The subcontractor is not debarred, suspended, or to the best of its knowledge or belief, proposed for debarment or ineligible for the award of contracts by any federal or state governmental agency or authority.										
2.	Neither the subcontractor nor any of its principal officers have, within the ten-year period preceding the submission of the Offeror's proposal, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a federal, state or local government contract or subcontract; violation of federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating federal or state criminal tax laws, or receiving stolen property.										
3.	Neither the subcontractor, nor any of its principal officers, is presently indicted for, or otherwise criminally or civilly charged with, commission of any of the offenses enumerated in paragraph 2 above.										
4.	There are no federal or state tax liens pending against the assets, property or business of the subcontractor. The subcontractor, has not, within the three-year period preceding this RFP, been notified of any delinquent federal or state taxes in an amount that exceeds $3,000 for which the liability remains unsatisfied. Taxes are considered delinquent if (a) the tax liability has been fully determined, with no pending administrative or judicial appeals; and (b) a taxpayer has failed to pay the tax liability when full payment is due and required.										
5.	The subcontractor has not commenced a voluntary case or other proceeding seeking liquidation, reorganization or other relief with respect to itself or its debts under any bankruptcy, insolvency or other similar law. The subcontractor has not had filed against it an involuntary petition under any bankruptcy, insolvency or similar law.										
6.	The Subcontractor certifies that it complies with the USTDA Nationality, Source, and Origin Requirements and shall continue to comply with such requirements throughout the duration of the USTDA-funded activity. The Subcontractor commits to notify USTDA, the Contractor, and the Grantee if it becomes aware of any change which might affect U.S. Firm's ability to meet the USTDA Nationality, Source, and Origin Requirements.										
The selected Subcontractor shall notify the U.S. Firm, Grantee and USTDA if any of the representations included in its proposal are no longer true and correct.											
Subcontractor certifies that the information provided in this form is true and correct. Subcontractor understands and agrees that the U.S. Government may rely on the accuracy of this information in processing a request to participate in a USTDA-funded activity. If at any time USTDA has reason to believe that any person or entity has willfully and knowingly provided incorrect information or made false statements, USTDA may take action under applicable law. The undersigned represents and warrants that he/she has the requisite power and authority to sign on behalf of the Subcontractor.											

Name		Signature	
Title			
Organization		Date	