

REQUEST FOR PROPOSALS

FEASIBILITY STUDY FOR THE

**CAGECE TERTIARY WASTEWATER TREATMENT PLANTS AND
AUTOMATED WATER AND SEWAGE CONTROL SYSTEM PROJECT**

Submission Deadline: **1:00 PM**
LOCAL TIME
FRIDAY, JUNE 22, 2012

Submission Place: CAGECE
Marcondes Sobreira
Av. Dr. Lauro Vieira Chaves, 1030 - Vila União
Fortaleza, CE, Brazil, 60422-901
Phone: 011 55 (85) 3101-2001

**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\$579,895 to Ceará Water and Sewage Treatment Company (CAGECE) (the "Grantee") in accordance with a grant agreement dated March 29th, 2012 (the "Grant Agreement"). USTDA will fund the cost of goods and services required for the preparation of a feasibility study ("Feasibility Study") on the proposed CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project ("Project") in Brazil ("Host Country"). 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 Feasibility Study.

1.1 BACKGROUND SUMMARY

Limited availability of potable water in the majority of northeastern states in Brazil coupled with recent and stricter regulatory requirements for the discharge of wastewater treatment plant effluent in the country have elevated the interest of local water and wastewater treatment companies to seek and adopt modern water treatment solutions as well as automation technologies to increase productivity and reduce costs.

In this regard, the Ceara Water and Sewage Treatment Company (CAGECE) will be taking several measures to comply with these requirements at the same time the company will be investing to improve productivity and expand its services provided in the state. CAGECE is responsible for water and sewage services in the State of Ceara. This study will determine the technical and financial viability of developing tertiary wastewater treatment plants as well as a roadmap and implementation plan for an automated water and sewage control system for the company.

This project is a priority for CAGECE, and it is expected to contribute to the government of Ceara's efforts to improve water access in the state. Portions of a background Definitional Mission is provided for reference in Annex 2.

1.2 OBJECTIVE

The objective of this feasibility study is twofold. First, it will help CAGECE determine the technical and financial viability of developing two tertiary wastewater treatment plants for water reuse in the capital city of Fortaleza. The study would also provide CAGECE with a preliminary design for the treatment plants. These facilities would expand the company's wastewater treatment capabilities and at the same time would allow the company to utilize the non-potable water produced from the water reuse process for industrial use. Second, this study would evaluate the company's existing automation and control systems in order to develop a roadmap, and implementation plan for the construction of an enhanced integrated automated water supply and wastewater management control center. This control center would oversee the company's existing automated water supply control system and automated sewage control system, adding remote process control and monitoring capability at its main water treatment plant, and other

facilities in the state. The Terms of Reference (TOR) for this Feasibility Study 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\$579,895. **The USTDA grant of US\$ 579,895 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\$579,895 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 CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System 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 Feasibility Study.

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 Feasibility Study.

2.5 PROJECT FUNDING SOURCE

The Feasibility Study will be funded under a grant from USTDA. The total amount of the grant is not to exceed US\$579,895.

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 Portuguese languages. Annex 6 does not need to be translated into Portuguese.

2.13 PROPOSAL SUBMISSION REQUIREMENTS

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

**CAGECE
Marcondes Sobreira
Av. Dr. Lauro Vieira Chaves, 1030 - Vila União
Fortaleza, CE, Brazil, 60422-901
Phone: 011 55 (85) 3101-2001**

An Original in English and Portuguese, one (1) copy in English, and three (3) copies in Portuguese of your proposal as well as a CD or Flash Drive with an electronic copy of your proposal in both languages must be received at the above address no later than Wednesday, 1:00 pm (local time), on Friday, June 22nd, 2012.

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 originals **in English and Portuguese, one (1) copy in English, and three (3) copies in Portuguese** as well as the CD or Flash Drive 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.

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.

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\$579,895, which is a fixed amount.

Offerors shall submit one (1) original in English and Portuguese, one (1) copy in English and three (3) copies in Portuguese 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, 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 Feasibility Study. 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 Feasibility Study.

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 Feasibility Study.

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 Feasibility Study. 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),
- 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 Feasibility Study 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:

Firms' specific experience related to the assignment: 25 point maximum

1. Firms' overall experience: 15 points
2. Firms' overseas experience: 10 points

Adequacy of proposed work plan and methodology in response to the TOR: 25 point maximum

1. Knowledge of proposed work and understanding of service: 10 points
2. Appropriateness of proposed methodology and workplan: 15 points

Qualifications and competence of the key staff for the assignment: 25 point maximum

1. Team Leader's experience in similar projects: 5 points
2. Project Engineer's experience in similar projects: 5 points
3. Mechanical Engineer's experience in similar projects: 5 points
4. Electrical Engineer's experience in SCADA and similar projects: 5 points
5. Economist / Financial Analyst's experience in similar projects: 5 points

Past performance: 25 point maximum

1. Six relevant and verifiable projects: 25 points
2. Five relevant and verifiable projects: 20 points
3. Four relevant and verifiable projects: 15 points
4. Three relevant and verifiable projects: 10 points
5. Two relevant and verifiable projects: 5 points

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

Price will not be a factor in contractor selection.

ANNEX 1

Marcondes Sobreira, CAGECE, Av. Dr. Lauro Vieira Chaves, 1030 - Vila União
Fortaleza, CE, Brazil, 60422-901, Phone: 011 55 (85) 3101-2001

B – Brazil: CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project

POC: Anthony O'Tapi, USTDA, 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901, Tel: (703) 875-4357, Fax: (703) 875-4009. CAGECE TERTIARY WASTEWATER TREATMENT PLANTS AND AUTOMATED WATER AND SEWAGE CONTROL SYSTEM 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 to determine the technical and financial viability of developing two tertiary wastewater treatment plants, as well as a roadmap and implementation plan for an automated water and sewage control system for the Ceara Water and Sewage Treatment Company (CAGECE).

This Feasibility Study will determine the technical and financial viability of developing two tertiary wastewater treatment plants as well as a roadmap and implementation plan for an automated water and sewage control system. The Terms of Reference (TOR) for this Feasibility Study are attached as Annex 5.

The U.S. firm selected will be paid in U.S. dollars from a \$579,895 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 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 1:00 pm (Local time), June 22nd, 2012 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

REPORT

Definitional Mission (DM): Brazil: Water and Environmental Sector Opportunities USTDA 2010510010

U.S. Trade and Development Agency
Attn.: Ms. Gabrielle Mandel, Country Manager
1000 Wilson Boulevard, Suite 1600
Arlington, VA 22209-3901
Phone 703-875-4357 Fax 703-875-4009

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March 08, 2010



This report was funded by the U.S. Trade and Development Agency (USTDA), a foreign assistance 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.

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The U.S. Trade and Development Agency (USTDA)

The U.S. Trade and Development Agency (USTDA) advances economic development and U.S. commercial interests in developing and middle income countries. The agency funds various forms of technical assistance, feasibility studies, training, orientation visits and business workshops that support the development of a modern infrastructure and a fair and open trading environment.

USTDA's strategic use of foreign assistance funds to support sound investment policy and decision-making in host countries creates an enabling environment for trade, investment and sustainable economic development. Operating at the nexus of foreign policy and commerce, USTDA is uniquely positioned to work with U.S. firms and host countries in achieving the agency's trade and development goals. In carrying out its mission, USTDA gives emphasis to economic sectors that may benefit from U.S. exports of goods and services.

Mailing and Delivery Address: 1000 Wilson Boulevard, Suite 1600, Arlington, VA 22209-3901
Phone: 703-875-4357 • **Fax:** 703-875-4009 • **Web site:** www.ustda.gov • **email:** info@ustda.gov

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Figure B2.2 Miriu and Siquiera Locations (illustrated in black font)

Figure B3.1a – Gavião Water Treatment Plant Schematic

Figure B3.1b – CAGECE Water and Wastewater Systems Automation Upgrade Schematics

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CAGECE WASTEWATER TERTIARY TREATMENT PROJECTS

Project Sponsor: Ceara Water and Wastewater Company (www.cagece.com.br/cagece)

**Project Sponsor Representative in Charge: Henrique Vieira Costa Lima, Director
Presidente**

Project Title: CAGECE Tertiary Wastewater Treatment Projects

Assistance Type: Feasibility Study (FS)

A2. EXECUTIVE SUMMARY

Ceara Water and Wastewater Company (CAGECE) has requested USTDA technical assistance for the Feasibility Study (FS) of two wastewater tertiary treatment projects (Projects) in Fortaleza, Brazil. The State of Ceara is prone to recurrent drought and the Projects are geared toward increasing the availability of water for multiple non-potable water uses in Fortaleza. It will improve the efficiency of the State of Ceara's integrated water resource management system, thus decreasing the vulnerability of its populations to cyclical drought.

If implemented, the Projects will promote water conservation and improved soil and vegetation management in the Fortaleza watershed that, in turn, will reduce erosion in the watershed. The Projects will be carried out in agreement with environmental policies that promote increasing the volume of water supplied by the State's water management company while at the same time mitigate negative environmental impacts to the area's water quality.

According to information researched for this report, Fortaleza is experiencing population growth associated with considerable business opportunities that require increased water supply. The Projects are geared towards providing the municipal environmental infrastructure necessary to support the orderly

development of the water service for sustained economic growth. Therefore, the Projects have an inherent positive developmental impact.

The Projects entail two wastewater tertiary treatment facilities; one in the Siqueira wastewater shed (15.09 MGD) and the other in the Miriu wastewater shed (17.4 MGD). According to discussions with Andre Macedo Faco, CAGECE's Director of Operation, the Projects are a high priority and CAGECE has allocated a sufficient budget for their implementation.

The USTDA technical assistance would support the introduction of new wastewater treatment technologies to increase the reuse of treated wastewater. The Projects will create an opportunity for U.S. suppliers of advanced wastewater treatment technology to demonstrate their technological advantages. The two projects, if implemented fully with tertiary treatment, have the potential to generate between \$32 and \$80 million in U.S. exports depending on the technology selected. While not used in justifying USTDA grant assistance, the multiplier effect of introducing U.S. technologies and companies into the Brazilian wastewater tertiary treatment market could yield much larger U.S. exports in the future.

The Projects will help U.S. manufacturers of wastewater tertiary treatment technology assert their technological advantages to capitalize on the unique set of circumstances that exist in Brazil, where as revealed by the DM research the country is moving aggressively toward a system of advanced wastewater treatment and reuse. USTDA support is critical in a market where European suppliers are aggressively pursuing new advanced wastewater treatment projects.

The proposed terms of reference is structured not only to give CAGECE a preliminary design for the treatment plants, but to give CAGECE the tools to evaluate several different technologies and processes for future advanced wastewater treatment projects. Based on strong U.S. export potential, significant environmental and health benefits, and potential economic developmental impact, AJGB International recommends USTDA funding for a feasibility study with a budget of \$342,867.

B2. PROJECT DESCRIPTION

B2.1 BACKGROUND

According to information researched for this report, Fortaleza is experiencing considerable business opportunities in the real estate market. This has come about as a result of attractive real estate prices in an area of Brazil that has historically lagged behind the more developed south and southeast regions of the country. In addition, Fortaleza's economy has been traditionally based on tourism (Fortaleza is Brazil's main domestic tourism destination, see Figure B2.1) and recently energy (off shore oil and major wind energy operations) and export due to a growing manufacture base have become significant economic engines. Moreover, air cargo traffic at the Fortaleza airport has increased by 40% during a one-year period ending in August 2010, which is another illustration of business growth. Fortaleza is a host city of the 2014 Soccer World Cup and is in the process of investing \$5.8 billion in major municipal infrastructure upgrades to prepare for this large international event.



Figure B2.1 – Fortaleza Beach Amenities

With a current population estimated at nearly 2.5 million inhabitants, Fortaleza is the 5th most populated city in Brazil, after São Paulo, Rio de Janeiro, Salvador, and Brasília. Much of the population growth of the past 20 years has resulted from migration of low-income families from rural areas to the outskirts of the city. One of the main causes of the city's population growth has been related to periods of droughts in the hinterland, which has resulted in rural exodus to the urban centers. As a result of population growth, Fortaleza and other urban areas in the State of Ceará are facing increasing environmental problems related to municipal system deficiencies, including water and air pollution, poor drainage, and inadequate solid waste disposal. Low-income populations living in informal settlements in flood-prone areas and/or areas with poor sanitation services and housing are particularly susceptible to these problems. More than a third of all housing units in Ceará are not connected to a piped water system, while more than half had inadequate sewage and solid waste disposal.

In this context the State of CEARA water and wastewater company, CAGECE (www.cagece.com.br/cagece), has requested USTDA technical assistance for the assessment of advanced wastewater treatment. The Project, as described below, focuses on the assessment of wastewater treatment for reuse which, in tandem with current policies, could provide water for non-potable use to reduce the demand for fresh water.

B2.2 PROJECT DESCRIPTION

The Fortaleza Metropolitan Area wastewater management system involves a large sewage preconditioning facility and several small wastewater treatment facilities. This design has shown significant operational disadvantages that have resulted in considerable operational, logistical and financial liabilities. CAGECE reports that water quality monitoring at several wastewater treatment plant discharge points has resulted in a complex logistical operation that requires the mobilization and deployment of water quality monitoring teams.

Additionally, CAGECE reports that in most cases the current wastewater treatment system does not fully comply with environmental and water quality regulations. CAGECE also documents that retrofitting the current facilities to add wastewater treatment capabilities will be very costly and will not assure compliance with regulatory requirements and water reuse capability. CAGECE indicates that the most viable alternative would be to develop wastewater facilities that will take advantage of the economy of scale

and will enable full water quality regulatory compliance. In its proposal to USTDA, CAGECE presents the following two wastewater treatment projects (Projects):

- The Miriu Advanced Wastewater Treatment Facility (751 l/sec, 17.14 MGD) and
- The Siqueira Advanced Wastewater Treatment Facility (661 l/sec, 15.09 MGD).

Table B2.2 below shows the Miriu and Siqueira facilities' planning level information provided by CAGECE. Figure B2.2 shows the location proposed for these facilities in Fortaleza.

Table B2.2 - Miriu and Siqueira Facilities Planning Level Data

Parameter	Miriu	Siqueira
	Population 2030	Population 2030
Population	380,171	379,175
Hydraulic Load		
Wastewater collection factor	100%	100%
Daily Average Wastewater Flow (l/sec)	751.40	661.41
Daily Average Wastewater Flow (l/sec)	870.20	773.44
Hourly Peak (l/sec)	1,226.58	941.49
Pollutant Load		
DBO ₅ (Kg/day)	19,000	18,958
Influent DBO ₅ (ppm)	300	300
TSS (Kg/day)	13,306	13,271
Influent TSS (ppm)	400	400

These Projects are designed to produce safe water for reuse and stabilized sludge. USTDA sponsored consultant work will involve a feasibility assessment of tertiary treatment at the Miriu and Siqueira facility sites for subsequent design and construction of tertiary wastewater management facilities at these locations.

CAGECE is interested in a study that will assess and showcase U.S. wastewater treatment technologies for improving the water quality using tertiary treatment technology for water reclamation. These Projects would have significant positive environmental and health impacts due to a reduction in untreated wastewater released into the environment.

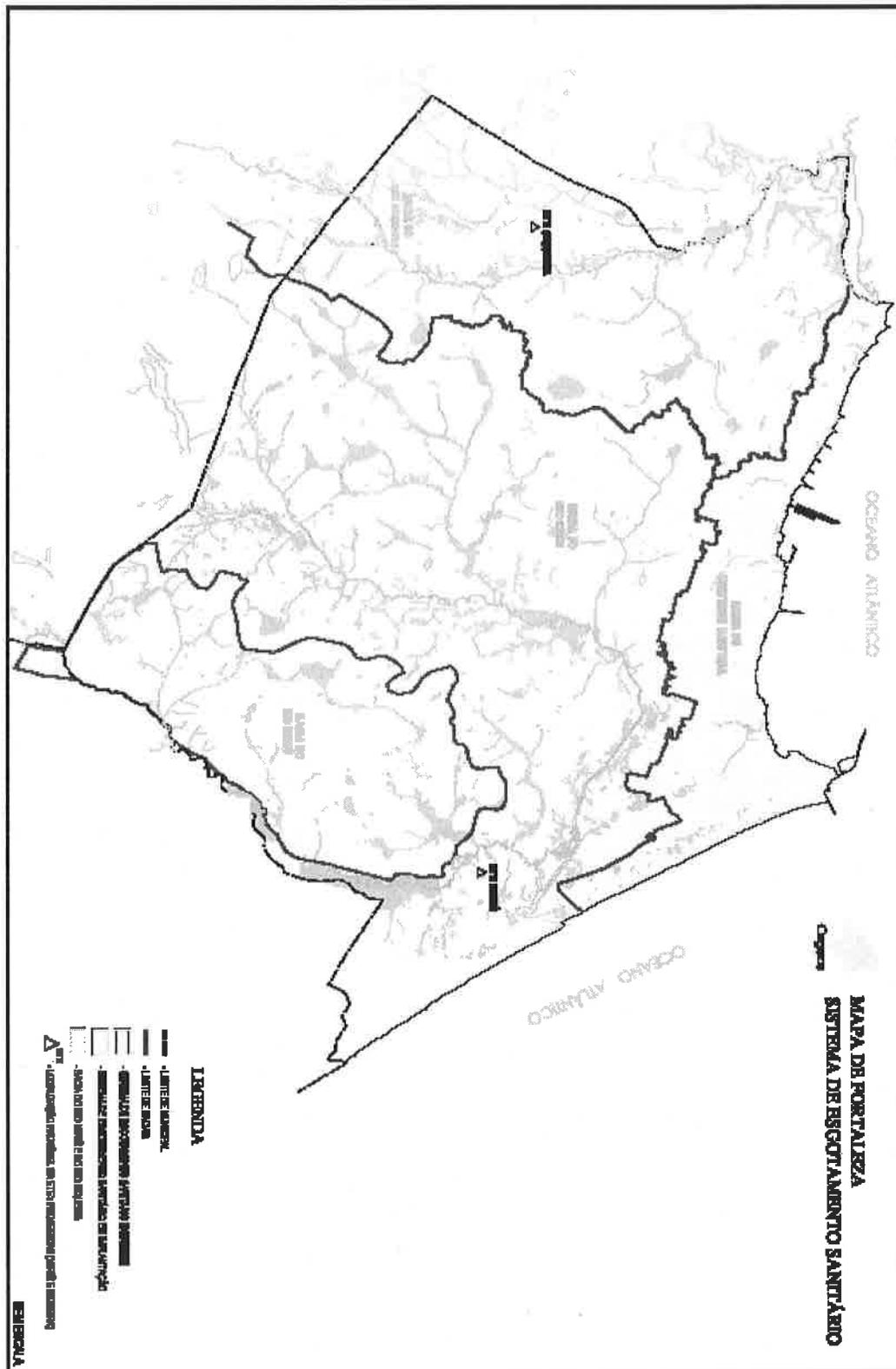


Figure B2.2 Miriu and Siquiera Locations (illustrated in black font)

The Projects have the potential for beneficial developmental impacts including: development of wastewater treatment for multiple non-potable water use, transfer of appropriate technologies for advanced wastewater treatment and reuse, promotion of long term, sustainable economic growth in Fortaleza through increased availability of water for industrial production, and job creation associated with advanced wastewater treatment plants.

The proposed Projects are consistent with the State of Ceara water conservation and environmental management policies and echoes CAGESE interest in the preservation of fresh water resources. If successfully implemented, the projects will provide a potential avenue for a more rational use of fresh water resources in the study area. In addition, they will provide a valuable precedent for other similar projects in the State of Ceara. The Miriu and Siqueira projects will mirror other efforts being considered elsewhere in Brazil and other Latin-American countries. The FS will perform detailed technical and economic analyses of the projects to determine the viability of wastewater reuse.

C2. PROJECT SPONSOR'S CAPABILITIES AND COMMITMENT

CAGECE, the Water and Sewerage Company of the State of Ceara, is a mixed capital company established by Law No. 9499 of July 20, 1971. CAGECE is the 5th largest company in the state of Ceara and, as indicated in Table C2, provides water and wastewater management services throughout the state.

Table C2 CAGECE Water and Wastewater Management Service Summary

Service	Fortaleza	Rest of the State of Ceara
Water Supply		
Number of Water Systems	1	251
Population Coverage, inhabitants, %	2,404,423, 97.8%	4,526,783, 96.91%
Wastewater		
Number of Wastewater Systems	1	64
Population Coverage, inhabitants, %	1,242,921, 50.56%	1,669,211, 35.74%

In 2009, CAGECE invested US\$81.35 million (R\$ 137.97 million) in the expansion and improvement of its water and wastewater systems. This capital investment was employed to add 47,061 and 26,759 new water and wastewater connections, respectively. A key feature of the CAGECE wastewater management service is that one hundred percent of the wastewater collected undergoes wastewater treatment. Currently, CAGECE has undertaken a wastewater capital investment that will expand wastewater coverage to 62% of the Fortaleza population.

CAGECE had a gross revenue of S\$325.514 million (R\$552.073 million) in 2009, which constituted a 10.2% increase from 2008. The water and wastewater revenues were US\$232.239 million (R\$393.879 million) and US\$93.274 million (R\$158.194 million). One of the factors that contributed to the increase in revenue was an overall increase in the billed volumes of water and wastewater. The net income from the water and wastewater operation was US\$23.526 million (R\$39.9 million), which represented a net return per share of US\$0.22 (R\$0.38).

As CAGECE approaches 40 years of service it continues to expand its reach with the goal of providing universal wastewater service throughout Ceara. Additionally, CAGECE's pro-environmental work was recognized with the 2007 Environmental Quality Award from the Association of Parliamentarians of Brazil.

According to the information provided by CAGECE's website (<http://www.cagece.com.br/cagece>), its success is based on a system of corporate management that enables the company to reduce costs by consolidating operations across the state. In addition, CAGECE has embarked in a water leak reduction program aimed at reducing water losses to no more than 20%, which would be the best water loss index in Brazil. Mr. Andre Macedo Faco, the CAGECE representative interviewed for this DM, reports that the company's investment level will continue in the future. Based on CAGECE's successful business history,

the DM assessment of the Project Sponsor's capabilities to undertake wastewater reclamation projects is positive.

In its USTDA proposal the Project Sponsor expresses that CAGECE is concerned with the preservation of the State's fresh water resources and intends to perform a feasibility study on reclaimed water use. Furthermore, CAGECE provides a discussion in which it asserts its commitment to investing in reclaimed water systems.

After reviewing the Project Sponsor's proposal and the information researched for this report, the DM concludes that the Project Sponsor has the necessary policies in place, the commercial interest and the investment capacity to implement wastewater reclamation projects.

D2. IMPLEMENTATION FINANCING

Discussions with Andre Macedo Faco, CAGECE's Director of Operation revealed that CAGECE intends to invest R\$348 million (US\$208 million) by the end of 2011 to improve sanitation services throughout the state. A total of R\$ 233 million (US\$145 million) will be used for sewage collection and treatment projects and R\$89 million (US\$55 million) will go toward water supply projects. The Project Sponsor indicates that it has confirmed plans to have the Miriu and Siqueira wastewater facilities fully operational by 2014.

E2. U.S. EXPORT POTENTIAL

E2.1 WASTEWATER TERTIARY TREATMENT CAPITAL INVESTMENT

The proposed facilities will range in size from 15.09 MGD (Siqueira) to 17.14 MGD (Miriú). Estimating the cost of the tertiary treatment technology is based on wastewater treatment technology construction costs presented in the technical literature consulted for this DM report (http://your.kingcounty.gov/dnrp/library/wastewater/rw/0803_FeasibilityStudy/Appendices_RWFfeasibilityStudy_Mar08.pdf). A polynomial regression equation was derived using the Microfiltration (MF), Ultraviolet (UV) and Membrane Bioreactor MBR-UV data to obtain a cost curve for each of these processes. These equations are:

MF Equation

$$f(x) = 4.380952380952e+06 \\ + 8.095238095238e+05 * x$$

Where: x is the size of the tertiary facility in MGD

UV Equation

$$f(x) = 2.369372178400e+05 \\ + 5.047034406244e+05 * x \\ + 4.238779235929e+03 * x^2$$

Where: x is the size of the tertiary facility in MGD

MBR UV Equation

$$f(x) = 1.319563548103e+07 \\ + 4.029560409888e+06 * x \\ + -3.868907520139e+04 * x^2$$

Where: x is the size of the tertiary facility in MGD

The cost of the tertiary treatment for the Fortaleza wastewater treatment facilities is shown in Table E2.1a.

Table E2.1a –Tertiary Treatment Export Potential (US\$)

Tertiary Treatment System	MGD	Total Cost	Export Potential ³
Siqueira			
MF UV ¹	15.09	25,392,375	15,235,425
MBR UV ²	15.09	64,972,267	38,983,360
Miriu			
MF UV ¹	17.14	28,363,507	17,018,104
MBR UV ²	17.14	70,018,104	42,010,862

¹: Assumes activated sludge for secondary treatment, cost of secondary treatment not included.

²: Assumes MBR for secondary treatment and water conditioning for reuse.

³: Assumes export potential is approximately 60% of the tertiary treatment total cost.

The figures estimated by the DM for the projects in Fortaleza were compared to actual cost of tertiary treatment projects being carried out in the State of Natal, Brazil, see Table E2.1b. The capital cost estimated for the Fortaleza Projects per person is less than the actual cost of tertiary treatment projects being implemented in Natal, Brazil. This suggests that the capital investment on U.S. technology can be applied to optimize wastewater treatment capital expenditures in Brazil.

Table E2.1b –Tertiary Treatment Capital Investment per Inhabitant (US\$/person) for Current Projects in Brazil

Tertiary Treatment System	MGD	Total Cost (US\$)	Capital Cost per Person (US\$/person)
ETE Natal	9.1	53,125,000	260
ETE Guarape	22.82	77,500,000	230
Siqueira	15.09	64,972,267	171
Miriu	17.14	70,018,104	184

¹: Assumes activated sludge for secondary treatment, cost of secondary treatment not included.

²: Assumes MBR for secondary treatment and water conditioning for reuse

³: Assumes export potential is approximately 60% of the tertiary treatment total cost.

E1.2 WASTEWATER TREATMENT TECHNOLOGY U.S. EXPORT POTENTIAL

U.S. technology export potential for the CAGECE Projects has been estimated based on the assumptions that a MBR process followed by UV will be used for wastewater tertiary treatment and that the export equipment and associated materials would comprise about 60% of the total capital cost, which, as shown in Table E2.1a, could reach about US\$40 million for each of the two Projects.

AJGB International, Inc. has discussed the Project with several U.S. consultants and manufacturers of wastewater management technology. Our preliminary assessment indicates that U.S. companies have an interest in participating in the above-mentioned Projects in Brazil. U.S. engineering and design companies that have participated in similar projects worldwide include:

- AECOM, Los Angeles, CA
- Black and Veatch, Kansas City, MO
- CDM International, Cambridge, MA
- CH2M-Hill, Denver CO
- MW Harza, Pasadena, CA
- TetraTech, Pasadena, MA

U.S. manufacturers of tertiary treatment technology currently active in this sector in Brazil include GE, Koch Membranes, Aeromod (sequential oxidation wastewater treatment), and CH2M-Hill (feasibility study for wastewater reuse).

U.S. companies such as Filtronics, Inc., GE Infrastructure, ITT and Koch Membrane Systems are proven manufacturers of advanced wastewater treatment technologies suitable for the required application. Many of the required technologies (i.e. UF, RO, MBR, UV) offer a strong potential for U.S. exports and are generally turnkey installations. GE and Koch Membranes have offices in Brazil and are actively pursuing the market for UF and MBR treatment. GE technology is being employed at the Sanasa's Campina tertiary treatment facility. Potential U.S. suppliers of wastewater technology and equipment are listed Table E1.2 below:

Table E1.2 Partial List of U.S. Suppliers of Wastewater Treatment Technology

Technology	Supplier
Wastewater Treatment Equipment	U.S. Filters Waukesha, WI
	Smith and Loveless, Lanexa, KS
	Waterlink, Canton, OH
	Severn Trent Services, Fort Washington, PA
	The Dow Chemical Co, Midland, MI
	Filtronics, Inc., Anaheim, CA
	GE Infrastructure, Fairfield, CT
	ITT, White Plains, NY
	Koch Membrane Systems, Inc., Wilmington, MA
	Pumps and Controls
Gorman Rupp, Mansfield, OH	
Smith and Loveless, Lanexa, OH	

F2. FOREIGN COMPETITION AND MARKET ENTRY ISSUES

Water shortages and an added water demand due to population growth have created important business opportunities for tertiary treatment water plants and wastewater reuse in many countries around the world. Several background references consulted for the preparation of this report indicate that the share of the wastewater reclamation market is expected to continue to grow in the foreseeable future. Current market projections for tertiary treatment systems indicate that total sales could reach more than \$70 billion over the next 20 years.

Several Brazilian, Canadian, European, Japanese and U.S. companies have been working to create a stronghold for their tertiary treatment technology for wastewater reuse. These companies have invested heavily in marketing their technologies around the globe. Brazilian companies operating in Ceara include Engesoft Engenharia, VBL Engenharia and Centro Project (Sao Paulo). European companies and especially French companies such as Saur, Degremont and Sidem are actively marketing their equipment around the world. All of which illustrate the very challenging and growing field of wastewater reclamation technology competitors from Europe, Japan and Canada.

Given that wastewater treatment for reuse has an expanding business potential, USTDA technical assistance for these projects is extremely important to maintain U.S. companies' competitiveness in this growing market. Therefore, the DM finds significant justification for supporting the requested USTDA technical support for these projects.

With a total U.S. export of 26 billion dollars in 2009, Brazil is the largest buyer of U.S. products in South America. The four largest foreign competitors to U.S. companies in Brazil are: China, Argentina, Germany and Japan.

According to information provided by the Office of the U.S. Commercial Service in Brazil (<http://www.focusbrazil.org.br/ccg/>), the 2009 Brazilian environmental technology market (including equipment, engineering/consulting services, instrumentation, construction and clean up services) is roughly estimated at US\$ 9 billion, of which US\$ 5.2 billion is related to the water and wastewater subsector, US\$ 3.4 for billion solid waste management, and US\$ 0.6 billion for air pollution control. The 2009 U.S. environmental technology export is estimated at nearly half a billion dollars.

The information reviewed shows that most of the environmental service work and technology products are provided by local firms and companies. In addition to well-established local companies, there are several European and Japanese environmental technology suppliers actively seeking business opportunities in Brazil.

This DM confirmed that environmental business opportunities for international companies in Brazil are mostly related to innovative and state of the art technologies not available locally. Because the typical water loss rate in Brazil is at over 40%, water reuse technologies have a great potential to flourish as more industries and municipalities are looking at water reuse to meet their water demand. Moreover, recent and stricter regulatory requirements for the discharge of wastewater treatment plant effluent have increased the demand for specialized services and wastewater treatment technologies.

Imports to Brazil are subject to a number of taxes and fees that account for a 56.064 percent increase in the FOB cost of the product. Thus, a tax imposed on imported products makes it challenging to compete with less costly local products, even if they are not the best suited application. On a positive note, Brazilians are generally familiar with the high quality of U.S. wastewater products and technology.

G2. DEVELOPMENTAL IMPACT

According to the DM evaluation the successful implementation of the proposed Projects will likely result in significant positive development impacts in the study area, and on a broader scale, in the State of Ceara. Our assessment indicates that the implementation of the Project will contribute to:

1. Developing a wastewater management infrastructure that will likely reduce public health risks, enhance economic productivity, deter environmental deterioration and promote economic growth and social wellbeing.
2. Carrying out an infrastructure project that promotes the benefits of water conservation measures and exemplifies worldwide efforts to improve fresh water management.
3. Human capacity building through the creation of new and more skilled jobs in the wastewater management sector.
4. Technology transfer by introducing wastewater treatment technology that generates reclaimed water safe for reuse and, as such, demonstrates wastewater reclamation processes that could be replicated in other parts of the State of Ceara and Brazil.

G2.1 ENVIRONMENTAL INFRASTRUCTURE

According to the background data and information reviewed for this report, the CAGECE Projects will reduce the use of fresh water for several water uses that do not require potable water quality. This should have a positive impact on the availability of potable water to meet the increased demand without relying on the exploitation of new water supply sources. Potential deterioration of environmental conditions

associated with the discharge of treated wastewater will likely be avoided as will the overexploitation of water resources. The CAGECE Projects are geared toward providing safe environmental related technology for municipal systems, which, in turn, may improve economic and environmental conditions as well as enhance the quality of both residences and business alike. Additionally, USTDA technical assistance would introduce environmental infrastructure and human capacity building. The level of capital investment could measure project success in wastewater tertiary treatment systems manufactured in the U.S. The following is a summary of the anticipated developmental impacts.

G2.2 HUMAN CAPACITY BUILDING

Planning, design, construction and operation of advanced wastewater management facilities in Fortaleza will certainly create technological knowledge and expertise that is currently nonexistent. A number of professionals and technicians will be needed for the operation of the Project. Additionally, local construction companies and specialty contractors such as electrical and electromechanical contractors will participate in construction activities. These Projects will provide training opportunities for technicians and professionals who could later use their experience in other similar projects elsewhere in Brazil and the region. All jobs created through these CAGECE Projects will be technical in nature and will require training of the hired work force.

G2.3 TECHNOLOGY TRANSFER AND PRODUCTIVITY IMPROVEMENTS

The CAGECE Projects are an example of classical technology transfers that offer multiple benefits to the sponsor's community. As discussed above, the Projects will provide the technological means to avoid potential water supply shortages that could become a risk factor for economic development. Conversely, a source of reusable water may allow for business growth. The TOR for the FS will require a detailed account of the expected technology transfer developmental impact for the Projects.

H2. IMPACT ON THE ENVIRONMENT

Wastewater reclamation that, in compliance with water quality standards, generates reusable wastewater quality that is less likely to create a negative impact on the environment. In addition, wastewater reclamation for reuse will likely reduce the demand for fresh water.

Based on similar wastewater reclamation projects around the world, the environmental development impacts anticipated for the proposed Projects include:

1. Reduction in public health and environmental risks related to unsafe wastewater disposal.
2. Reducing water resources use.
3. Providing treated wastewater for industrial and agriculture reuse.
4. Helping to maintain proper environmental conditions for socioeconomic development.

There is no expected long-term negative impact on the environment from the proposed Projects. On the contrary, long-term positive environmental impacts of the Project are expected from the decreased levels of untreated or insufficiently treated wastewater into the environment. The Project would mitigate the release of pollutants, oxygen-demanding substances, pathogens, nutrients, and inorganic and synthetic organic chemicals into the environment and would reduce the incidence of fish kills, algal blooms and bacterial contamination of waterways and aquifers. Consequently, the implementation of the CAGECE Projects should provide substantial positive socioeconomic and environmental impacts. A reduction in water resource contamination due to improved wastewater treatment will slow the contamination of irreplaceable water resources.

Because of the installation of equipment and instrumentation and construction of related infrastructure, the implementation of wastewater treatment projects may have temporary water quality impacts. However these may be avoided or mitigated using standard construction management and pollution prevention techniques. The project implementation should not have negative impacts on river or seawater uses. Other uses such as commercial fishing and industrial activities should remain unobstructed throughout the life of the Project. The FS TOR will include a preliminary environmental impact assessment in line with USTDA's basic requirements.

12. IMPACT ON U.S. LABOR

The Project would provide municipal wastewater tertiary treatment for water reuse. The Project would not promote the establishment of any business other than for the purpose of serving the local market more efficiently (e.g. local agent/distributor). Based upon our review, we find that the Project does not provide: (a) any financial incentive to a business enterprise currently located in the United States for the purpose of inducing such an enterprise to relocate outside the United States if such incentive or inducement is likely to reduce the number of employees of such business enterprise in the United States because United States production is being replaced by such enterprise outside the United States; (b) assistance for any project or activity that contributes to the violation of internationally recognized workers rights; or (c) direct assistance for establishing or expanding production of any commodity for export by any country other than the United States, if the commodity is likely to be in surplus on world markets at the time the resulting productive capacity is expected to become operative and if the assistance will cause substantial injury to United States producers of the same; similar, or competing commodity.

The Project will generate new demand for U.S. equipment and services and should have a net positive impact on the U.S. trade balance, as expansion of the current volume of wastewater reclamation related export would most likely increase employment in the U.S.

Technical personnel from the U.S. would have to travel to Brazil in order to provide technical assistance for the project. However, it does not appear that U.S. based manufacturers or service providers would need to relocate outside the U.S. for an extended period of time to meet the demands created by the proposed USTDA technical assistance.

The DM considers that USTDA funding of the prospective technical assistance will not contradict any of the clauses of the Foreign Operations, Export Financing and Related Program Appropriations legislation.

J2. QUALIFICATIONS

It is proposed that the FS be conducted by an expert U.S. company with ample experience in the field of feasibility analysis of projects that involve wastewater tertiary treatment for water reuse. Therefore, it is expected that the company selected will have demonstrated qualifications, experience and the required capability to carry out the technical requirements of the CAGECE Projects. The suggested selection criteria for the firm and team that will execute the USTDA grant assistance is the following:

Firms' specific experience related to the assignment: 25 point maximum

1. Firms' overall experience: 15 points
2. Firms' overseas experience: 10 points

Adequacy of proposed work plan and methodology in response to the TOR: 25 point maximum

1. Knowledge of proposed work and understanding of service: 10 points
2. Appropriateness of proposed methodology and workplan: 15 points

Qualifications and competence of the key staff for the assignment: 25 point maximum

1. Team Leader's experience in similar projects: 5 points
2. Project Engineer's experience in similar projects: 5 points
3. Mechanical Engineer's experience in similar projects: 5 points
4. Electrical Engineer's experience in similar projects: 5 points
5. Economist / Financial Analyst's experience in similar projects: 5 points

Past performance: 25 point maximum

1. Six relevant and verifiable projects: 25 points
2. Five relevant and verifiable projects: 20 points
3. Four relevant and verifiable projects: 15 points
4. Three relevant and verifiable projects: 10 points
5. Two relevant and verifiable projects: 5 points

K2. JUSTIFICATION

The Project offers a unique opportunity for USTDA to advance the use of appropriate technologies that promote economic growth while improving the environment and public health in Brazil. The Brazilian wastewater treatment market is highly competitive and challenging for U.S. companies. However, CAGECE's aggressive and well-funded program to shift to advanced wastewater treatment for water reuse, coupled with the strong technical capacity of U.S. companies in this market, sets the stage for a successful USTDA feasibility study funding. With USTDA support, U.S. suppliers of wastewater tertiary treatment engineering and design could position themselves more strategically to capture a greater share of potentially large environmental technology market in Brazil. Table K2 below summarizes the DM evaluation of the proposed project with respect to USTDA's minimum criteria for funding FS.

Table K2 - Evaluation of the proposed project in terms of the USTDA minimum criteria for funding of FS

Criteria	Evaluation Findings
Likelihood of Obtaining Financing	CAGECE has indicated that it will use its own financial resources to implement projects that may originate from the USTDA technical assistance.
Significant U.S. Export Potential	U.S. export potential will be about 60 percent of the capital investment in wastewater reclamation technology. Thus, in this case the U.S. export potential is estimated in the range of \$32 million to \$80 million. The estimated cost for the USTDA grant to assist with the feasibility study is \$324,867.
National Development Priority	Wastewater management projects are the project sponsor's priority.
Foreign Competition Addressed by USTDA Funding	USTDA funding of the FS would provide an important opportunity to assess and possibly employ U.S. MBR technology in Brazil. This type of technology will likely be needed for similar projects in the region. Canadian, European and Japanese companies are actively marketing their products throughout the world.

L2. TERMS OF REFERENCE AND BUDGET

Appendix L2 contains the proposed Terms of Reference for the requested feasibility study. Appendix L2 presents a detailed budget and task breakdown for the feasibility study. The DM estimates that the completion of the FS will take approximately six (6) months.

M2. RECOMMENDATIONS

The DM assesses that the Project is of importance to U.S. commercial and developmental goals, specifically through the promotion of appropriate U.S. advanced wastewater treatment technologies for

water reuse. CAGECE is interested in assessing the suitability of technology that is rapidly becoming a preferred alternative throughout the world.

As discussed above, USTDA support is critical to helping U.S. manufacturers and companies establish a presence not only in Brazil, but also in the South American region as a whole. In the wastewater tertiary treatment market, U.S. companies face strong competition from European companies, especially from France and Germany. The project has significant export potential for tertiary wastewater treatment technology in terms of the initial capital investment as well as long-term maintenance, spare parts, and expansion. More importantly, the Project will provide ample demonstration of U.S. technology and data to support its cost-effectiveness in Ceara and the rest of Brazil.

AJGB recommends USTDA funding of the FS, based on the following assumptions:

1. CAGECE offers a commitment that Projects will not go into the design phase until the USTDA FS is completed and the Grantee has the opportunity to assess the advantages of the current U.S. wastewater treatment technologies;
2. The Project Sponsor offers support for the execution of the FS in terms of technical services for wastewater analysis, land surveying and geotechnical work;
3. The Project Sponsor offers personnel and office space for logistic support; and
4. CAGECE indicates its intention to proceed with the project implementation in terms acceptable to U.S. companies interested in providing technology and services for the construction and operation of the project.

N2. PROJECT PORTFOLIO ASSESSMENT

The DM team evaluated the CAGECE proposal for implementing wastewater tertiary treatment at Miriu and Siqueira sites. The Projects as formulated meet technical criteria anticipated for municipal infrastructure capital investment and the DM supports USTDA FS financing assistance to expedite its implementation.

Current water supply shortfalls justify consideration of wastewater tertiary treatment. The TOR for the FS are provided in Appendix L2. The DM recommends USTDA funding of the FS to develop a wastewater tertiary treatment system in Brazil.

O2. CONTACTS

Contact data is provided in Appendix O1.

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CAGECE WATER AND WASTEWATER SYSTEMS AUTOMATION UPGRADE PROJECT

Project Sponsor: Ceara Water and Wastewater Company (www.cagece.com.br/cagece)
Project Sponsor Representative in Charge: Henrique Vieira Costa Lima, Director
President
Project Title: CAGECE Water and Wastewater Systems Automation Upgrade Project
Proposal Type: Feasibility Study (FS)

A3. EXECUTIVE SUMMARY

CAGECE, the Water and Sewerage Company of the State of Ceara, has requested USTDA technical assistance for a FS that will evaluate improvements to its Fortaleza automated water supply control system (CECOP) and its Fortaleza automated sewage control system (CECOE). CAGECE is also interested in adding remote process control and monitoring technology at its 10.2 m³/sec (232.83 MGD) Gaviao water treatment plant (ETA GAVIAO). In addition, CAGECE requests the assessment of technology for an enhanced integrated automated water supply and wastewater management control center (CIWWSA) for the oversight of the CECOP, ETA GAVIAO and CECO E operations.

The CIWWSA will include geo-referencing within a Supervisory Control and Data Acquisition System (SCADA). The planned system will allow Human-Machine Interface (HMI) and remote control access through Personal Digital Assistance (PDA). Additionally the improved system will allow the simulation of water supply and wastewater management scenarios including various trend analyses. Figure A3.1b shows the schematic of the CAGECE Water and Wastewater System Automation Upgrade Project.

According to interviews with CAGECE's Andre Macedo Faco, CAGECE Operations Manager, the improved automation of the CAGECE water and wastewater management systems is a priority to keep up with the level of service efficiency required by an increasing demand. The Project would have significant positive environmental and health impacts from the improved supply of potable water for domestic and industrial use in the Fortaleza area.

The Project also has important potential developmental impacts from the standpoint of improved wastewater management infrastructure. The transfer of advanced technologies for water supply distribution optimization should result in increased water supply availability, as Non Revenue Water (NRW) will be reduced. The enhanced remote control and monitoring of the existing water treatment system should enable a more secure and reliable water quality and an enhanced wastewater collection system management should result in lower risk of environmental impact. The proposed action aims to promote long term, sustainable economic growth and job creation in Fortaleza through improved water supply and wastewater collection systems and implementation of SCADA systems.

The proposed TOR for the FS will investigate the viability of SCADA technologies for water and wastewater systems operated by CAGECE. The U.S. export potential is assessed at approximately US\$ 4.5 million dollars. The FS will also assess the technical, financial and economic attractiveness of the Project. Based on significant environmental and health benefits, and positive potential economic developmental impact, AJGB International recommends USTDA funding for a feasibility study with a budget of \$240,828.

B3. PROJECT DESCRIPTION

B3.1 BACKGROUND

CAGECE, the Water and Sewerage Company of the State of Ceara, is a mixed capital company established by Law No. 9499 of July 20, 1971. CAGECE is the 5th largest company in the state of Ceara and, as indicated in Table B3.1, provides water and wastewater management services throughout Ceara.

Table B3.1 CAGECE Water and Wastewater Management Service Summary

Service	Fortaleza	Rest of the State of Ceara
Water Supply		
Number of Water Systems	1	251
Population Coverage, inhabitants, %	2,404,423, 97.8%	4,526,783, 96.91%
Wastewater		
Number of Wastewater Systems	1	64
Population Coverage, inhabitants, %	1,242,921, 50.56%	1,669,211, 35.74%

CAGECE had a gross revenue of US\$325.514 million (R\$552.073 million) in 2009, which constituted a 10.2% increase from 2008. The water and wastewater revenues were US\$232.239 million (R\$393.879 million) and US\$93.274 million (R\$158.194 million). One of the factors that contributed to the increase in revenue was an overall increase in the billed volumes of water and wastewater. The net income from the water and wastewater operation was US\$23.526 million (R\$39.9 million), which represented a net return per share of US\$0.22 (R\$0.38).

In 2009, CAGECE invested US\$81.35 million (R\$ 137.97 million) in the expansion and improvement of its water and wastewater systems. This capital investment was employed to add 47,061 and 26,759 new water and wastewater connections, respectively. According to the information provided by CAGECE's website (<http://www.cagece.com.br/cagece>), its success is based on a system of corporate management that enables the company to reduce costs by consolidating operations across the state. In addition, CAGECE has embarked in a water leak reduction program aimed at reducing water losses to no more than 20%, which would be the best water loss index in Brazil. Reduction in NRW should allow for an increase in the volumes of billed water and wastewater which, in turn, should result in higher revenues. Mr. Andre Macedo Faco, the CAGECE representative interviewed for this DM, reports that the company's investment level will continue in the future.

With a current population estimated at nearly 2.5 million inhabitants, Fortaleza is the 5th most populated city in Brazil, after São Paulo, Rio de Janeiro, Salvador, and Brasília. Much of the population growth of the past 20 years has resulted from migration of low-income families from rural areas to the outskirts of the city. One of the main causes of the city's population growth has been periods of droughts in the hinterland, which has resulted in a rural exodus to the urban centers.

In part as a result of population growth, Fortaleza and other urban areas in Ceará are facing increasing water supply problems related to municipal system deficiencies. For example, over a third of all housing units in Ceará are not connected to a piped water system. As indicated above, CAGECE is carrying out a capital investment program aimed to increase and improve water supply infrastructure. CAGECE is also employing water system automation technology to improve its water supply system efficiency.

In December 1998 CAGECE deployed an automated macro-system to monitor and control water distribution in the Fortaleza metropolitan area. The main purpose of this automated water supply control system (CECOP, see Appendix B3.1a) was to obtain the necessary reports to enable remote control and real-time operational decisions in a centralized manner. The key features of the system deployed in 1998 involved 58 Remote Terminal Units (RTU), which currently supply 3,300 operating variables including water pressure, flow rate, temperature, reservoir levels, pumping stations operation, pressure regulating

valves and reading of chlorine analyzers. The key objectives of the current automated water supply control system are:

- Pumping equipment protection;
- Energy consumption reduction;
- NRW reduction;
- Water quality assurance; and
- Improved water distribution efficiency.

In 2002 CAGECE carried out the implementation of an automated sewage control center (CECOE, see Appendices B3.1b and c) for Fortaleza. CECOE allows operational decisions in real time. As a result of CECOE, CAGECE has reported a reduction in energy consumption and decreased rates of sewage leakage into the environment. The sewage management system involves 115 monitoring stations. The current CECOE operation involves 31 RTU for the monitoring of pump stations and sluice gates and provides information for the partial control and monitoring of the Fortaleza sewage system operation.

In its quest for an improved water supply and wastewater management operation, CAGECE is now planning hardware and software improvements to its CECOP and CECOE systems. Additionally, CAGECE is requesting technical assistance to add remote control capability to control and monitor the water treatment process at its ETA GAVIAO a 10.2 m³/sec (232.83 MGD) direct filtration water treatment plant which uses chlorine for disinfection, see Figure B3.1a.

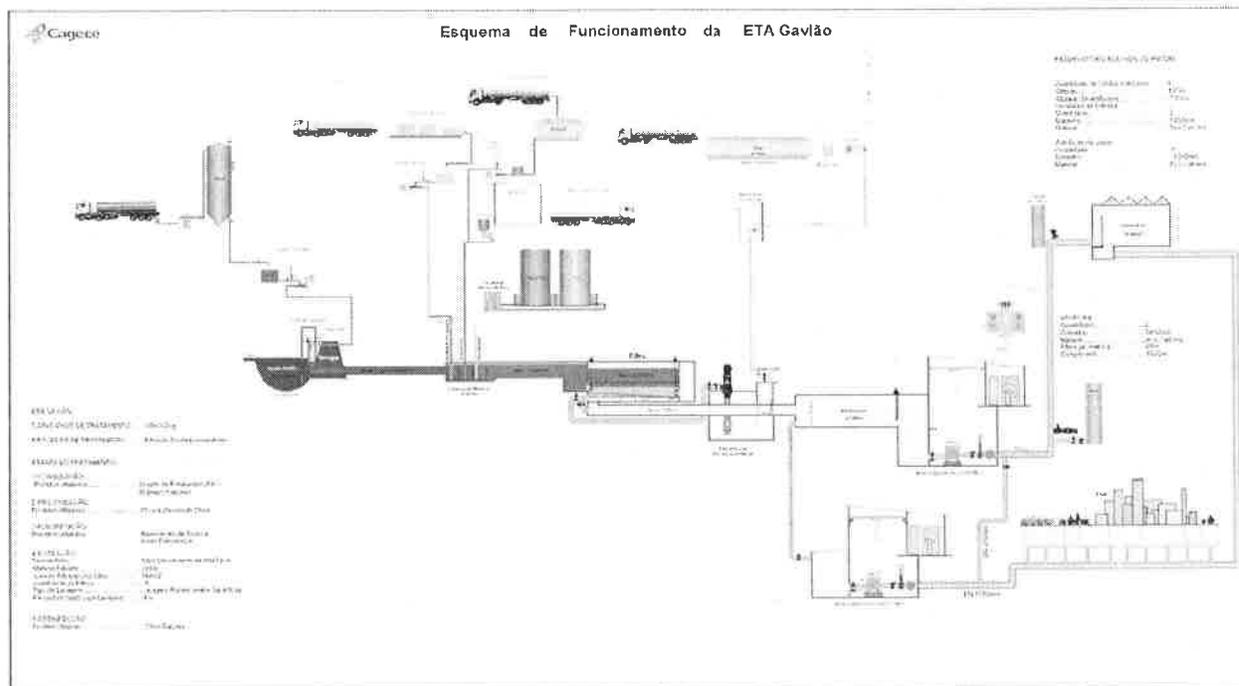


Figure B3.1a – Gaviao Water Treatment Plant Schematic

CAGECE is also planning an enhanced integrated automated water supply and wastewater management control system that will include geo-referencing within a Supervisory Control and Data Acquisition System (SCADA). The planned system will allow Human-Machine Interface (HMI) and remote control access through Personal Digital Assistance (PDA). Additionally, the improved system will allow for the simulation of water supply and wastewater management scenarios. Below is a description of the proposed CAGECE project, see Figure B3.1b also.

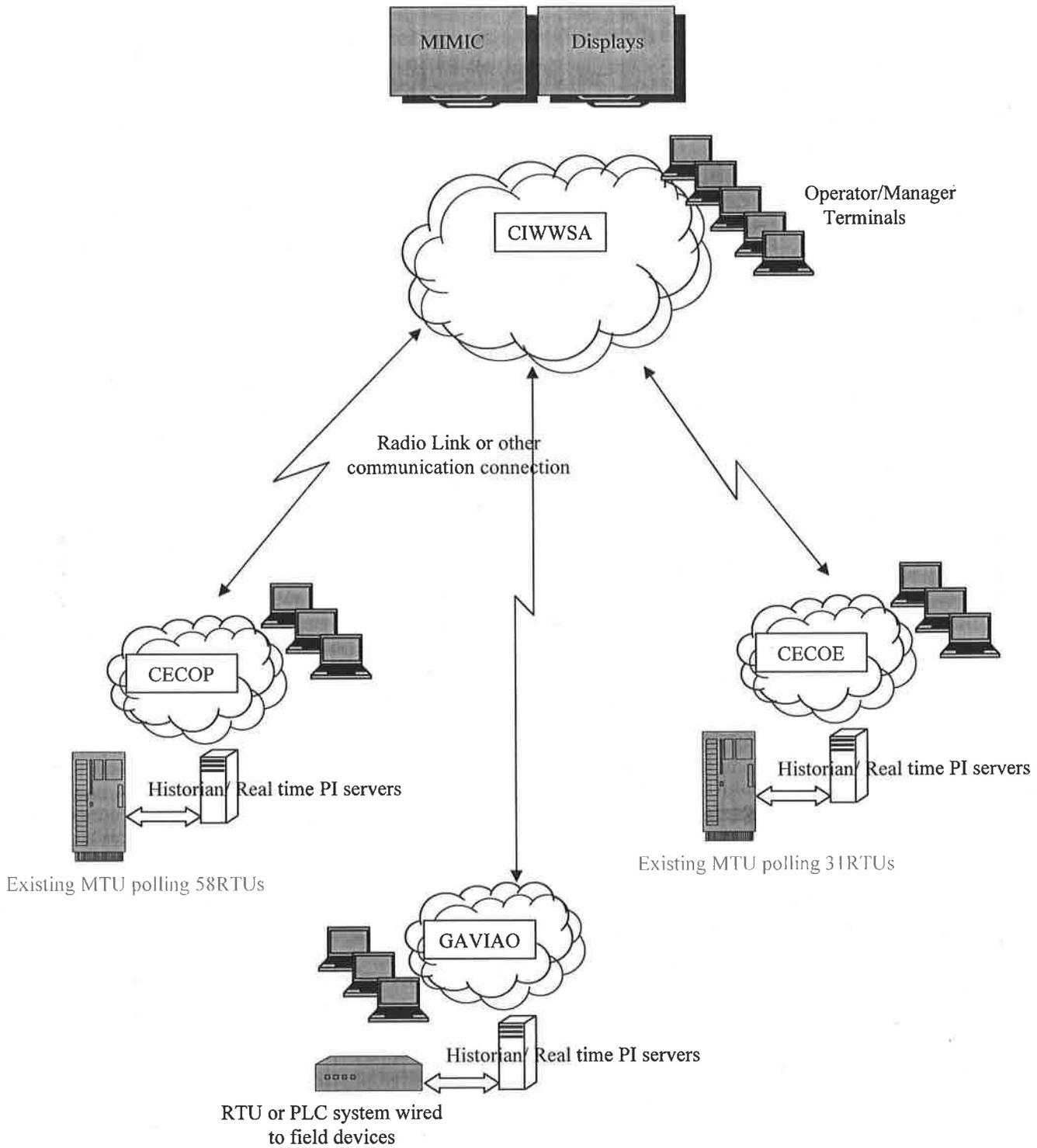


Figure B3.1b – CAGECE Water and Wastewater Systems Automation Upgrade Schematics

B3.2 PROJECT DESCRIPTION

CAGECE is requesting USTDA technical assistance for the technical assessment of the following four actions:

1. Acquisition of advanced information technology software and hardware to upgrade the CECOP system;
2. Acquisition of advanced information technology software and hardware for remote control and monitoring of the ETA GAVIAO;
3. Acquisition of advanced information technology software and hardware to upgrade the CECO E system; and
4. Establishment of a Center for Integrated Water Supply and Wastewater Systems Operation Automation in Fortaleza (CIWWSA), which is to be installed in the administrative center of CAGECE.

The CIWWSA will provide easy access to data and information to CAGECE's authorized managers and engineers to support a number of activities, including business reporting, operation management oversight, water treatment and distribution systems evaluation and wastewater collection system operation analysis and improvements planning.

The CIWWSA will feature real-time data collection automation and processing capability within a Geographic Information System framework that will enable hydraulic simulation and forecasting including pattern recognition to alert abnormal operating conditions. The CIWWSA will also feature the development and operation of software that is capable of integrating predictive hydraulic modeling for water and wastewater systems' operation using cadastral infrastructure database. The CIWWSA will be equipped to evaluate historical data and suggest adjustments to possible failures in water supply and wastewater infrastructure already implemented.

As indicated above, the CIWWSA software will also assist decision makers in planning and managing the expansion and/or improvement of the water and wastewater systems. In essence the objectives of the CIWWSA are to provide central collection, storage and processing of operations data from CECOP, ETA GAVIAO and CECO E. The CIWWSA will generate data and information for the followings CAGECE units:

- Business Department
- Operation Department
- Administration Department

C3. PROJECT SPONSOR'S CAPABILITIES AND COMMITMENT

As CAGECE approaches 40 years of service it continues to expand its reach with the goal of providing universal wastewater service throughout Ceara. Additionally, CAGECE's pro-environmental work was recognized with the 2007 Environmental Quality Award from the Association of Parliamentarians of Brazil.

According to information provided by CAGECE's website (www.cagece.com.br/cagece), CAGECE has grown into a solvent mixed capital company with total revenues and net profit reaching approximately US\$325.51 million and US\$23.52 million in 2009, respectively. Annual capital investment reached US\$81.35 million in 2009. CAGECE has demonstrated excellent technical capabilities in reducing NRW losses. In fact, its 2009 water loss index (estimated at approximately 26%) is one the best in the entire Brazilian water sector.

CAGECE has also demonstrated its commitment to maintaining and expanding the Ceara's water supply and distribution infrastructure through the use of advanced system's control and monitoring technology. With a 2011 water system capital investment budget of over US\$55 million, CAGECE recognizes the importance of not only building out and rehabilitating the infrastructure but also modernizing the system and increasing its efficiency. The Project was identified by CAGECE as a priority, particularly as related to engaging appropriate U.S. technologies. CAGECE officials noted that they are especially impressed by U.S. water and wastewater monitoring and control systems.

After reviewing the Project Sponsor's proposal and the information provided in its website, the DM concludes that the Project Sponsor has the policies in place, the commercial interest and the investment capacity to commit the required resources to implement the Project.

D3. IMPLEMENTATION FINANCING

Discussions with Andre Macedo Faco, CAGECE's Director of Operation revealed that CAGECE intends to invest R\$348 million (US\$208 million) by the end of 2011 to improve water and sanitation services throughout the state. A total of R\$ 233 million (US\$389 million) will be used for sewage collection and treatment projects and R\$ 89 million will go toward water supply projects. According to Andre Faco, the CECOP and CECOUE upgrades, the Gaviao SCADA and the CIWWSA are a priority due to their importance as a tool for improving CAGECE service.

E3. U.S. EXPORT POTENTIAL

The overall cost for the project was estimated based on a discussion and information provided by CAGECE representatives.

1. The capital investment in advanced information technology software and hardware for upgrading the CECOP system is estimated at R\$5,000,000 (US\$2.94 million);
2. The capital investment in advanced information technology software and hardware for remote control and monitoring of the Gaviao water treatment plant; R\$1,000,000 (US\$0.625 million);
3. The capital investment in advanced information technology software and hardware for upgrading the CECOUE system; R\$6,000,000 (US\$3.75 million); and
4. The capital investment associated with the hardware and software of the CIWWSA is estimated at R\$500,000 (US\$0.312 million).

Thus, the total cost of improving SCADA capability at the water and wastewater systems within Fortaleza is estimated at US\$ 7.63 million. Hardware and software represent about 60% to 75% of the total cost with labor and other direct costs accounting for the remaining capital expenditures. Accordingly, the U.S. export potential is assessed at approximately US\$ 4.5 million dollars.

The key export potential is SCADA software and hardware for the automation of the water and water systems' operation. SCADA technology includes input-output signal hardware, controllers, interface devices and related communication software. Complete SCADA systems may be acquired from a single supplier but they are more frequently assembled from hardware and software components available from various U.S. and European suppliers of industrial automation and information software. Table E.3 below list several U.S. suppliers of automation technology.

Table E.3 Suppliers of Automation and Water and Wastewater Information Systems Technology

SCADA Technology Supplier	Location
Automated Sonix Corp.	Boca Grande, FL
Auatechniques Inc.	Birmingham, AL
Campbell Scientific, Inc.	Logan, UT
GE Enterprises Solutions	Charlottesville, VI
Honeywell	Morristown, NJ
Iconics	Foxboro, MA
Revere Control Systems	Birmingham, AL
Rockwell Automation	Milwaukee, WI
Stevens Water Monitoring Systems, Inc.	Portland, OR
Wonderware	Lake Forest, CA
Water and Wastewater SCADA Systems Consultants.	Location
AECOM Technology Corp	Loa Angeles, CA
Carrollo Engineers	Walnut Creek, CA
CH2M-Hill	Englewood, CO
HDR,	Omaha, NE
IDModeling	Arcadia, CA
MWH	Broomfield, CO
RW Beck	Seattle, WA

F3. FOREIGN COMPETITION AND MARKET ENTRY ISSUES

As indicated above, municipal water and wastewater systems automation aim at reducing NRW and energy use. Water shortages and added demand due to population growth have created important business opportunities for water and wastewater automation projects in many countries around the world. As a result, several Canadian, European, Japanese and U.S. companies have been working to create a stronghold for their water related modeling and information technology. The US' main competitors are ABB of Switzerland, Citect of Australia, Schneider Electric of France, Barco Ltda of Brazil and Siemens AG of Germany.

In Brazil local firms and companies provide most of the environmental service work and technology products. Well established Brazilian environmental infrastructure local companies providing information technology and services include the following:

- DPM Engenharia
- Conexao Engenharia
- CPFL (Sao Paulo – Campinas)
- SABESP (Sao Paulo)
- COELCE (Fortaleza, Ceara)

This DM confirmed that environmental business opportunities for international companies in Brazil are mostly related to innovative and state of the art technologies not available locally. Recent and stricter regulatory requirements for the discharge of wastewater treatment plant effluent have increased the demand for specialized services and wastewater treatment technologies including automated water quality control and monitoring.

U.S. exporters of technology should be aware that imports to Brazil are subject to a number of taxes and fees that account for a 56.064 percent increase in the FOB cost of the product. Thus, a tax imposed on imported products makes it challenging to compete with less costly local products even if they are not the best suited application. On a positive note, Brazilians are generally familiar with the high quality of U.S. water and environmental products and technology, which makes U.S. high-tech products competitive.

G3. DEVELOPMENTAL IMPACT

G3.1 ENVIRONMENTAL INFRASTRUCTURE

The Project would require developing an advanced monitoring and controlling system to enhance the reliability and efficiency of water treatment and supply and wastewater management within Fortaleza. Currently the water system delivers up to 10.2 m³/sec (232.83 MGD) of water within a distribution network of 4,621 km. The wastewater collection system extends 2,223 km. The TOR for the FS will require a detailed account of the expected infrastructure developmental impact for the Project.

G3.2 HUMAN CAPACITY BUILDING

The Project, if fully implemented, would create several long-term jobs for system maintenance and operation. Additional jobs would be created through the provision of an expanded and improved water and wastewater service. Training in advanced water supply distribution and wastewater quality monitoring and control technologies, including the SCADA system, would be required during project implementation, particularly during the first two years of its operation. The TOR for the FS includes a detailed analysis of the expected workforce requirements including training for the Project.

G3.3 TECHNOLOGY TRANSFER AND PRODUCTIVITY IMPROVEMENTS

Advanced monitoring and control systems such as SCADA are not exactly new to Brazil but they offer an opportunity to expand the current automation capacity with enhanced real-time decision making capability. Because up to date SCADA capability is not employed in the operation of the CAGECE water supply and wastewater, the CAGECE Project will be a substantial improvement over the existing water and wastewater systems operating procedures. If fully implemented the Project would entail transfer of knowledge of these technologies to CAGECE local operators. The TOR for the FS will require a detailed account of the expected technology transfer developmental impact for the Project.

H3. IMPACT ON THE ENVIRONMENT

There is no expected negative impact on the environment from the proposed Project. Positive environmental impacts of the project would come from decreased levels of water losses within the system, which is critical to ameliorate the current water deficit discussed above. The Project would also increase the energy efficiency of the water supply and distribution system, with a resulting decrease in emissions and other environmental impacts due to the reduction of electric power requirements. Improved wastewater quality monitoring should result in greater compliance with environmental regulations. AJGB International recommends that the TOR include a preliminary environmental impact assessment in line with USTDA's basic requirements.

I3. IMPACT ON U.S. LABOR

The Project would develop an advanced monitoring and control system for the water supply and wastewater management systems within Fortaleza. The Project would not promote the establishment of any business other than for the purpose of serving the local market more efficiently (e.g. local agent/distributor). Based upon our review, we found that the Project does not provide: (a) any financial incentive to a business enterprise currently located in the United States for the purpose of inducing such an enterprise to relocate outside the United States if such incentive or inducement is likely to reduce the

number of employees of such business enterprise in the United States because United States production is being replaced by such enterprise outside the United States; (b) assistance for any project or activity that contributes to the violation of internationally recognized workers rights; or (c) direct assistance for establishing or expanding production of any commodity for export by any country other than the United States, if the commodity is likely to be in surplus on world markets at the time the resulting productive capacity is expected to become operative and if the assistance will cause substantial injury to United States producers of the same, similar, or competing commodity. Positive impacts on U.S. labor would emerge from prospective U.S. exports of goods and services, as described in section E3 above.

J3. QUALIFICATIONS

The FS would be conducted by an expert U.S. company with ample experience in the feasibility analysis of SCADA systems for water and wastewater projects. Therefore, it is expected that the company selected will have demonstrated qualifications, experience and the required capability to carry out the technical requirements of the CAGECE Water and Wastewater Systems Automation Project. The suggested selection criteria for the firm and team that will execute the USTDA grant assistance is the following:

1. Firms' specific experience related to the assignment: 25 point maximum
 - a. Firms' overall experience: 15 points
 - b. Firms' overseas experience: 10 points
2. Adequacy of proposed work plan and methodology in response to the TOR: 25 point maximum
 - a. Knowledge of proposed work and understanding of service: 10 points
 - b. Appropriateness of proposed methodology and workplan: 15 points
3. Qualifications and competence of the key staff for the assignment: 25 point maximum
 - a. Team Leader's experience in similar projects: 5 points
 - b. Project Engineer's experience in similar projects: 5 points
 - c. Electrical SCADA Engineer's experience in similar projects: 5 points
 - d. Economist / Financial Analyst's experience in similar projects: 5 points
4. Past performance: 25 point maximum
 - a. Six relevant and verifiable projects: 25 points
 - b. Five relevant and verifiable projects: 20 points
 - c. Four relevant and verifiable projects: 15 points
 - d. Three relevant and verifiable projects: 10 points
 - e. Two relevant and verifiable projects: 5 points

K3. JUSTIFICATION

The Project offers a unique opportunity for USTDA to advance the use of U.S. high-tech water and wastewater automation expertise and promote economic growth while improving public health and environmental conditions in Brazil. The Project would improve the efficiency and reliability of water supply and wastewater management infrastructure in Fortaleza which, as discussed in section B3.1, is a necessity due to the large portion of the population that does not have access to piped potable water. The automation of the Gaviao water treatment process for remote control and monitoring is vital to improving the reliability and safety of the water supply which is critical to the health and wellbeing of the population and, consequently, to the local economy.

The Brazilian water supply and wastewater treatment market is a highly competitive and challenging one for U.S. companies. However, CAGECE's aggressive and well-funded program to modernize and expand its water supply and distribution systems, coupled with a strong desire to introduce U.S. companies and technologies into the market, sets the stage for USTDA feasibility study funding. By introducing U.S. expertise into the market, which has been dominated by foreign suppliers through local engineering and design firms, USTDA could help create a large market for U.S. suppliers.

L3. TERMS OF REFERENCE AND BUDGET

The objective of the prospective technical assistance is to give support to a feasibility study that will investigate the viability of current SCADA technologies for water and wastewater systems operated by CAGECE in Brazil. The FS also evaluates the application of SCADA technologies for water treatment system operation optimization.

The primary goal is to provide technical guidance for assessing and confirming the technical, financial and economic attractiveness of developing the proposed action. Appendix L3 contains the proposed Terms of Reference for the requested feasibility study. Appendix L3 presents a detailed budget and task breakdown for the feasibility study. The DM estimates that the completion of the FS will take approximately four (4) months.

M3. RECOMMENDATIONS

Our conclusion is that the Project is of importance to U.S. commercial and developmental goals, specifically through the promotion of appropriate advanced technologies for water supply distribution and wastewater quality monitoring. CAGECE is committed to the modernization of Fortaleza's water supply and wastewater management infrastructure and have allocated significant financial and other resources to achieve their objectives. USTDA support for the Project is critical to helping U.S. SCADA technology manufacturers and companies establish their presence not only in CEARA, but also in Brazil and the South American Region. U.S. SCADA manufacturers face strong competition from European companies, especially from France and Germany. The project has a significant export potential due to the capital investment and recurrent revenue generated from maintenance and water systems expansion. More importantly, the project will demonstrate the cost-effectiveness of U.S. SCADA technology in Brazil.

AJGB recommends USTDA funding of the FS, based on the following assumptions:

1. CAGECE offers a commitment that projects will not enter the design phase until the USTDA FS is completed and the Grantee has the opportunity to assess the advantages of current U.S. made SCADA technologies;
2. The Project Sponsor offers support for the execution of the FS in the form of local office space and local transportation to the U.S. contractor for the Project;
3. The Project Sponsor offers personnel for logistic support; and
4. CAGECE indicates its intention to proceed with the project implementation in terms acceptable to U.S. companies interested in providing technology and services for the design, implementation and operation of the project.

N3. PROJECT PORTFOLIO ASSESSMENT

The DM team evaluated the CAGECE proposal for implementing water and wastewater systems automation technology. The current water supply shortfalls and the out-of-date water and wastewater systems management procedures justify consideration of the proposal for enhanced automation of the CAGECE water and wastewater management systems. The Project as formulated meets technical criteria

anticipated for municipal infrastructure capital investment and the DM supports USTDA FS financing assistance to expedite its implementation.

The TOR for the FS are provided in Appendix L3. The DM recommends USTDA funding of the FS to provide U.S. companies with a presence in the development of automated water and wastewater systems in Brazil.

O3. CONTACTS

See Appendix O1.

Appendix B3.1a
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOP Background Information
(Included in Report Vol.2)

Appendix B3.1b
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOE Background Information
(Included in Report Vol.2)

Appendix B3.1c
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOP Planned Improvements
(Included in Report Vol.2)

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**REPORT Vol. 2
Appendices B1.1, B3.1a, B3.1b, B3.1c and O1**

**Definitional Mission (DM): Brazil: Water and Environmental
Sector Opportunities
USTDA 2010510010**

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March 08, 2010



This report was funded by the U.S. Trade and Development Agency (USTDA), a foreign assistance 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.

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Appendix B3.1b – CAGECE Water and Wastewater Systems Automation Upgrade Project, CECOE Background Information

Appendix B3.1c – CAGECE Water and Wastewater Systems Automation Upgrade Project, CECOP Planned Improvements

Appendix L3 - CAGECE Water and Wastewater Systems Automation Upgrade Project, Proposed Terms of Reference and Budget

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Table B3.1 CAGECE Water and Wastewater Management Service Summary

Table E.3 Suppliers of Automation and Water and Wastewater Information Systems Technology

Table E.4b U.S. Suppliers of Automation Technology

Table F4 Potential Foreign Competitors for SCADA and NRW Projects

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Figure B3.1a – Gaviao Water Treatment Plant Schematic

Figure B3.1b – CAGECE Water and Wastewater Systems Automation Upgrade Schematics

Appendix B3.1a
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOP Background Information

1. Situação Atual do CECOP

Desde 1999, a CAGECE faz a supervisão e o controle à distância do Sistema de Abastecimento de Água de Fortaleza e Região Metropolitana através do Centro de Controle Operacional (CECOP). Neste local, são monitorados 3711 variáveis de operação pressão, vazão, temperatura, níveis de reservatórios e situação das estações elevatórias e VRP's.

As informações são adquiridas e gerenciadas pelo Centro de Controle Operacional, o qual monitora por um operador, através de 02 (dois) computadores, que se encontra em rede com o servidor de aquisição de dados e monitoramento das informações geradas nas 56 Unidades de Terminais Remotos (UTR's).

A partir da sala de controle do CECOP, o operador dispõe de todas as condições de monitorar, comandar e realizar modificações nos parâmetros operacionais, mediante o recebimento de dados das UTR's e o envio de sinais de comando para as mesmas.

Cada estação (UTR) é dotada de instrumentos de campo, tais como:

- transmissor de pressão;
- medidor magnético de vazão;
- analisador de cloro residual;

- medidor ultras sônico;
- transdutor de corrente, fator de potência e temperatura;
- painel com o controlador LC 700 da Smar e Atos;
- estabilizadores de alimentação e
- rádio de comunicação de dados.

2. Protocolo de comunicação

O protocolo HART permite a sobreposição do sinal de comunicação digital aos sinais analógicos de 4-20mA, sem interferência, na mesma fiação. O HART proporciona alguns dos benefícios apontados pelo modbus, mantendo ainda a compatibilidade com a instrumentação analógica e aproveitando o conhecimento já dominado sobre os sistemas 4-20mA existentes. Para Transmitir o sinal digital juntamente com o analógico, utiliza-se a técnica de FSK (frequency shift key) no qual um sinal senoidal de corrente pico-a-pico de 1mA na frequência de 1200KHz significa "1" e 2400KHz significa "0".

Há algumas limitações na utilização desse padrão de comunicação. Por exemplo. Pode-se ter uma configuração mestre-escravo ultimando sinal analógico e digital no mesmo par de fios. Essa configuração só é possível para um escravo no par de fios. Para a utilização de mais de um dispositivo, o sinal analógico é desprezado. A corrente que era usada na comunicação analógica fica definido em 4ma todo o tempo (apenas para a alimentação dos dispositivos), e os sinais de controle é transmitido nas frequências conhecidas 1200 kHz-2400 khz. Pode-se configurar até 15 dispositivos nesse modo.

3. O sistema de rádio-modem

O SISTEMA PONTO-MULTIPONTO TRANSPARENTE LIVRE DE LICENÇA É FORMADO POR RÁDIOS COM TECNOLOGIA SPREAD SPECTRUM, NA FAIXA DE 902 MHZ A 907,5 MHZ E 915 MHZ A 928 MHZ, UTILIZANDO A TÉCNICA DE PULOS DE FREQUÊNCIA ("FREQUENCY HOPPING").

O SISTEMA SPREAD SPECTRUM NÃO REQUER LICENCIAMENTO NA ANATEL, NEM QUALQUER TIPO DE RECOLHIMENTO DE TAXAS DE PARA A INSTALAÇÃO OU O FUNCIONAMENTO.

OS RÁDIOS QUE COMPÕEM ESTE SISTEMA POSSUEM PROCESSADOR DSP ("DIGITAL SIGNAL PROCESSOR") DE ALTA PERFORMANCE QUE GARANTE TAXAS DE TRANSMISSÃO DE ATÉ 115,2 Kbps.

USUALMENTE SÃO FEITOS SISTEMAS COM UM PONTO CENTRAL, CHAMADO MESTRE, E PONTOS REMOTOS. PODE SER NECESSÁRIA A UTILIZAÇÃO DE REPETIDORA, CASO O ALCANCE TENHA QUE SER EXPANDIDO OU O PONTO CENTRAL ESTEJA MAL LOCALIZADO, DO PONTO DE VISTA DE RADIOCOMUNICAÇÃO. DEPENDENDO DO EQUIPAMENTO, A REPETIDORA PODE SER FEITA COM APENAS UM RÁDIO (STORE & FORWARD).

- SOFTWARE

- Supervisório -Eclipse E3 – versão 2.5 builder 176

- E3 Server 10.000 Hoststandby – 1 Licença

- E3 Serve Pack 10.000 - 1 Licença

- E3 Studio – 1 Licença

- E3 Viewer – 9 Licenças de Leitura e Escrita

Componentes



E3 Studio: Ferramenta única de configuração do sistema, servindo com plataforma universal de desenvolvimento.



E3 Server: É o servidor de aplicações, onde são processadas as comunicações e gerenciados os processos principais do sistema. Ferramenta única de configuração do sistema, servindo com plataforma universal de desenvolvimento.



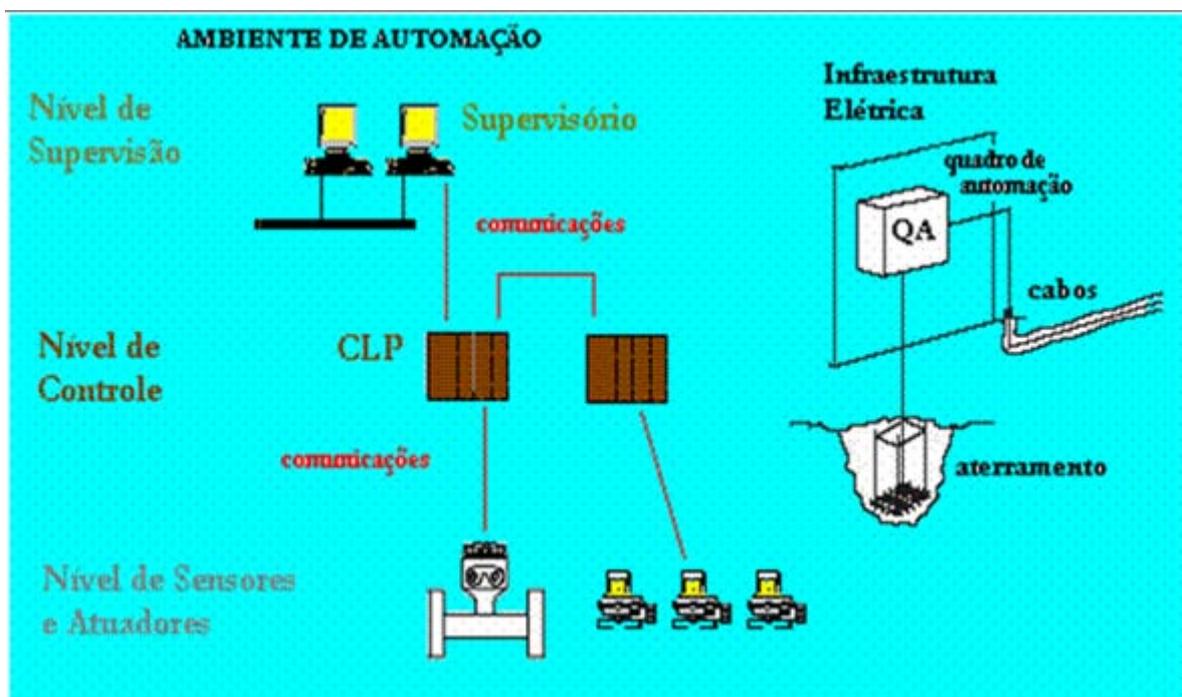
E3 Viewer: É a interface de operação com o usuário (console de operação). Permite rodar a aplicação que está no servidor em qualquer computador e pode ser executado tanto na rede local como na intranet/internet via browser.

- Configuração Diagrama Ladder
 - - CLP Smar
 - - CLP Atos
- Hardware
 - CLP Smar
 - CLP Atos
 - Rádio-Modem modelo MDS-TRANSNET-900
 - Nobreak
 - Transmissor de pressão;
 - Medidor magnético de vazão;
 - Analisador de cloro residual;

- Medidor ultras sônico;
- Transdutor de corrente, fator de potência e temperatura;
- Painel com o controlador LC 700 da Smar e Atos;
- Estabilizadores de alimentação/ Nobreak;
- Rádio de comunicação de dados.

Figuras do Layout e Dispositivos:

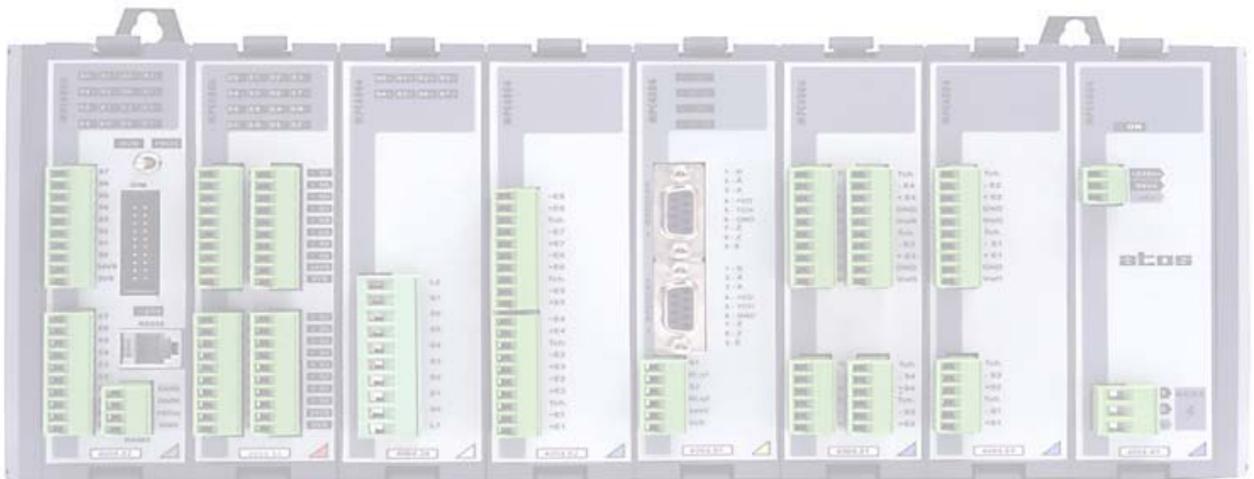
- **Ambiente de Automação**

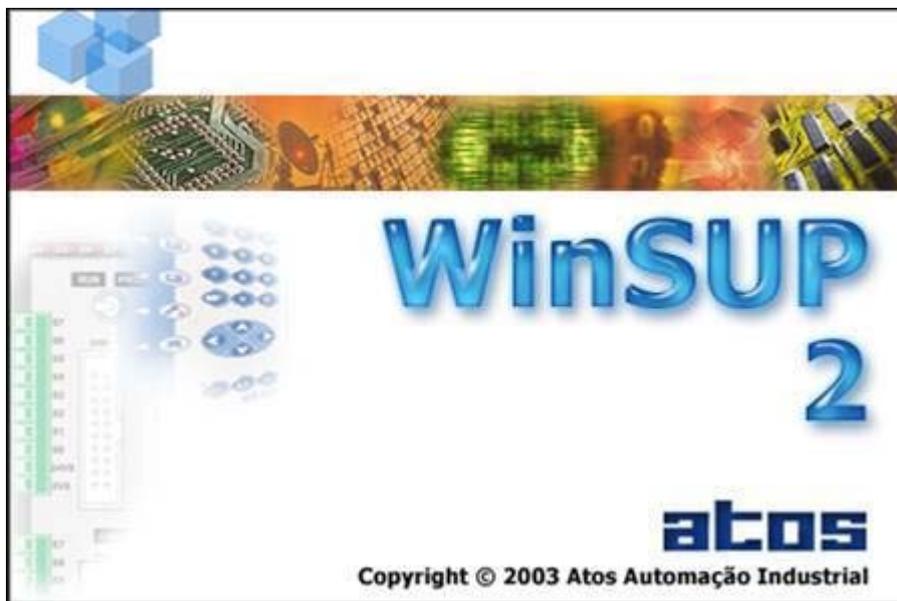


- **CLP SMAR**



- **CLP ATOS**





- Válvulas de Controle

- Válvula Borboleta Bi-Excêntrica revestida internamente em borracha



- Válvula Borboleta com Flanges Classe 300



- Transmissor de Pressão – LD301 - Smar



- **Medidor Magnético de Vazão**

Princípio de medição

Um condutor elétrico, neste caso o meio eletricamente condutivo, passa através de um campo magnético.

A tensão U induzida neste meio é diretamente proporcional à velocidade média do fluxo v .

A indução magnética B (intensidade de campo magnético) e a distância entre eletrodos D (diâmetro nominal do tubo) são constantes.

$$U = K \times B \times v \times D \quad (1)$$

K constante do instrumento

B intensidade do campo magnético

v velocidade média do fluxo

D distância entre os eletrodos

A taxa volumétrica do fluxo q_v , pode ser calculada de acordo com:

$$q_v = v \times D^2 \times \frac{\pi}{4} \quad (2)$$

segue da equação 1 que

$$v = \frac{U}{K \times B \times D} \quad (3)$$

Portanto:

$$q_v = \frac{U}{K \times B} \times D \times \frac{\pi}{4} \quad (4)$$

Sistemas de medição

O medidor de vazão eletromagnético consiste de um elemento primário, que é instalado na linha de dutos, e um conversor de sinais.

O projeto compacto tem um conversor de sinais montado diretamente no elemento primário.

Para sistemas com campo D.C. pulsante, as bobinas de campo do elemento primário que geram o campo magnético são energizadas por uma corrente contínua pulsante de um conversor de sinais.

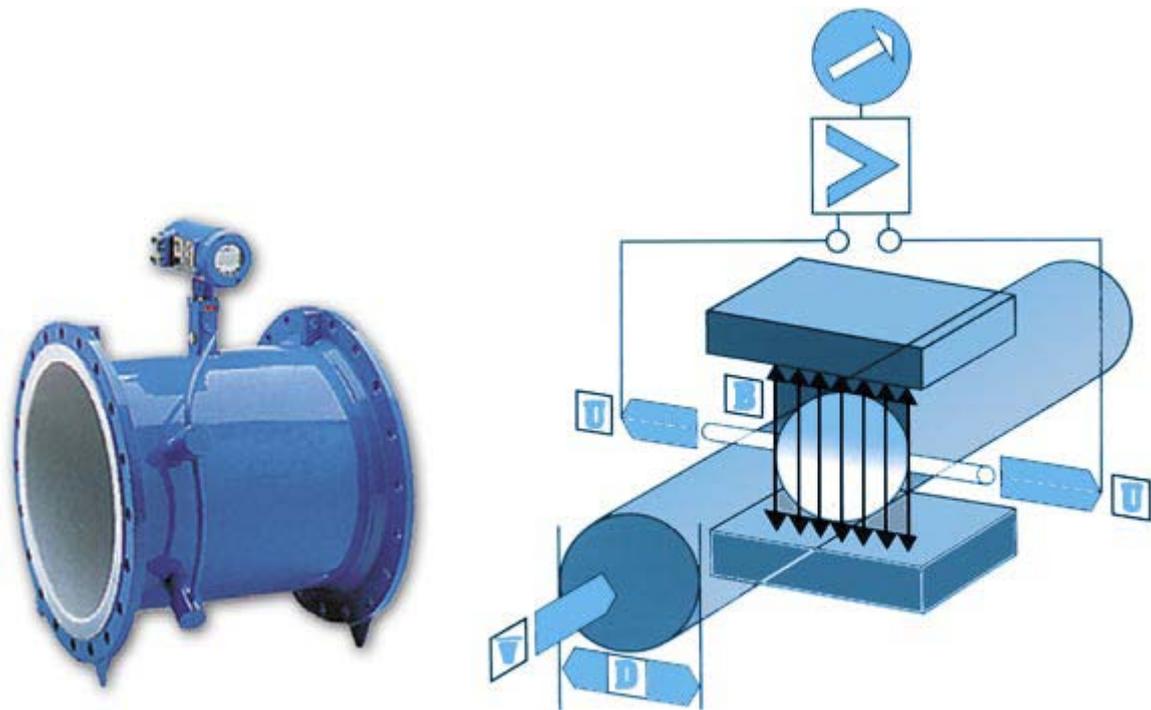
O sinal de medição é uma tensão de onda quadrada de mesma frequência. Estes sistemas produzem erros de medição extremamente pequenos.

O sinal da tensão induzida é coletado por dois eletrodos de medição em contato condutivo com o meio ou indiretamente por acoplamento capacitivo.

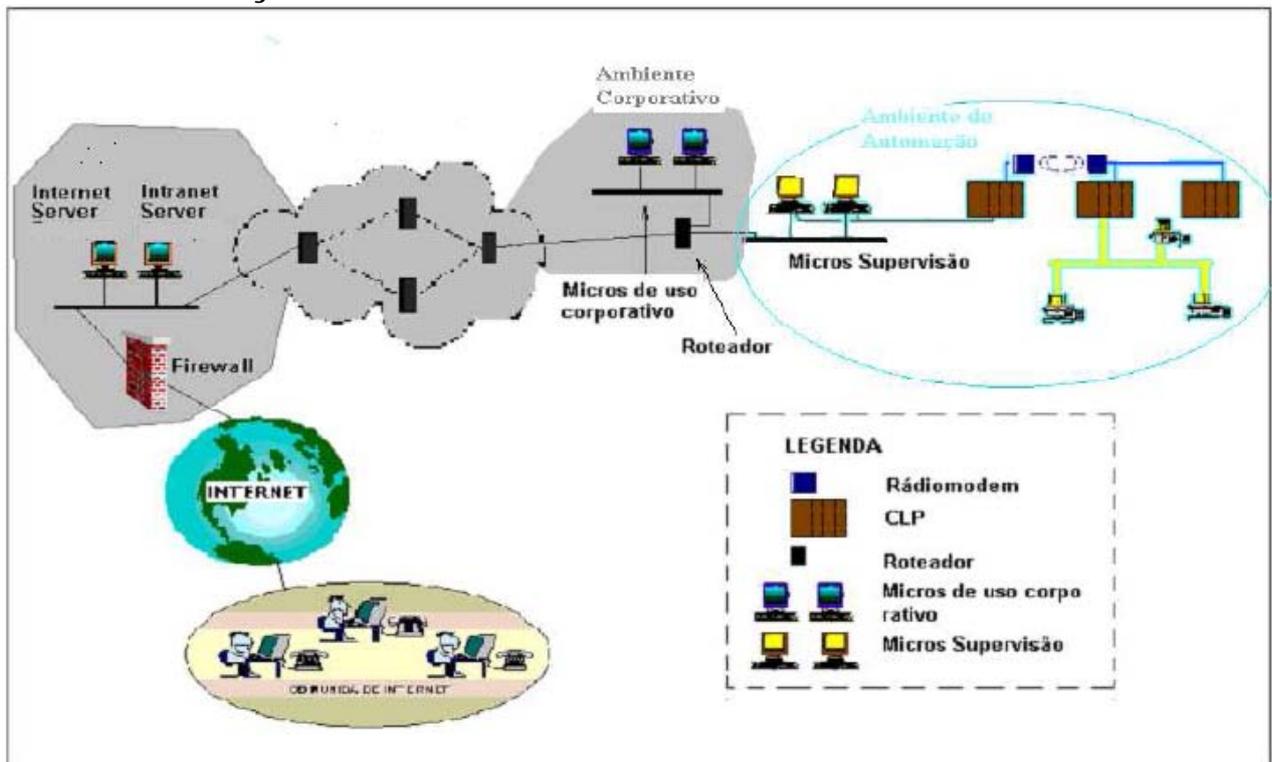
Um conversor de sinal amplifica o sinal e o converte em um sinal padrão analógico (p.ex. 4 a 20 mA) e um sinal de frequência (p. ex. 1 pulso para cada galão americano ou metro cúbico do meio que flui através do tubo de medição).

Para assegurar que a tensão não está em curto-circuito pela parede do tubo, o tubo de medição é feito de material eletricamente isolante ou equipado com revestimento isolante.

A medição é bastante independente do perfil do fluxo e outras propriedades do meio, tais como a pressão, temperatura, viscosidade, densidade, consistência, condutividade elétrica, e contaminação do eletrodo.

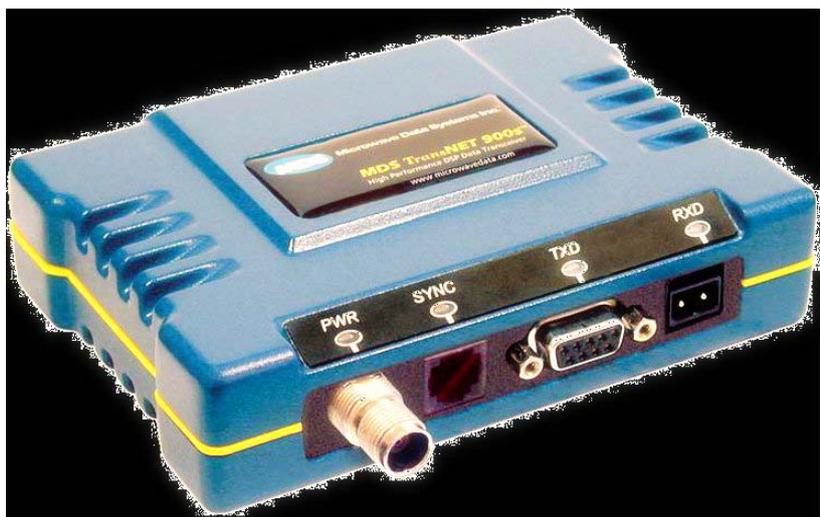


- Concepção de uma Rede de Comunicação de dados de Automação



- Rádio-Modem

- 51 - Rádio-Modem -
- 12 - em reserva, queimados, aguardando contrato de elegibilidade.
- 03 – repetidoras



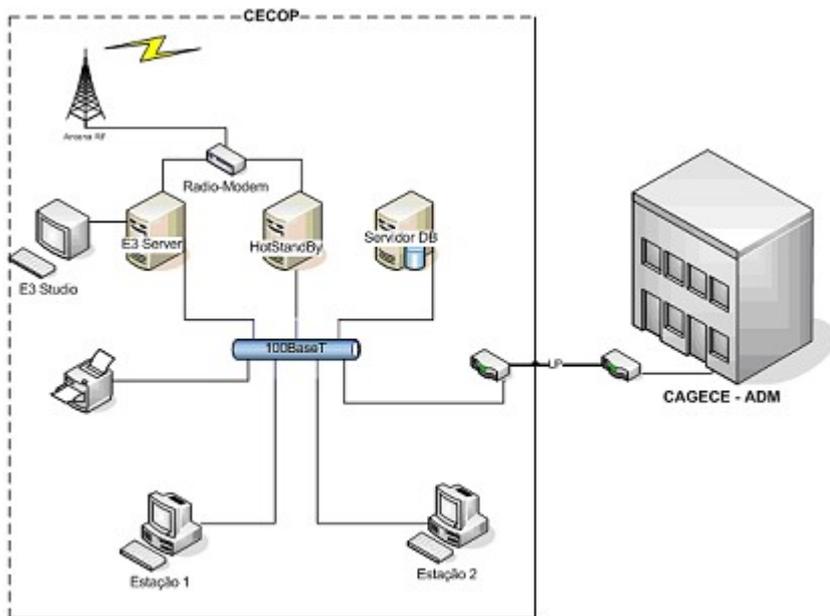
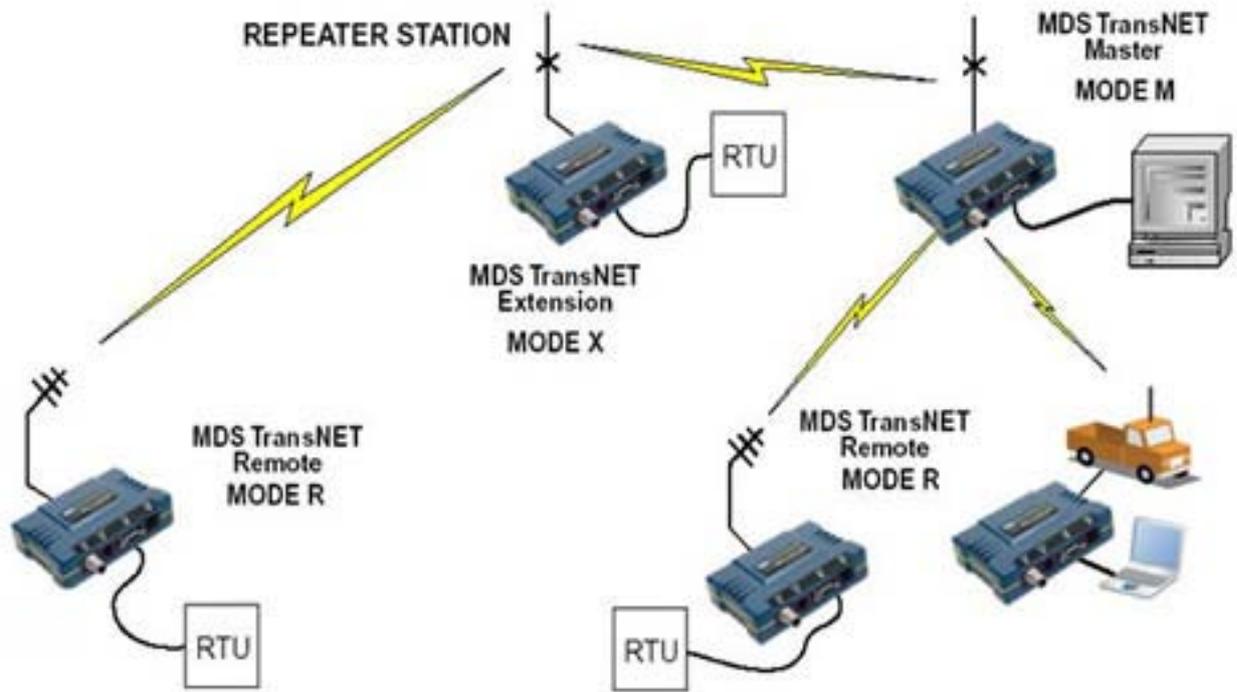
- Analisadores de Cloro 18

- 12 em funcionamento
- 06 com defeitos

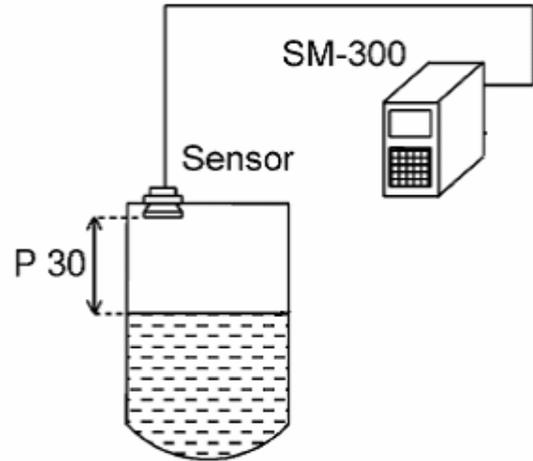


Analisador de Cloro Residual

- Topologia de Rede do CECOP



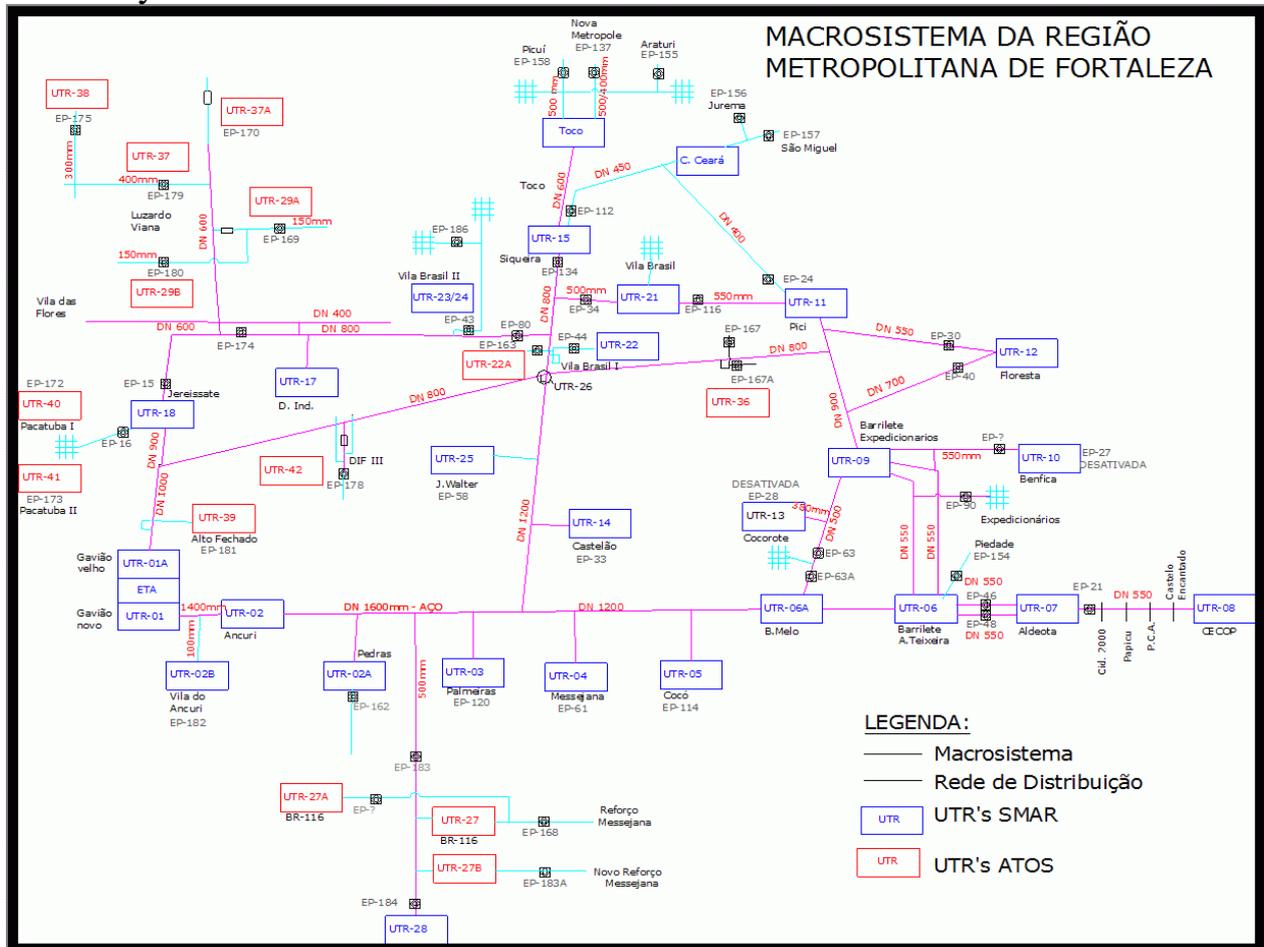
- Medidor Ultra sônico de nível
 - 18 medidores



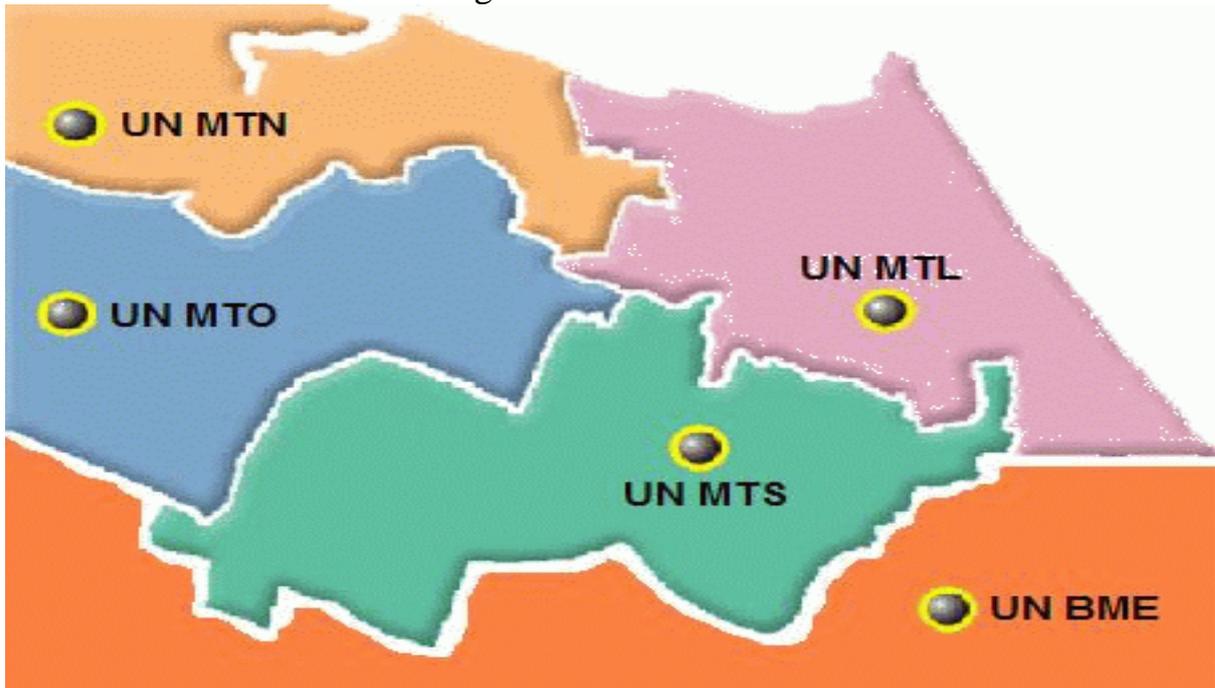
Controlador Remoto SM/SW300

Medidor Ultra-sônico utilizado nos reservatórios apoiado e poço de sucção das elevatórias

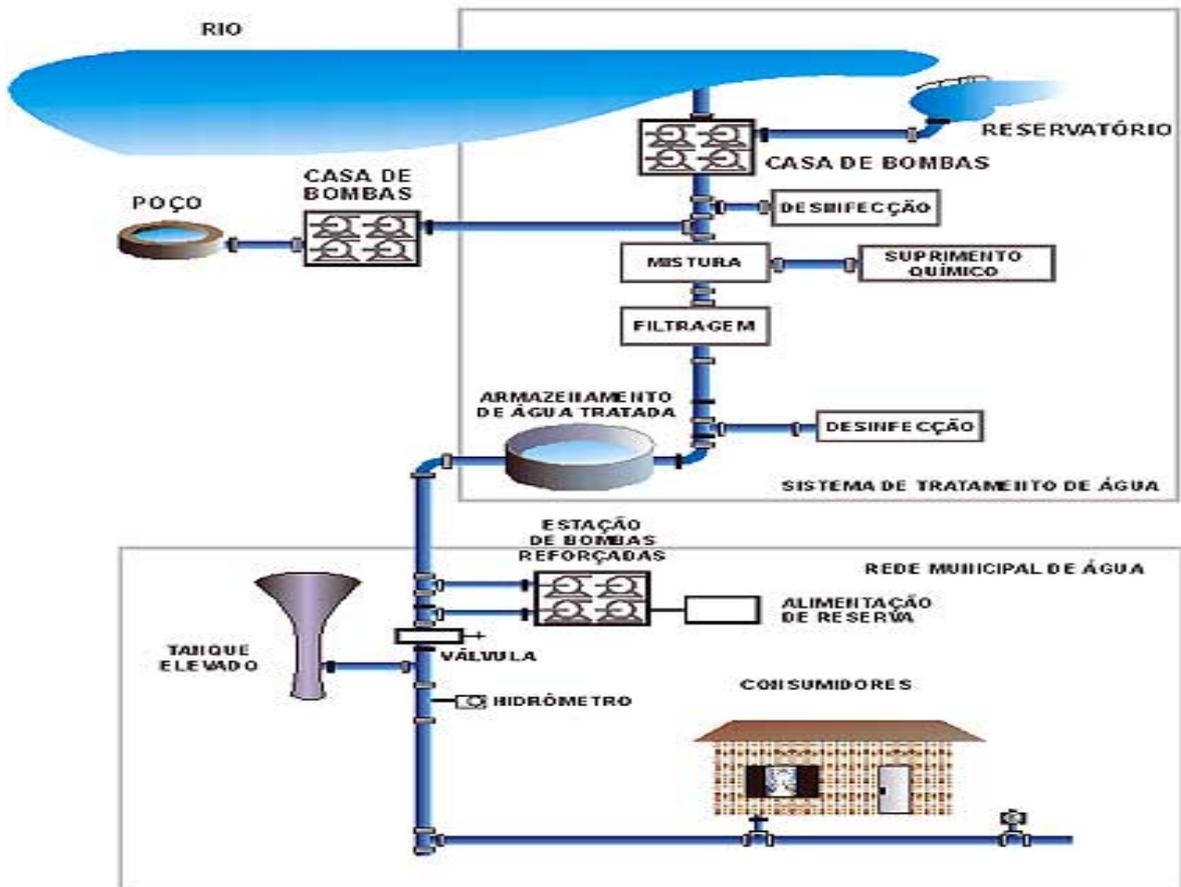
- Layout da Planta com as UTR's.



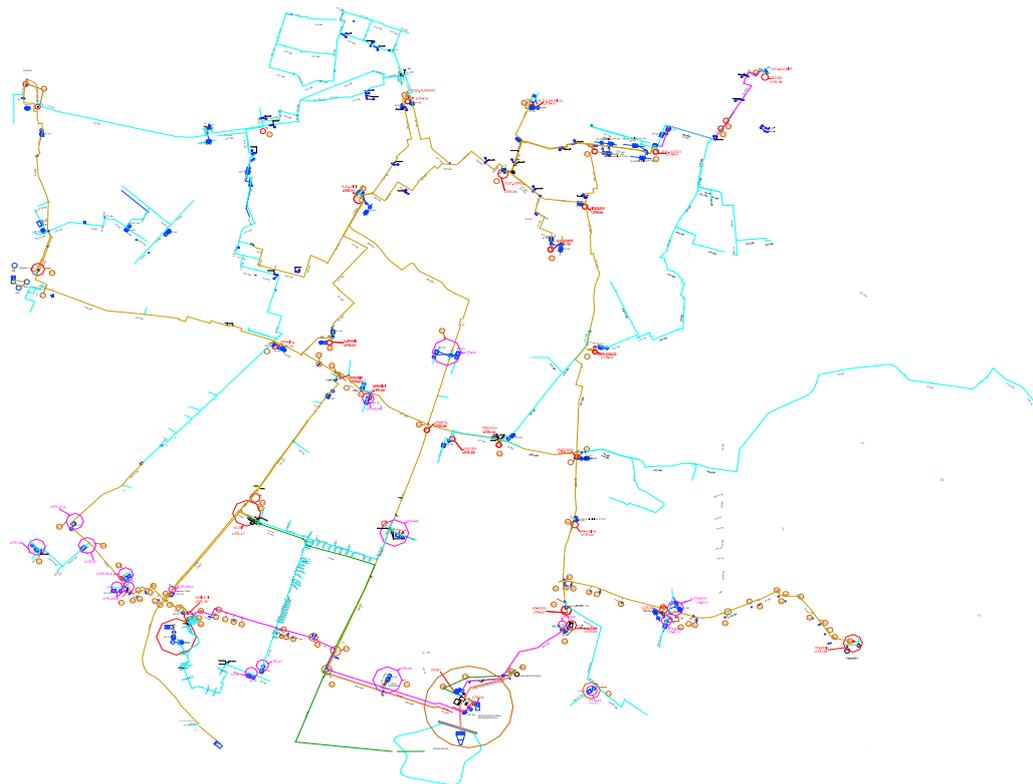
- Divisão das Unidades de Negócios



FORNECIMENTO DE ÁGUA-CONCEPÇÃO



- Redes adutoras



- Dados dos Reservatórios de Fortaleza

SETORES	TIPO RESERV.	VOLUME(m ³)	N.ºMÁX(m)	N.ºMÍN (m)	COTA TERREONO (m)	EQUIP.CONTRO LE DE NÍVEL
ALDEOTA	ENTERRADO (4 CÉLULAS)	30.000	40,55	34,65	42,50	SIM
	ELEVADO	1.500	63,80	52,80	42,50	
BENFICA	ENTERRADO (4 CÉLULAS)	40.000	18,65	13,65	17,65	SIM
	ELEVADO	2.000	44,15	40,15	23,90	
COCOROTE	SEMI-ENTERRADO (4 CÉLULAS)	12.825	19,20	15,20	19,70	SIM
	ELEVADO	1.000	52,06	44,06	20,70	
EXPEDICIO-NÁRIOS	SEMI-ENTERRADO (4 CÉLULAS)	20.000	18,85	13,85	23,00	SIM
	ELEVADO	1.800	52,30	47,05	23,00	
PICÍ	ENTERRADO (4 CÉLULAS)	20.150	41,15	36,15	32,50	SIM
	ELEVADO	1.200	63,80	51,80	31,50	
FLORESTA	SEMI-ENTERRADO (4 CÉLULAS)	32.500	20,80	15,80	21,30	SIM

	ELEVADO	2.000	56,00	45,00	20,50	
MUCURIBE	APOIADO	15.000	53,35	48,50	50,00	SIM
CONJ.CEARÁ	ENTERRADO	3.000	29,10	21,60	27,00	SIM
	ELEVADO	600	45,00	40,00	27,00	
JEREISSATI	SEMI-ENTERRADO	4.000	-	-	-	SIM
	ELEVADO	500	56,20	52,90	-	
DISTRITO INDUSTRIAL	SEMI-ENTERRADO	4.000	74.040	69.04	-	SIM
	ELEVADO	300	-	-	-	

- Relação das UTR's com o total das TAGS escrita no sistema de automação de água do projeto CAGECE.

UTR01 – Gavião Novo –

Total de número de TAGS = 268

UTR1A – Gavião Velho –

Total de número de TAGS = 142

UTR02 – Reservatório ANCURI

Total de número de TAGS = 049

UTR03 – VRP Palmeiras

Total de número de TAGS = 051

UTR04 – VRP Messejana

Total de número de TAGS = 094

UTR05 – VRP Cocó

Total de número de TAGS = 117

UTR06 – Barrilete Alves Teixeira

Total de número de TAGS = 128

UTR6A – VRP Borges de Melo

Total de número de TAGS = 059

UTR07 – Elevatória Aldeota

Total de número de TAGS = 190

UTR08 – Reservatório Mucuripe

Total de número de TAGS = 099

UTR09 – Barrilete Expedicionários

Total de número de TAGS = 073

UTR10 – Elevatória Benfica

Total de número de TAGS = 155

UTR10a – Elevatória BenficaII

Total de número de TAGS = 015

UTR11 – Elevatória Pici

Total de número de TAGS = 169

UTR12 – Elevatória Floresta
Total de número de TAGS = 240

UTR14 – VRP Castelão
Total de número de TAGS = 066

UTR15 – VRP Siqueira
Total de número de TAGS = 098

UTR16 – Vila Peri
Total de número de TAGS = 058

UTR17 – Distrito Industrial (Água Bruta e Tratada)
Total de número de TAGS = 038

UTR18 – Elevatória Jereissate
Total de número de TAGS = 056

UTR21 – Vila Brasil
Total de número de TAGS = 056

UTR22 – Vila Brasil I
Total de número de TAGS = 042

UTR23/24 – Vila Brasil II / Mondubim
Total de número de TAGS = 062

UTR25 – Conjunto José Walter
Total de número de TAGS = 038

UTR26 – Expedicionários com Perimetral (Distribuição)
Total de número de TAGS = 032

UTR27A – Reforço de Pedras
Total de número de TAGS = 037

UTR27B – Novo Reforço de Messejana
Total de número de TAGS = 035

UTR28 – VRP Eusébio
Total de número de TAGS = 079

UTR29AB – Loteamento Maracanaú/Conj.Maracanauzinho
Total de número de TAGS = 037

UTR36 – Expedicionários
Total de número de TAGS = 027

UTR37/A – Luzardo Vianna / Mondubim
Total de número de TAGS = 057

UTR38 – Mucunã
Total de número de TAGS = 035

UTR39 – Alto Fechado
Total de número de TAGS = 037

UTR40– Pacatuba I
Total de número de TAGS = 035

UTR42 – DIF III

Total de número de TAGS = 042
UTR43 – Gereraú
Total de número de TAGS = 035
UTR44 – Trilho Maracanaú
Total de número de TAGS = 077
UTR47 – Papi Jr.
Total de número de TAGS = 077
UTR48 – Booster Miramber
Total de número de TAGS = 019
UTR49 – Toco
Total de número de TAGS = 028
UTR50 – DNIT
Total de número de TAGS = 024
UTR51 – Nova Metropole
Total de número de TAGS = 036
UTR52 – Esplanada Araturi
Total de número de TAGS = 036
UTR53 – Dom Almeida Lustosa
Total de número de TAGS = 035
UTR54 – São Miguel
Total de número de TAGS = 035
UTR55 – Cidade Nova
Total de número de TAGS = 035
UTR56 – Praias Oeste
Total de número de TAGS = 038
UTR57 – Reforço Caucaia
Total de número de TAGS = 017
UTR58 - Reforço do Pici
Total de número de TAGS = 039
UTR59 - Palmares
Total de número de TAGS = 059
UTR60 - Santo Amaro
Total de número de TAGS = 205

TOTAL DAS TAGS DO PROJETO CAGECE = 3711

4. MELHORIAS PROPOSTAS

- Aquisição de um software para simulação do balanço hidráulico do sistema de abastecimento da RMF, a ser integrado ao sistema de automação, com objetivo de auxiliar nas decisões de manobras e melhorias na rede de distribuição do macrossistema.
- Automação dos processo da Estação de Tratamento de Água da ETA-Gavião.

Fortaleza, 18 de Novembro de 2010.

Appendix B3.1b
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOE Background Information

RELATÓRIO Automação / Medição de Vazão

- **CONSIDERAÇÕES GERAIS**

Este trabalho terá como finalidade diagnosticar e apresentar propostas de soluções aos problemas estruturais da automação do sistema de esgotamento sanitário de Fortaleza, Caucaia e Maracanaú, sinalizando a melhor metodologia de execução juntamente com o custo da proposição.

- **CECOE**

2.1) Computadores

Atualmente, a rede de computadores que compõem a automação do sistema de esgotamento sanitário de Fortaleza e RMF é composto de três computadores, sendo, um servidor de dados e duas estações de operação e visualização. Estas máquinas tem um regime de 24 horas de trabalho todos os dias da semana. Segue suas configurações:

2.1.1) Servidor

4. CPU, fabricação da HP
5. Processador Intel de clock 2,8 GHz.
6. Modulo de memória de 1 GB.
7. HD-1 de 160 GB
8. HD-2 de 40 GB
9. Sistema Operacional instalado: Windows XP Service Pack 2
10. Rede Internet/Intranet comunicando através do link da Geinf
11. Banco de dados utilizado: Access da Microsoft Office.
12. Nobreak STAY700
13. O sistema supervisorio (Elipse E3, V2.5b176), dispõe de cinco licenças de visualização e uma de servidor com 5.000 tags.
14. Uma impressora instalada na sala de controle operacional.
15. Dois conversores USB-Serial (RS232), um conversor USB-serial (RS-485) e um Conversor de USB-Serial (DF-1)
16. Um rádio MDS TransNet900 operando como mestre.
17. Monitor CRT 17 polegadas

2.1.2) Estações de monitoramento e controle

18. CPU, fabricação da HP
19. Processador Intel de clock 2,8 GHz.
20. Modulo de memória de 256 MB.
21. HD de 40 GB
22. Sistema Operacional instalado: Windows XP Service Pack 2
23. Rede Internet/Intranet comunicando através do link da Geinf
24. Nobreak STAY700
25. Monitor CRT 17 polegadas

2.1.3) Diagnóstico / Prognóstico

Estes computadores estão há mais de quatro anos operando 24 horas por dia, e já vem apresentando problemas (por várias vezes foi aberto o chamamo técnico à GEINF para dar manutenção nos mesmos). Observamos também que este computador que tem o papel de servidor é um micro convencional, comum,

que não tem redundância, ou seja, qualquer problema com ele compromete toda a operação assistida das estações remotas, podendo a Cagece ser penalizada por extravasamento de esgoto, tendo em vista que algumas delas não tem a figura do operador e mantenedor da estação, estão dependente da automação. Outro detalhe são os monitores que estão velhos e fora de foco, causando um cansaço na vista de quem trabalha defronte à eles, principalmente, os operadores que tem turnos de 12 horas. Como forma de melhoria e aumentarmos a confiabilidade do sistema sugerimos troca de todos os computadores e monitores por LCD (>22"), e termos realmente um servidor de banco de dados e os backups sendo feito no servidor da Cagece.

2.2) Sala de Controle

Observamos a falta de um responsável que conheça o supervisório na qual os operadores devam se reportar, comunicar as ocorrências, problemas com o sistema, etc. Observamos também que o grau de instrução dos operadores é abaixo do que acreditamos ser ideal, no mínimo técnico. Atualmente nenhum tipo de relatório operacional, gerencial e de manutenção é realizado pelos operadores.

Alem destes, a sala de controle esta precisando de reforma, pois a bancada dos micros esta em estado de conservação precária, o ar condicionado não resfria e as cadeiras estão quebradas. Deverá ser elaborado um projeto de lay-out, prevendo bancadas adequadas ao uso profissional da aplicação e um painel do tipo Panel View, para visualização adequada do sistema.

2.3) Software Supervisório

O sistema supervisório esta desatualizado e com vários erros; telas com problemas, algumas estações sem históricos, endereçamentos de tag errados e banco de dados fragmentado.

Atualmente o banco de dados utilizado é o Microsoft Access que não é aconselhado para uma aplicação profissional, como também não é o banco de dados utilizado pela companhia, possuindo grandes limitações.

Como melhoria sugerimos um upgrade no software supervisório para a última versão, aquisição de licença para podermos fazer as alterações e correções quando necessárias, e principalmente implementar a função "Hot Standby-By" no servidor, ou seja, quando um servidor parar o outro assume esta função, dando mais confiabilidade e estabilidade ao sistema.

Sugerimos a reformulação gráfica de todas as telas sinóticas do aplicativo supervisório, incluindo melhorias nas telas de gerenciamento de alarmes, históricos, mapa de localização das estações e gerenciamento energético.

2.4) Controle do CECO E

Atualmente o mestre de todo o sistema é o próprio supervisório e quando este falha o sistema fica vulnerável, portanto sugerimos modificação na arquitetura do sistema de modo que tenhamos como mestre dois CLPs funcionando em Redundância, pois quando um falhar o outro assumi a operação e através de uma interfase homem máquina (IHM) o operador poderá operar as estações.

- **Estação EPC**

3.1) Gradeamento Mecanizado

O acompanhamento deste sistema é muito simplório, apenas visualizamos o status das comportas e se a esteira esta ligada. Atualmente não sabemos quando a grade esta suja e quando o sistema precisa ser ligado para limpar. Como o estado de conservação do quadro de comando e sua própria estrutura estão bastante deterioradas, não sugerimos nenhum investimento não automação do gradeamento, até porque há a intenção de substituir o existente e somente podemos analisar a integração quando a gerência definir o novo equipamento.

3.2) Estação Elevatória EE-1

Devido a substituição dos equipamentos antigos por problemas e vida útil, faz-se necessário a integração dos novos inversores de frequência, medidores microprocessado de temperatura dos motores e dos mancais das bombas. Como melhoria para o sistema sugerimos a aquisição e integração de um multimedidor de grandezas elétricas para o painel de alta tensão assim como os transformadores de corrente (Tcs AT) para este cubículo.

Com todos estes equipamentos integrados ao CECO, teremos muitos benefícios para operação e manutenção do sistema, pois passaremos a ter históricos que nos possibilitarão fazer relatórios gerenciais, por exemplo, saber o custo operacional de cada elevatória, traçar curvas de tendência, registrar e conhecer os alarmes e diagnósticos dos acionadores dos motores, etc.

Outro fator que precisa ser melhorado é a concepção do sistema de operação automática das bombas de recalque, pois atualmente o sistema apenas opera em modo automático (PID) com uma bomba e a unidade deseja que pelo menos três bombas sejam selecionadas para esta operação e trabalhem conforme o nível de setpoint previamente estabelecido.

✓ Estação dos Sopradores

Através desta estação é realizado o acompanhamento dos sopradores e das peneiras rotativas, no entanto, ambos estão praticamente desativados. Devido a esta estação ter ventilação através de venezianas, o gabinete (Rack) do CLP esta bastante deteriorado devido a maresia e portanto desligado.

Foram adquiridos três chaves softstart para acionamento dos sopradores, sugerimos a integração dos mesmos ao supervisorio para com isto sabermos quais alarmes e termos o diagnóstico de algum problema com a chave.

Sugerimos instalação de multimedidor de grandezas elétricas e Tcs, para gerenciamento energético dos sopradores, peneiras e ETO.

Como as peneiras estão em processo de licitação, não podemos emitir nenhum parecer de como será a integração com o supervisorio, acreditamos que será necessário fazer alterações na tela e na forma de comunicação.

Atualmente não temos nenhum acompanhamento da estação de tratamento de odores, ETO, e como melhoria do sistema a gerência gostaria que fosse criada uma tela específica para estação, de modo a termos a integração dos analisadores de gases, da estação meteorológica, dos exaustores e históricos dos equipamentos.

✓ Estação Elevatória EE-2

Em 2006 esta estação incendiou e até hoje esta sem automação. Novos equipamentos e quadros de comando foram adquiridos, faltando apenas componentes os que iriam compor a automação.

Devido a substituição dos equipamentos antigos faz-se necessário a integração dos novos inversores de frequência, medidores microprocessado de temperatura dos motores e dos mancais das bombas. Como melhoria para o sistema sugerimos a aquisição e integração de um multimedidor de grandezas elétricas para o painel de alta tensão, assim com os transformadores de corrente (Tcs AT) para este cubículo.

Com todos estes equipamentos integrados ao CECO, teremos muitos benefícios para operação e manutenção do sistema, pois passaremos a ter históricos que nos possibilitarão fazer relatórios gerenciais, por exemplo saber o custo operacional de cada elevatória, traçar curvas de tendência, registrar e conhecer os alarmes e diagnósticos dos acionadores dos motores, etc.

Em decorrência do incêndio ocorrido, os cabos da rede de automação e telefonia foram danificados, portanto precisam ser trocados.

Sugerimos instalar e integrar um sensor de nível no tanque geral de combustível dos geradores e trocar o medidor de vazão existente no interceptor terrestre.

➤ Estações Remotas

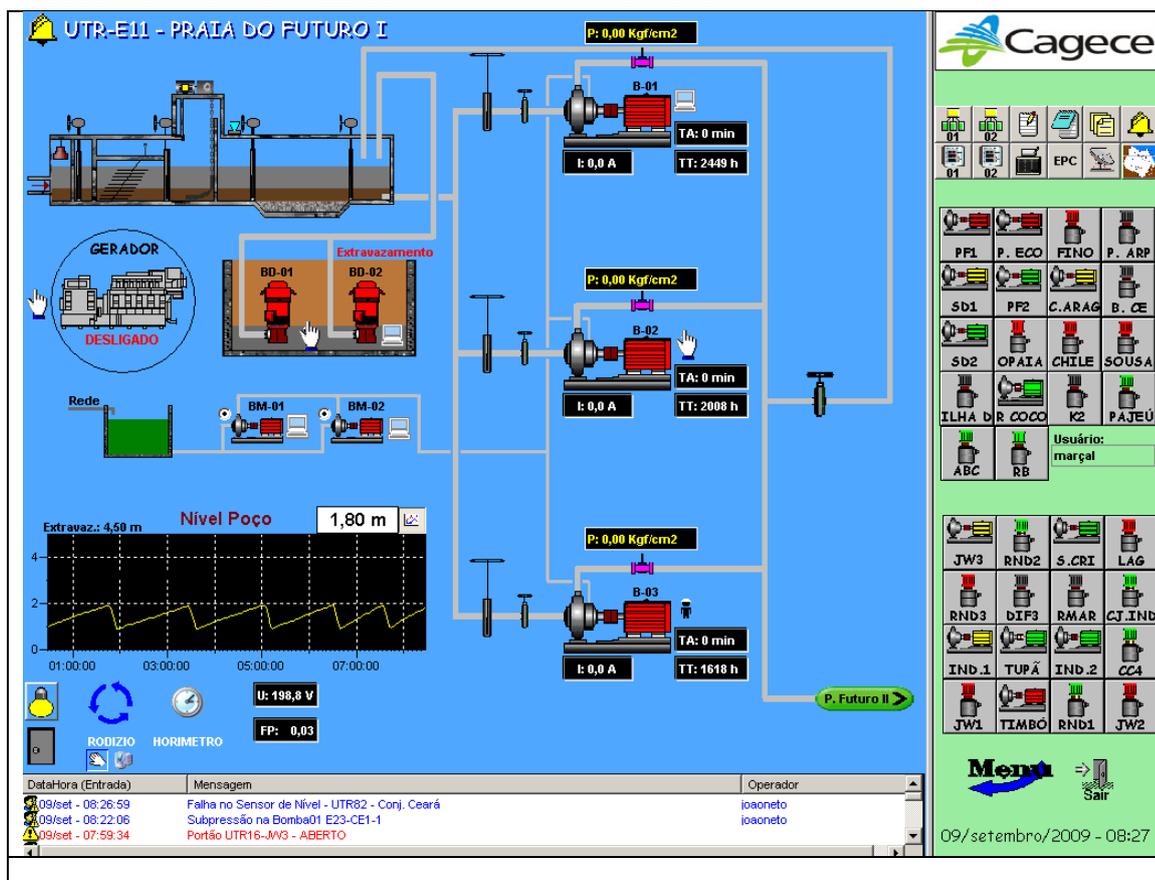
O sistema das remotas está dividido em dois tipos de protocolo, um que é proprietário da Rockwell Automation (DF-1), e outro que é protocolo aberto (ModBus RTU).

O sistema que é composto pelos equipamentos da Rockwell foram os primeiros a serem instalados (1998), a Gemea vem tentando licitar um contrato de manutenção destes equipamentos e atualmente estamos sem reserva. Outras desvantagens deste sistema é a questão da velocidade (max. 19.2 Kbps) e a integração com outros equipamentos torna-se difícil e de custo elevado, pois é necessário instalar conversores, acessórios, etc, portanto sugerimos trocar estes CLPs, por outros que tem protocolos abertos ou similar a outra rede existente (Modbus RTU).

Estações com equipamentos Rockwell: EPC, EE-SD-1, EE-SD-2, Praia do Futuro I, Praia do Futuro II, Parque Ecológico, Finopan, EE-Pajeú, EE-Reversora do Coco, Parque Rio Branco, ABC, Chile, Capitão Aragão, Lagoa do Opaia, Sousa Pinto.

Diagnóstico destas estações:

UTR-11 PRAIA DO FUTURO I

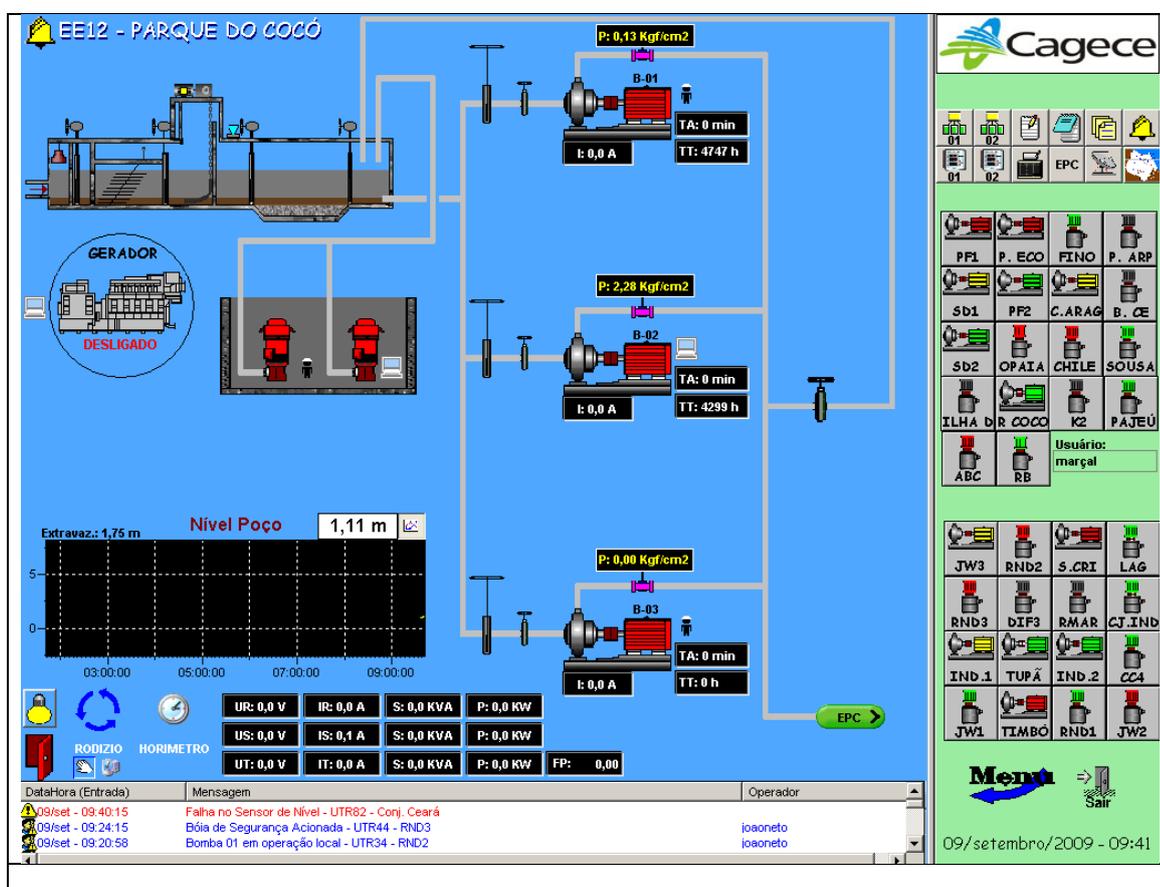


O sistema é composto de três bombas de recalque, duas bombas de drenagem, duas bombas para água de selagem (foram desativadas) e um gerador de energia elétrica.

Observamos que:

- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando.
- 2) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 3) Algumas bombas estão sem indicação e outras com indicações erradas de tensão, corrente e fator de potência.
- 4) Gerador está sem monitoramento remoto.
- 5) Rodízio automático das bombas não funciona.
- 6) Quando a bomba 3 da Praia do futuro II quando ligada esta sinalizando que a bomba 3 Praia do Futuro I foi acionada.
- 7) Existem desenho sinalizando uma lâmpada em que os operadores não sabem do que se trata.
- 8) Poço das bombas de dreno esta sinalizando extravasamento constantemente.

UTR-12 PARQUE ECOLÓGICO

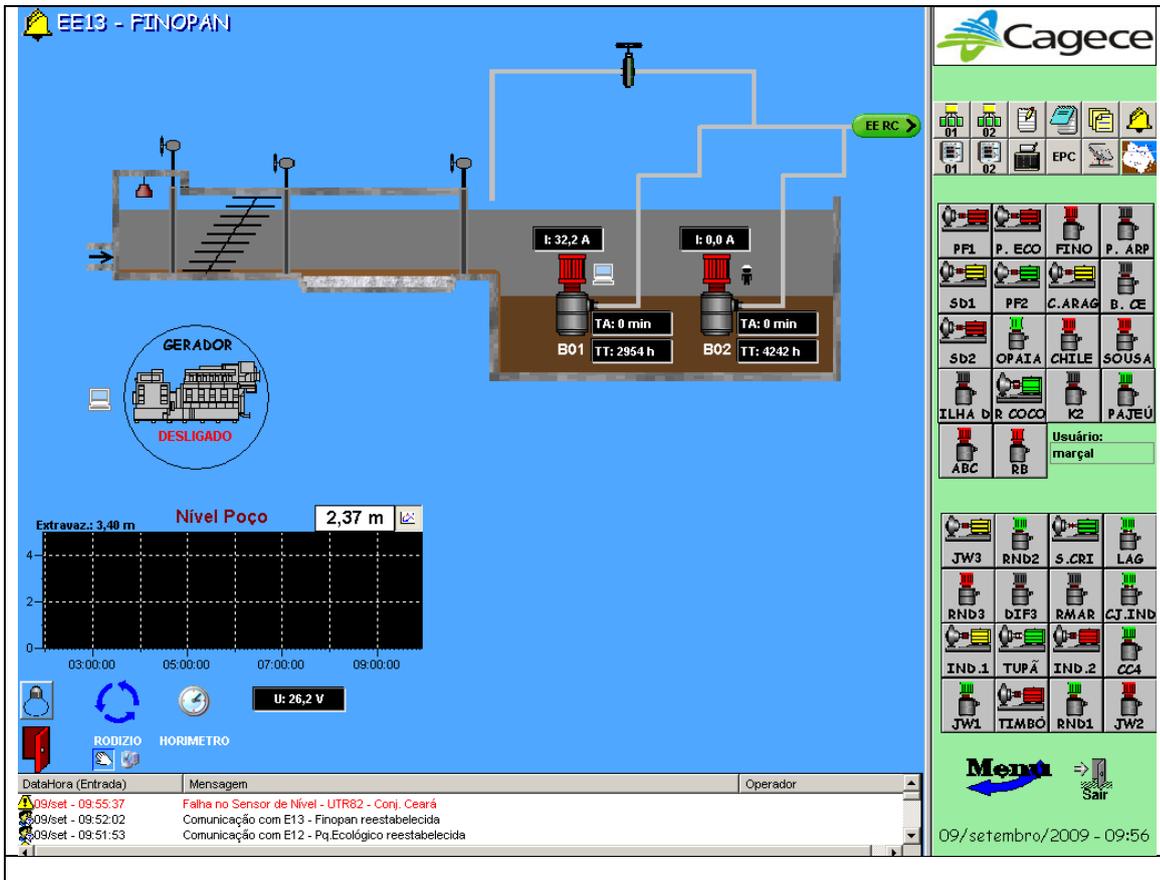


O sistema é composto de três bombas de recalque, duas bombas de drenagem.

Observamos que:

- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente.
- 2) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 3) Algumas bombas estão sem indicação e outras com indicações erradas de tensão, corrente, fator de potência, potencia ativa.
- 4) Gerador não esta integrado a automação.
- 5) Rodízio automático das bombas não funciona.
- 6) O Gráfico do nível do poço não esta aparecendo, embora a indicação do nível esteja sendo mostrada.
- 7) Sensores de fim de curso das portas estão com defeito.

UTR-13 FINOPAN



O sistema é composto de apenas duas bombas de recalque.

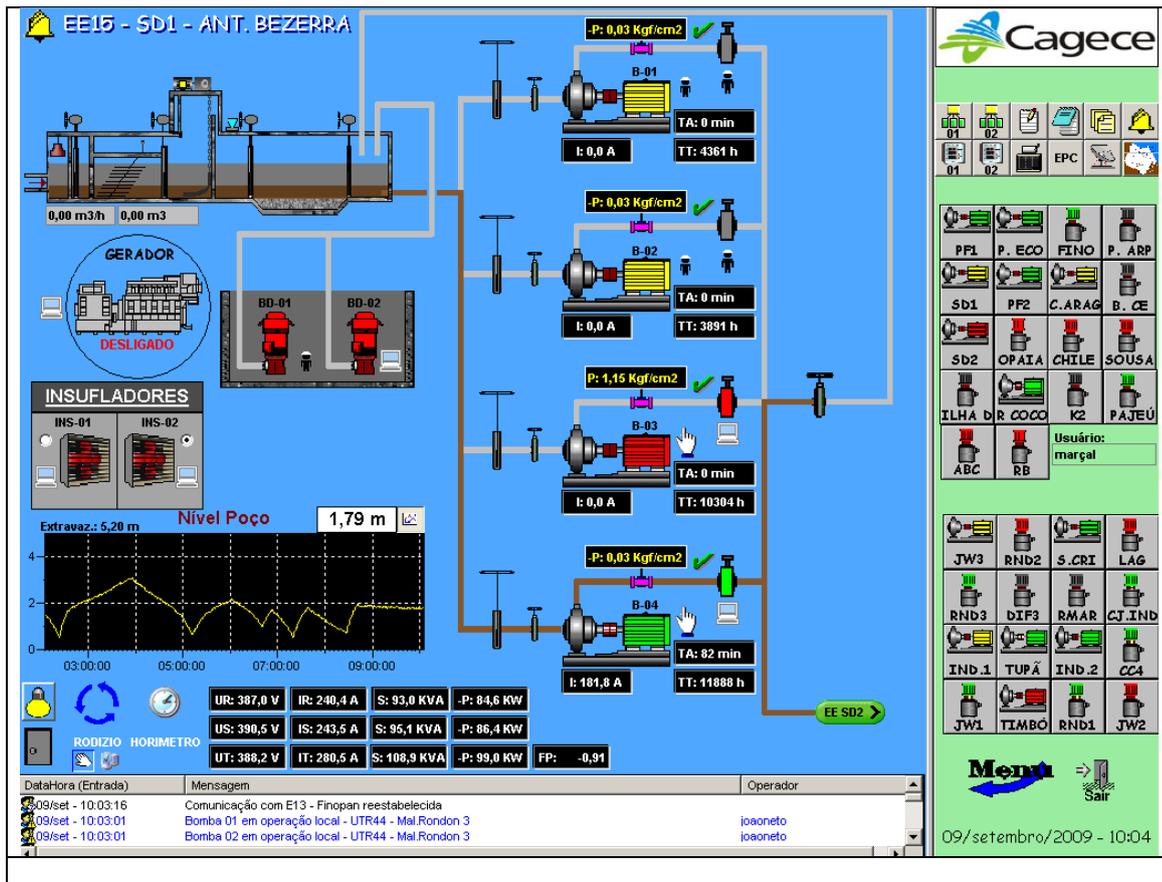
Observamos que:

- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) Algumas bombas estão com indicações erradas de tensão, corrente e fator de potência.
- 3) Rodízio automático das bombas não funciona.
- 4) O Gráfico do nível do poço não está aparecendo, embora a indicação do nível esteja sendo mostrada.
- 5) Sensores de fim de curso das portas estão com defeito.

UTR-14 P. Arpuador

Estação não integrada ao sistema de automação.

UTR-15 SD 1

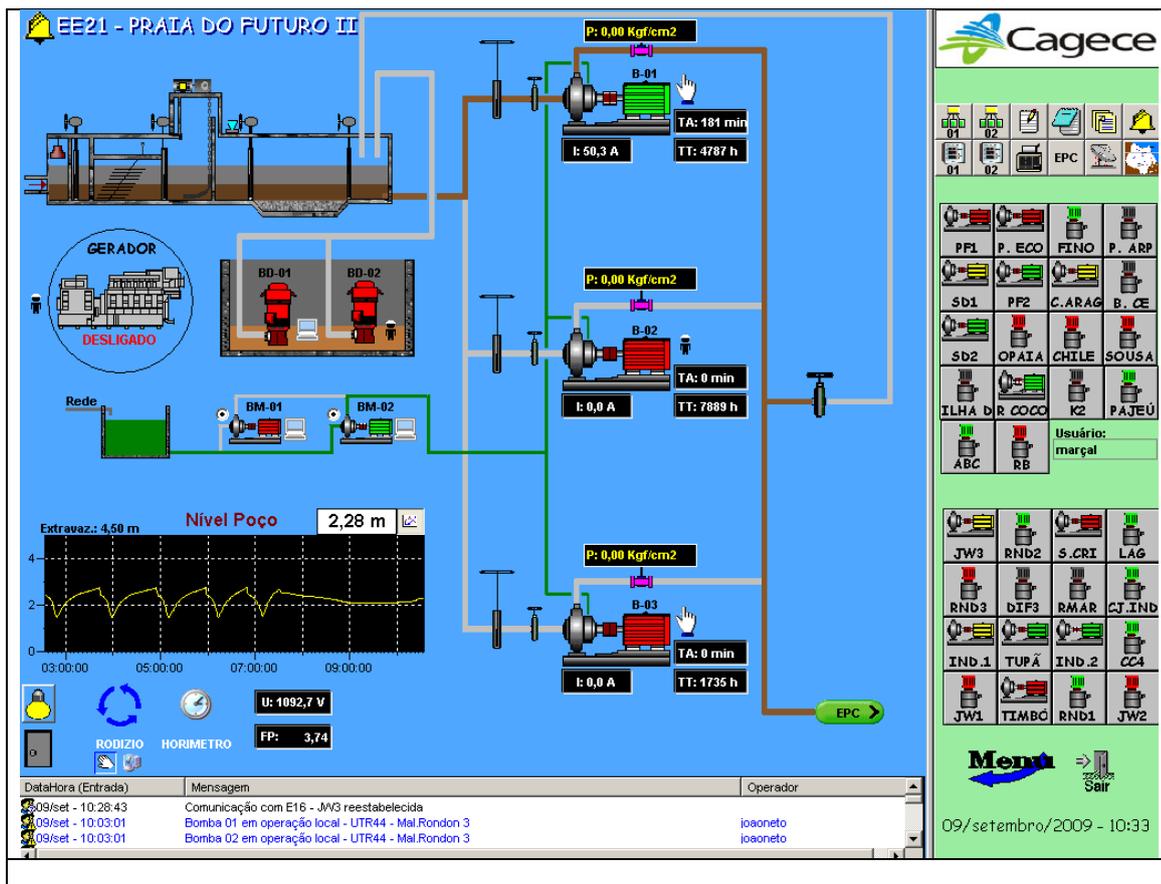


O sistema é composto de quatro bombas de recalque, duas bombas de drenagem, dois insufladores de ar e quatro registros automatizados na linha de recalque.

Observamos que:

- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) As bombas estão com indicações erradas de correntes, fator de potência e potência dos motores.
- 3) Rodízio automático das bombas não funciona.
- 4) Sensores de fim de curso das portas estão com defeito.
- 5) Medidores de pressão na linha de recalque das bombas não estão funcionando.

UTR-21 PRAIA DO FUTURO II

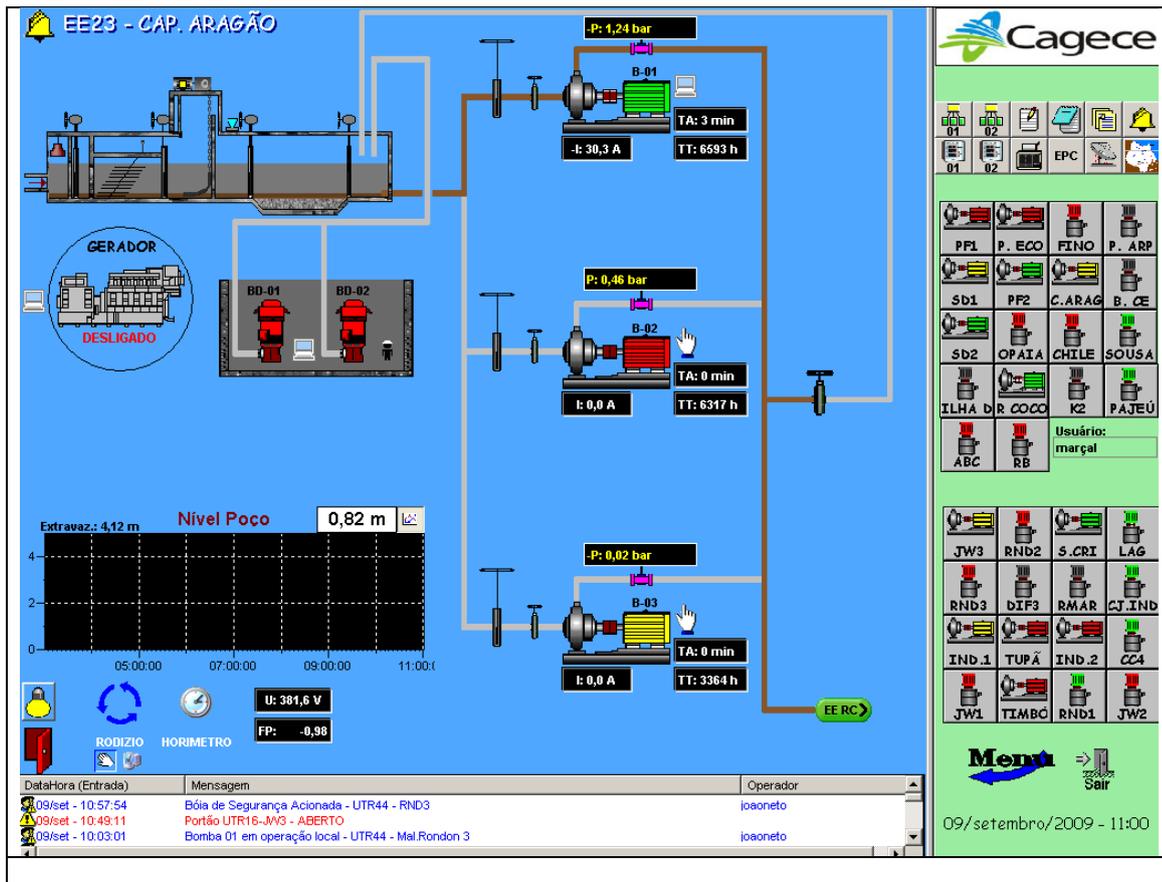


O sistema é composto de três bombas de recalque, duas bombas de drenagem, duas bombas para água de selagem (foram desativadas) e um gerador de energia elétrica.

Observamos que:

- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando.
- 2) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 3) Algumas bombas estão sem indicação e outras com indicações erradas de tensão, corrente e fator de potência.
- 4) Gerador está sem monitoramento remoto.
- 5) Rodízio automático das bombas não funcionam.
- 6) Quando a bomba 3 da Praia do futuro II é ligada esta sinalizando que a bomba 3 Praia do Futuro I foi acionada.

UTR-23 CAPITÃO ARAGÃO



O sistema é composto de três bombas de recalque, duas bombas de drenagem.

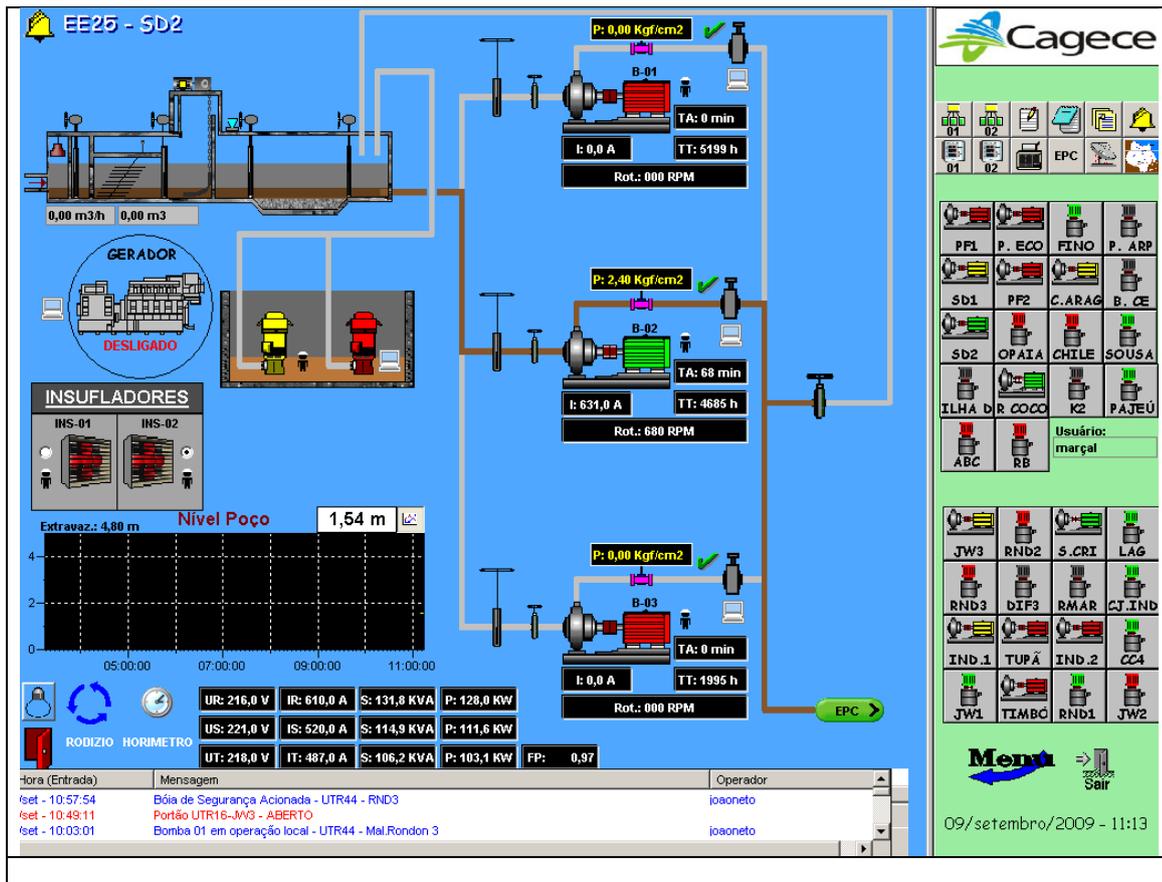
Observamos que:

- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente.
- 2) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 3) As bombas estão com indicações erradas de corrente e fator de potência.
- 4) Não existe Gerador na estação.
- 5) Rodízio automático das bombas não funcionam.
- 6) O Gráfico do nível do poço não esta aparecendo, embora a indicação do nível esteja sendo mostrada.
- 7) Sensores de fim de curso das portas estão com defeito.

UTR-24 BARRA DO CEARÁ

Estação não integrada ao sistema de automação.

UTR-25 SD 2

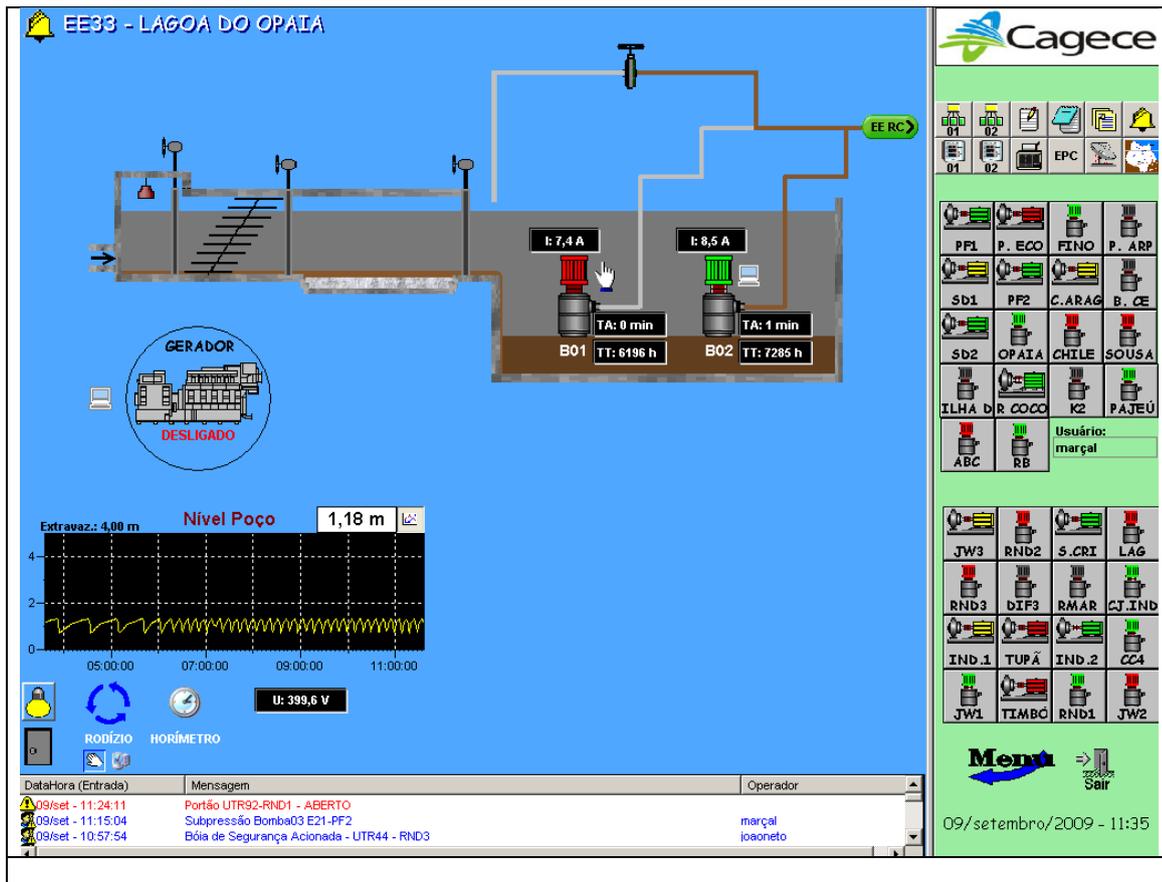


O sistema é composto de três bombas de recalque, duas bombas de drenagem, dois insufladores de ar e três registros automatizados na linha de recalque.

Observamos que:

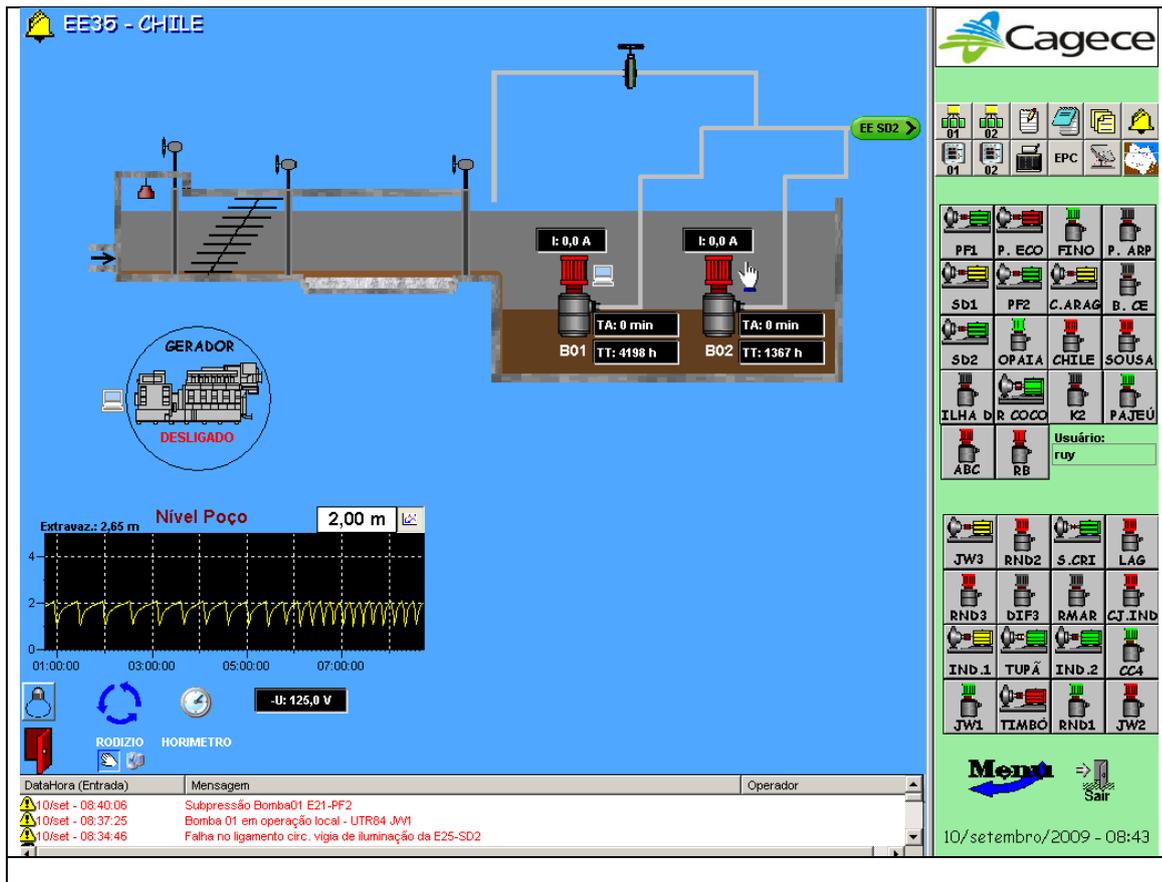
- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) As bombas estão com indicações erradas de correntes, fator de potência e potência dos motores.
- 3) Rodízio automático das bombas não funciona.
- 4) Sensores de fim de curso das portas estão com defeito.
- 5) Medidores de pressão na linha de recalque das bombas não estão funcionando corretamente.
- 6) O Gráfico do nível do poço não esta aparecendo, embora a indicação do nível esteja sendo mostrada.

UTR-33 LAGOA DO OPAIA



- O sistema é composto de apenas duas bombas de recalque. Observamos que:
- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
 - 2) As bombas estão com indicações erradas de tensão e corrente.
 - 3) Rodízio automático das bombas não funciona.

UTR-35 CHILE

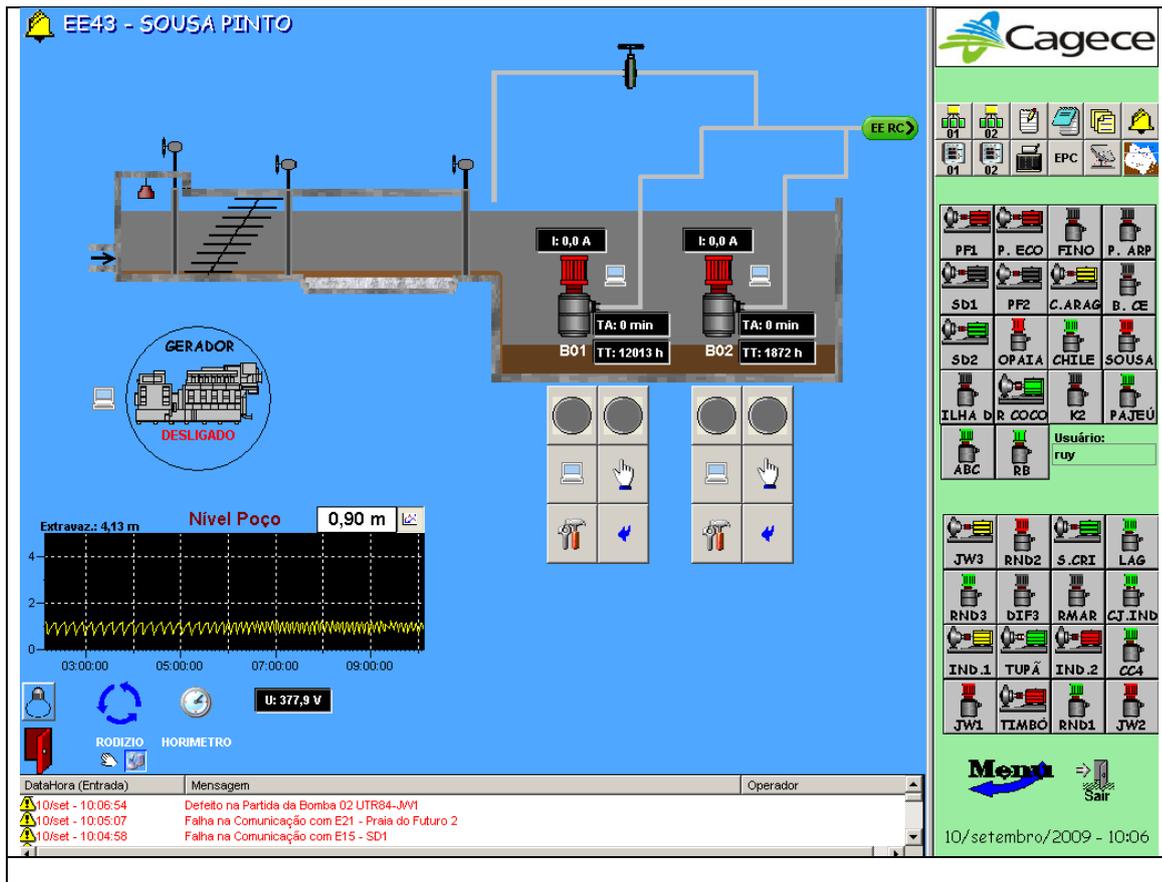


O sistema é composto de apenas duas bombas de recalque.

Observamos que:

- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) As bombas estão sem indicação de tensão, corrente e fator de potência.
- 3) Rodízio automático das bombas não funcionam.
- 4) Estação não possui fim de curso nas portas.
- 5) Estação sem gerador de energia.

UTR-43 SOUSA PINTO



O sistema é composto de apenas duas bombas de recalque.

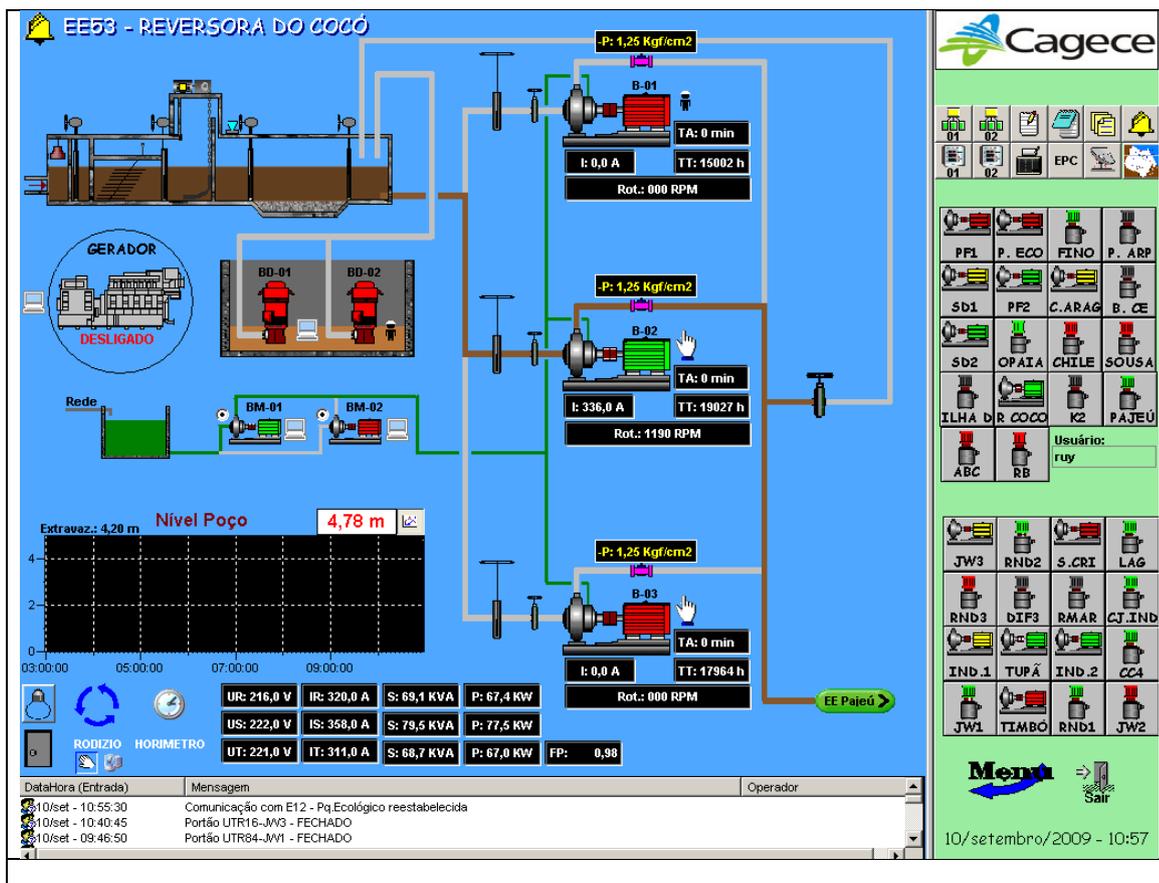
Observamos que:

- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) As bombas estão com indicação errada de tensão, correntes.
- 3) Rodízio automático das bombas não funcionam.
- 4) Estação não possui fim de curso nas portas.
- 5) Estação sem gerador de energia.

UTR-45 ILHA DOURADA

Estação não integrada ao sistema de automação.

UTR-53 REVERSORA DO COCÓ



O sistema é composto de três bombas de recalque, duas bombas de drenagem e duas bombas para água de selagem (desativada) .

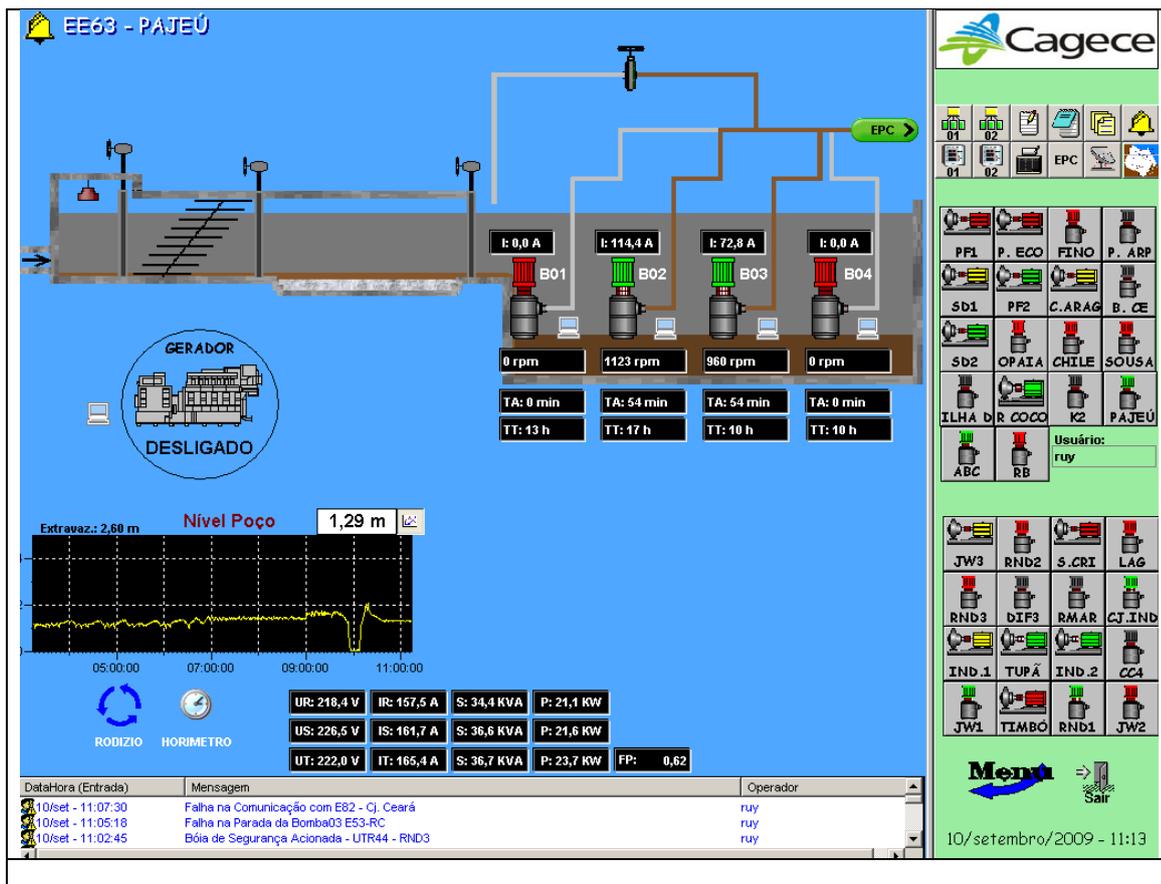
Observamos que:

- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente.
- 2) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 3) A lógica para operação automática das bombas não esta funcionando corretamente.
- 4) Não esta chamando a tela dos Geradores.
- 5) Rodízio automático das bombas não funcionam.
- 6) O Gráfico do nível do poço não esta aparecendo, embora a indicação do nível esteja sendo mostrada.
- 7) Sensores de fim de curso da porta do CCM na foram instalados na reforma da estação.
- 8) Bomba 03 sem indicação de corrente, RPM, e tempos de funcionamento.

UTR-55 K2

Estação não integrada ao sistema de automação.

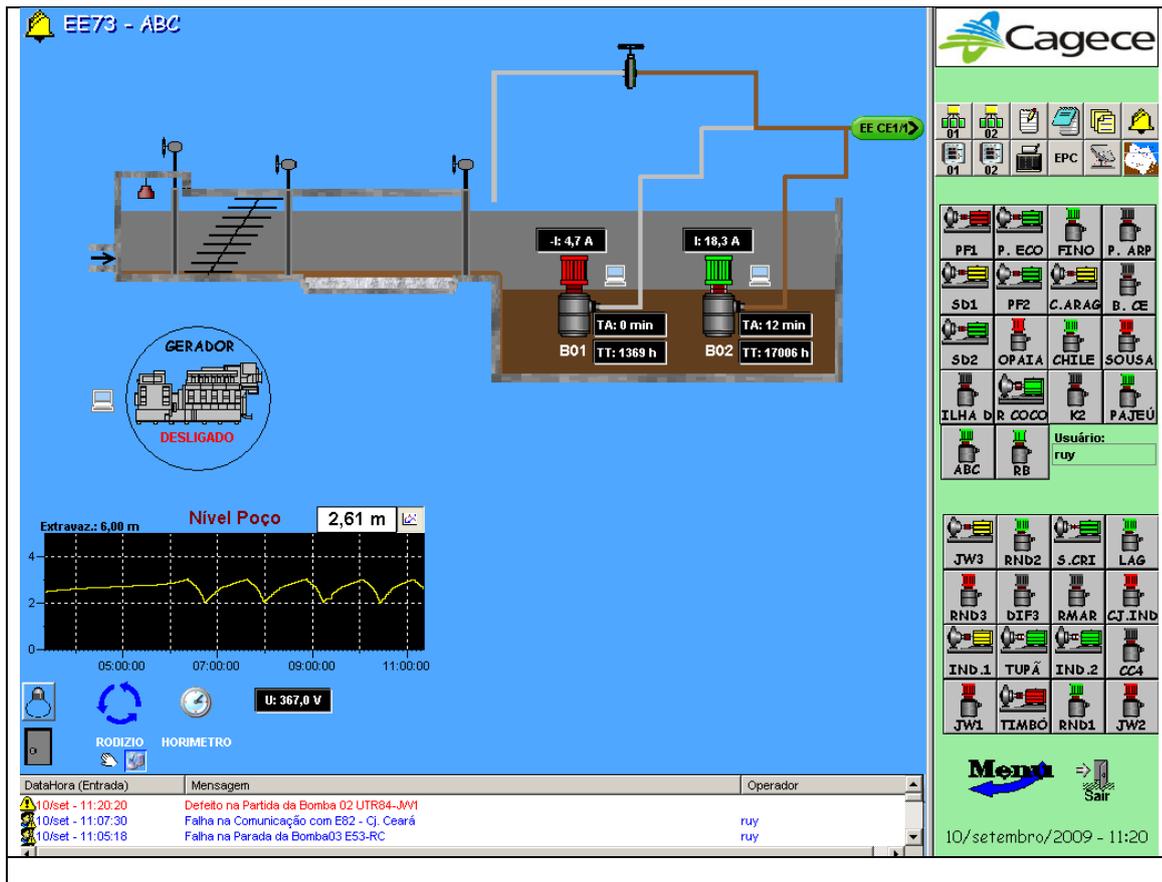
UTR-63 PAJEÚ



O sistema é composto de quatro bombas de recalque e um gerador de energia elétrica. Observamos que:

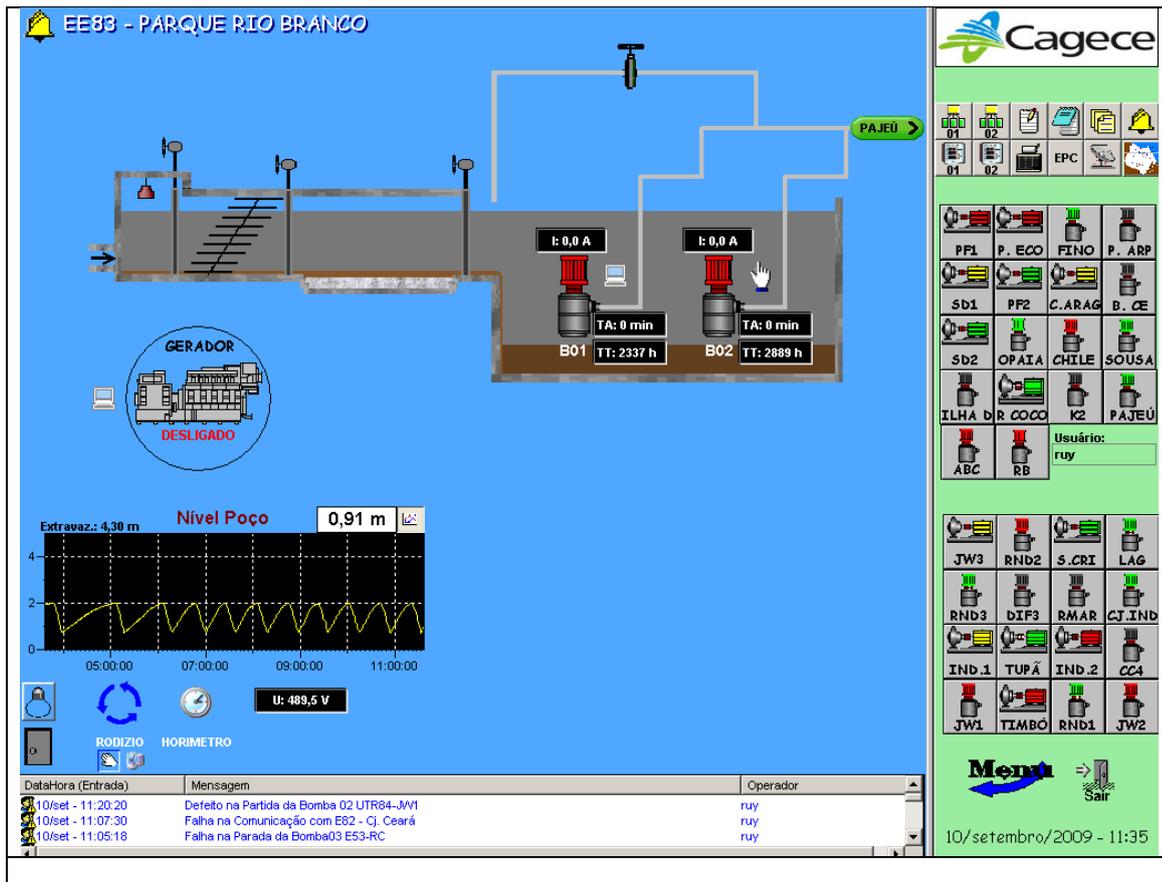
- 1) A estação está recebendo duas obras, sendo, a troca do quadro de comando das bombas e instalação de um grupo gerador.
- 2) Atualmente a estação está em fase de teste de operação do quadro de comando e posteriormente será integrado ao sistema o grupo gerador.

UTR-73 ABC



- O sistema é composto de apenas duas bombas de recalque. Observamos que:
- 1) Os tempos de funcionamento das bombas não estão sendo totalizados.
 - 2) Rodízio automático não funciona corretamente.
 - 3) Estação não possui fim de curso nas portas.
 - 4) Estação sem gerador de energia.

UTR-83 Parque Rio Branco



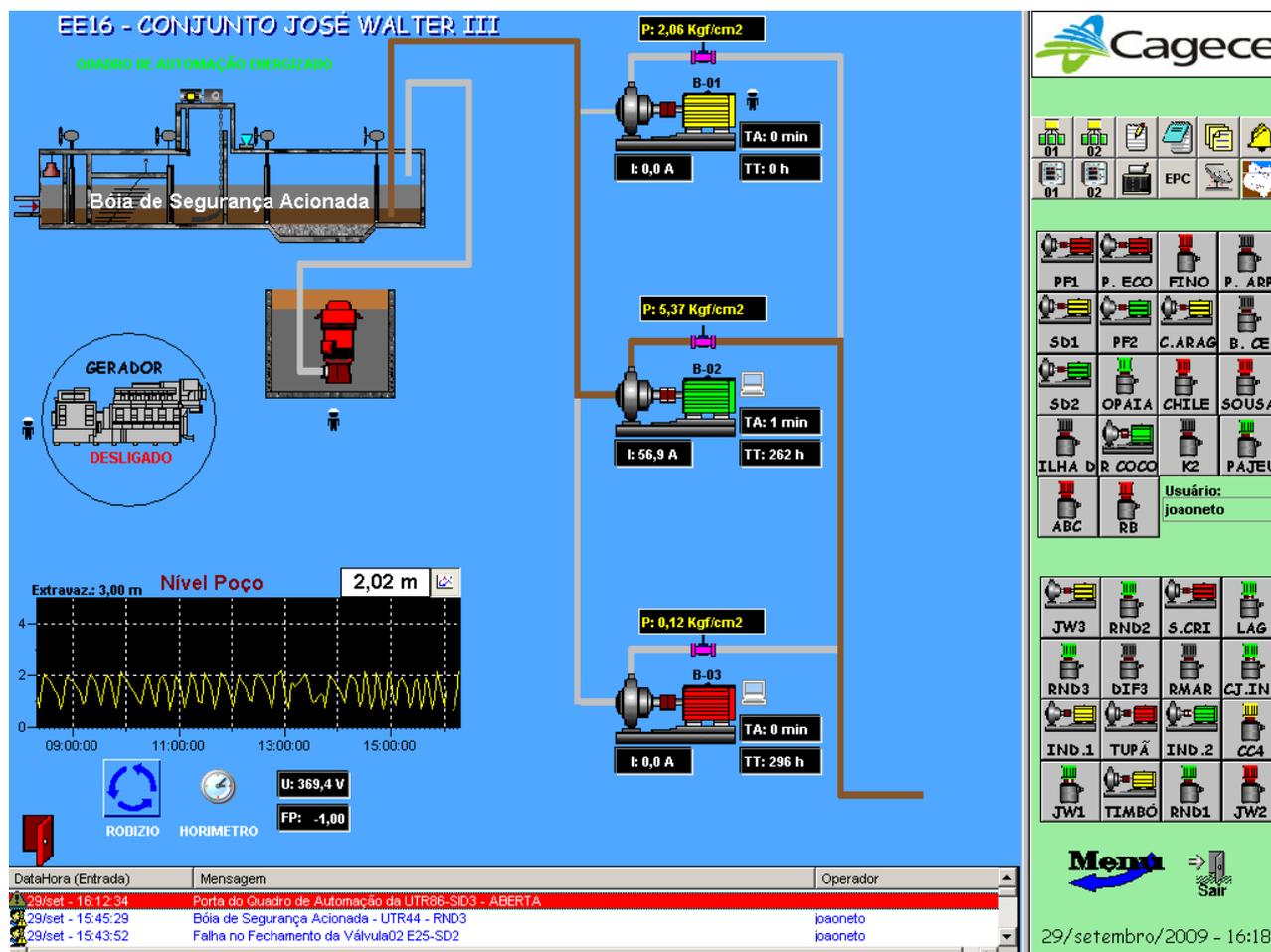
O sistema é composto de apenas duas bombas de recalque.

Observamos que:

- 1) Os tempos de funcionamento das bombas não estão sendo totalizados;
- 2) Rodízio automático não funciona corretamente.
- 3) Estação não possui fim de curso nas portas.
- 4) Estação sem gerador de energia.

Estações com equipamentos CLPs Siemens: Conjuntos José Walter I, II e III, Marechal Rondon I, II e III, São Cristovão, Conjunto Lagamar, Distrito Industrial I, II e III(Timbó), Tupã Mirim, Romeu Martins, Conjunto Ceará 4ª etapa, Conjunto industrial e DIF 3.

UTR-16 CONJUNTO JOSÉ WALTER 3



- 1) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente.
- 2) Os sensores de fator de potência não estão funcionando.
- 3) Animação *portão aberto/fechado* não funciona
- 4) Erro na animação do poço de sucção: indicação "BÓIA DE SEGURANÇA ACIONADA" é mostrada sempre.
- 5) Bomba de dreno indicando extravasamento, animação com erro.

UTR-34 MARECHAL RONDON II

EE34 - MARECHAL RONDON II
QUADRO DE AUTOMAÇÃO ENERGIZADO

GERADOR

DESLIGADO

B01

I: 0.0 A
TA: 0 min
TT: 2949 h

B02

I: 0.0 A
TA: 0 min
TT: 4773 h

Nível Poço 1,99 m

Extravaz.: 3,00 m

RODIZIO

HORIMETRO

U: 0,0 V

FP: 0,07

01 02 01 02

EPC

PF1	P. ECO	FINO	P. ARP
SD1	PF2	C. ARAG	B. CE
SD2	OPAIA	CHILE	SOUSA
ILHA D	R. COCO	K2	PAJEÚ
ABC	RB	Usuário: joaneto	

JW3	RND2	S. CRI	LAG
RND3	DIF3	RMAR	CJ. IND
IND.1	TUPÁ	IND.2	CC4
JW1	TIAMBÓ	RND1	JW2

Menú → Sair

29/ setembro/2009 - 16:32

- Indicações de corrente das bombas, tensão do barramento e fator de potência estão erradas.

UTR-37 SÃO CRISTOVÃO

EE37 - SÃO CRISTOVÃO
QUADRO DE AUTOMAÇÃO ENERGIZADO

Vazão
-143,57 m³/h

Vol. Acum.
423490158,0 m³

GERADOR
DESLIGADO

Nível Poço
0,83 m

Status e Comando das Duas Bombas

B-01
TA: 0 min
TT: 99 h
I: 0,0 A

B-02
TA: 6 min
TT: 904 h
I: 23,1 A

Extravaz.: 3,00 m

U: 370,7 V

RODIZIO **HORIMETRO**

Usuário: joaneto

Menu **Sair**

29/setembro/2009 - 16:50

DataHora (Entrada)	Mensagem	Operador
29/set - 16:38:19	Bóia de Segurança Acionada - UTR44 - RND3	joaneto
29/set - 16:26:54	Portão UTR16-JW3 - FECHADO	
29/set - 16:24:51	Porta do Quadro de Automação da UTR16-JW3 - FECHADA	

- 1) Indicações de vazão e volume não funcionam corretamente.
- 2) Bomba de dreno com erro de animação.

UTR-42 CONJUNTO LAGAMAR

EE42 - CONJUNTO LAGAMAR
QUADRO DE AUTOMAÇÃO ENERGIZADO

GERADOR
DESLIGADO

Nível Poço 1,18 m

Extravaz.: 3,00 m

U: 25,3 V
FP: 1,00

RODIZIO HORIMETRO

DataHora (Entrada)	Mensagem	Operador
29/set - 16:57:46	Subpressão Bomba01 E21-PF2	
29/set - 16:52:27	Comunicação com E25 - SD2 reestabelecida	
29/set - 16:38:19	Bóia de Segurança Acionada - UTR44 - RND3	joaneto

Cagece

01 02 EPC

PF1 P. ECO FINO P. ARP
 Sb1 PF2 C.ARAG B. CE
 Sb2 OPA1A CHILE SOUSA
 ILHA d R COCCO K2 PAJEU
 ABC RB

Usuário: joaneto

JW3 RND2 S.CRI LAG
 RND3 DIF3 RMAR CJ.IND
 IND.1 TUPÁ IND.2 CC4
 JW1 TIMBÓ RND1 JW2

Ment Sair

29/setembro/2009 - 16:58

1) Indicações de corrente das bombas e tensão do barramento não funcionam corretamente.

UTR-44 MARECHAL RONDON III

EE44 - MARECHAL RONDON III

QUADRO DE AUTOMAÇÃO ENERGIZADO

Bóia de Segurança Acionada

GERADOR
DESLIGADO

Extravaz.: 3,00 m

Nível Poço

0,86 m

U: 386,9 V

RODIZIO

HORIMETRO

Data/Hora (Entrada)	Mensagem	Operador
29/set - 17:06:55	Comunicação com E12 - Pq.Ecológico reestabelecida	
29/set - 17:01:35	Comunicação com E86 - Timbó reestabelecida	
29/set - 16:57:46	Subpressão Bomba01 E21-PF2	joaneto

01 02

01 02 EPC

PF1	P. ECO	FINO	P. ARP
Sb1	PF2	C. ARAG	B. CE
Sb2	OPAIA	CHILE	SOUSA
ILHA d	R. COCO	K2	PAJEU
ABC	RB	Usuário: joaneto	

JW3	RND2	S. CRI	LAG
RND3	DIF3	RMAR	CJ.IND
IND.1	TUPÁ	IND.2	CC4
JW1	TIMBÓ	RND1	JW2

Mentá → Sair

29/setembro/2009 - 17:11

1) Funcionamento normal.

UTR-46 DISTRITO INDUSTRIAL III

EE46 - DISTRITO INDUSTRIAL III

GERADOR
DESLIGADO

Extravaz.: 3,00 m **Nível Poco** NULL

11:00:00 13:00:00 15:00:00 17:00:00

RODIZIO HORIMETRO NULL NULL

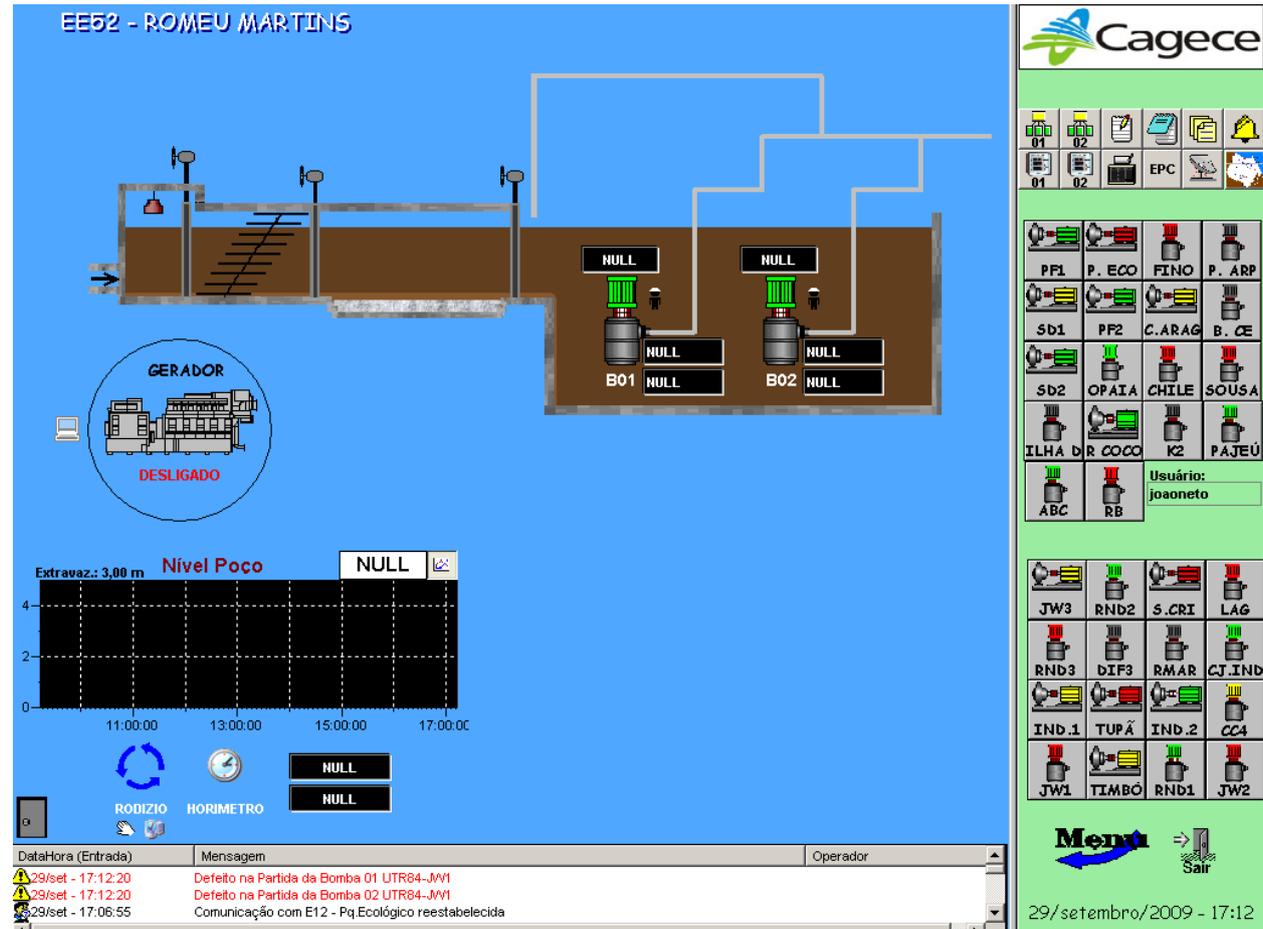
DataHora (Entrada)	Mensagem	Operador
29/set - 17:06:55	Comunicação com E12 - Pq.Ecológico reestabelecida	
29/set - 17:01:35	Comunicação com E86 - Timbó reestabelecida	
29/set - 16:57:46	Subpressão Bomba01 E21-PF2	joaoneto

Menu Sair

29/setembro/2009 - 17:12

- 1) DESABILITADA

UTR-52 ROMEU MARTINS



-
- 1) DESABILITADA. Ver animação das bombas que indicam estarem ligadas.
- 2) A UTR esta montada na GEMEA, mas não existe uma condição segura para sua instalação. Também será necessário fazer algumas alterações e adaptações no quadros das bombas para a integração.
-

UTR-56 CONJ. INDUSTRIAL

EE56 - CONJUNTO INDUSTRIAL
QUADRO DE AUTOMAÇÃO ENERGIZADO

GERADOR
DESLIGADO

Nível Poço 1,18 m
Extravaz.: 3,00 m

U: 379,1 V

RODIZIO HORIMETRO

DataHora (Entrada)	Mensagem	Operador
29/set - 17:12:20	Defeito na Partida da Bomba 01 UTR84-JW1	
29/set - 17:12:20	Defeito na Partida da Bomba 02 UTR84-JW1	
29/set - 17:06:55	Comunicação com E12 - Pq.Ecológico reestabelecida	

Cagece

01 02 EPC

PF1 P. ECO FINO P. ARP
Sb1 PF2 C.ARAG B. CE
Sb2 OPAIA CHILE SOUSA
ILHA D R COCO K2 PAJEU
ABC RB Usuário: joaoneto

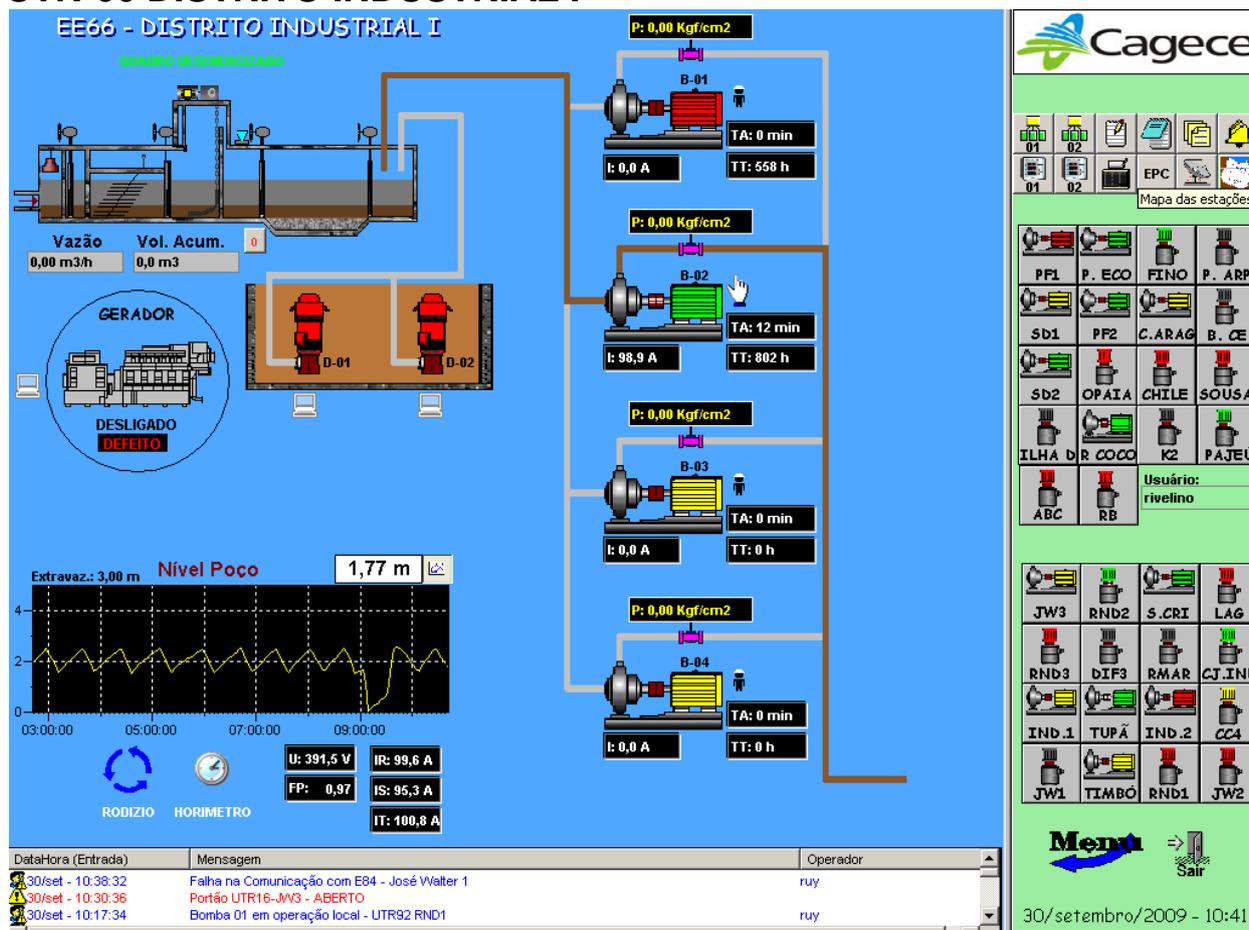
JW3 RND2 S.CRI LAG
RND3 DIF3 RMAR CJ.IND
IND.1 TUPÁ IND.2 CC4
JW1 TIMBO RND1 JW2

Menu Sair

29/setembro/2009 - 17:12

-
- 1) Indicações de corrente das bombas não funcionam corretamente.

UTR-66 DISTRITO INDUSTRIAL I



- 1) Indicações de vazão e volume não funcionam corretamente.
- 2) Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente.
- 3) A operação manual de liga/desliga funciona com bastante lentidão, e a partir da repetição do comando.
- 4) Erro na animação do poço de sucção: indicação “QUADRO DESENERGIZADO” é mostrada sempre.
- 5) Bomba de dreno sem comando remoto.
- 6) Mesmo em comando remoto manual, a bomba liga automaticamente.

UTR-74 TUPÃ MIRIM

EE74 - TUPÃ MIRIM
 QUADRO DE AUTOMAÇÃO ENERGIZADO

GERADOR
 DESLEGADO

LIGA 9 h
 DESL 21 h

Aeradores
 A-01 A-02 A-03 A-04

Extravaz.: 3,00 m
Nível Poço 1,46 m

03:00:00 05:00:00 07:00:00 09:00:00

U: 358,8 V

RODIZIO HORIMETRO

B-01
 I: 0,0 A TA: 0 min TT: 15491 h

B-02
 I: 0,0 A TA: 0 min TT: 3183 h

Cagece

01 02 01 02 EPC

P.F1 P. ECO F.I.N.O P. ARP
 S.B1 P.F2 C.A.R.A.G B. CE
 S.B2 O.P.A.I.A C.H.I.L.E S.O.U.S.A
 I.L.H.A D. R. C.O.C.C.O K2 P.A.J.E.U
 ABC RB Usuário: rivellino

J.W.3 R.N.D.2 S.C.R.I L.A.G
 R.N.D.3 D.I.F.3 R.M.A.R C.T.I.N.D
 I.N.D.1 T.U.P.Á I.N.D.2 C.C.4
 J.W.1 T.I.M.B.Ó R.N.D.1 J.W.2

Ment Sair

DataHora (Entrada)	Mensagem	Operador
30/set - 10:38:32	Falha na Comunicação com E84 - José Walter 1	ruy
30/set - 10:30:36	Portão UTR16-JW3 - ABERTO	ruy
30/set - 10:16:11	Subpressão Bomba02 E25-SD2	ruy

30/setembro/2009 - 10:48

- Defeito na animação da bomba de dreno.

UTR-76 DISTRITO INDUSTRIAL II

EE76 - DISTRITO INDUSTRIAL II

QUADRO DE AUTOMAÇÃO ENERGIZADO

Vazão
-1404,40
m3/h

Vol. Acum.
429489747,8
m3

GERADOR
DESLIGADO

Nível Poço
Extravaz.: 3,00 m
2,27 m

U: 372,3 V
FP: -0,84

RODIZIO **HORIMETRO**

01 02

01 02

EPC

PFL P. ECO FINO P. ARP

Sb1 PF2 C. ARAG B. CE

Sb2 OPAIA CHILE SOUSA

ILHA d R COCO K2 PAJEÚ

ABC RB

Usuário:
rivellino

JW3 RND2 S. CRI LAG

RND3 DIF3 RMAR CJ_IND

IND.1 TUPÁ IND.2 CC4

JW1 TIMBO RND1 JW2

Ment

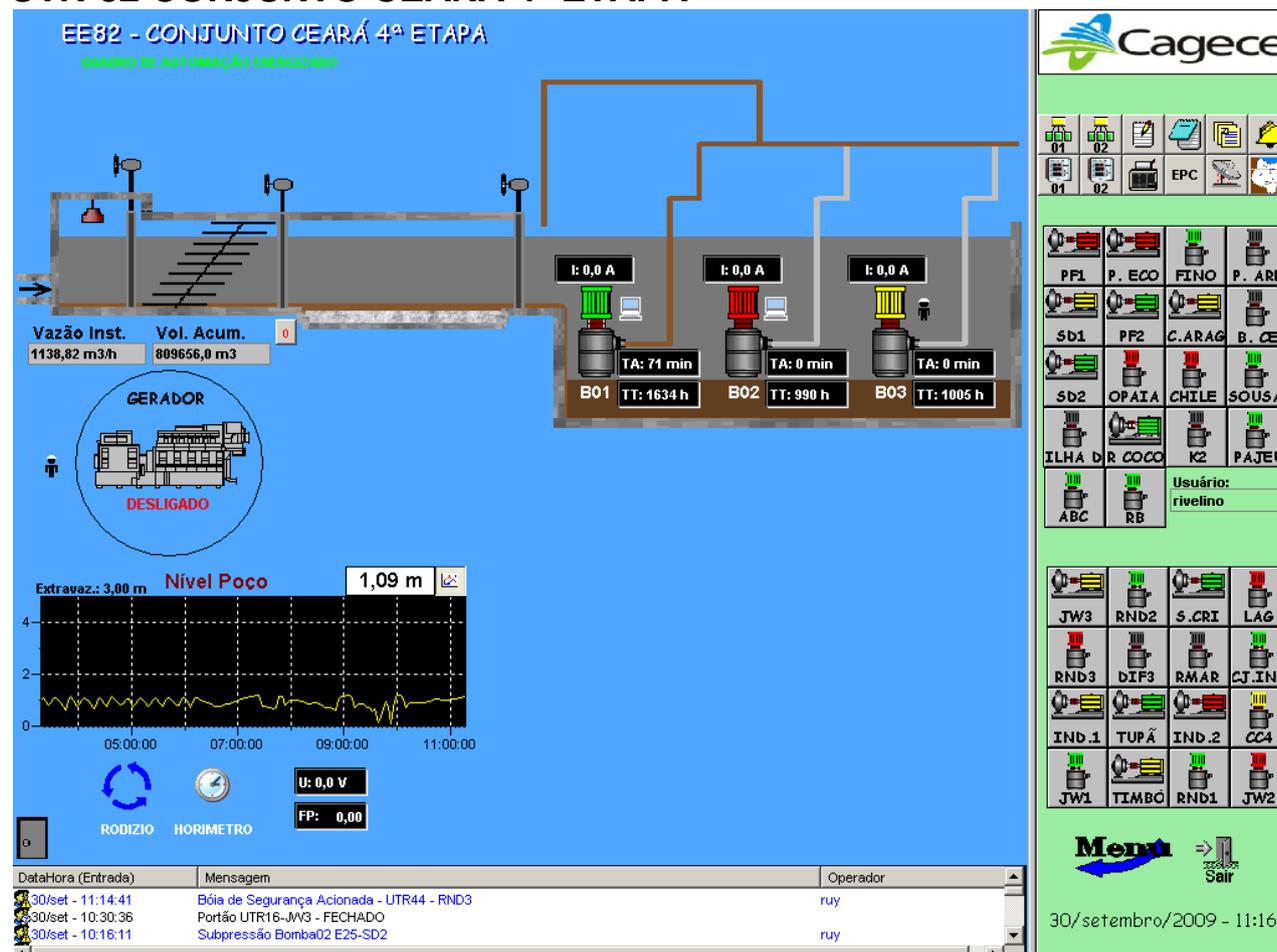
Sair

30/setembro/2009 - 11:08

Data/Hora (Entrada)	Mensagem	Operador
30/set - 10:30:36	Portão UTR16-JW3 - FECHADO	
30/set - 10:16:11	Subpressão Bomba02 E25-SD2	ruy
30/set - 10:00:41	Defeito na Bomba 03 da UTR82 - Conj.Ceará	ruy

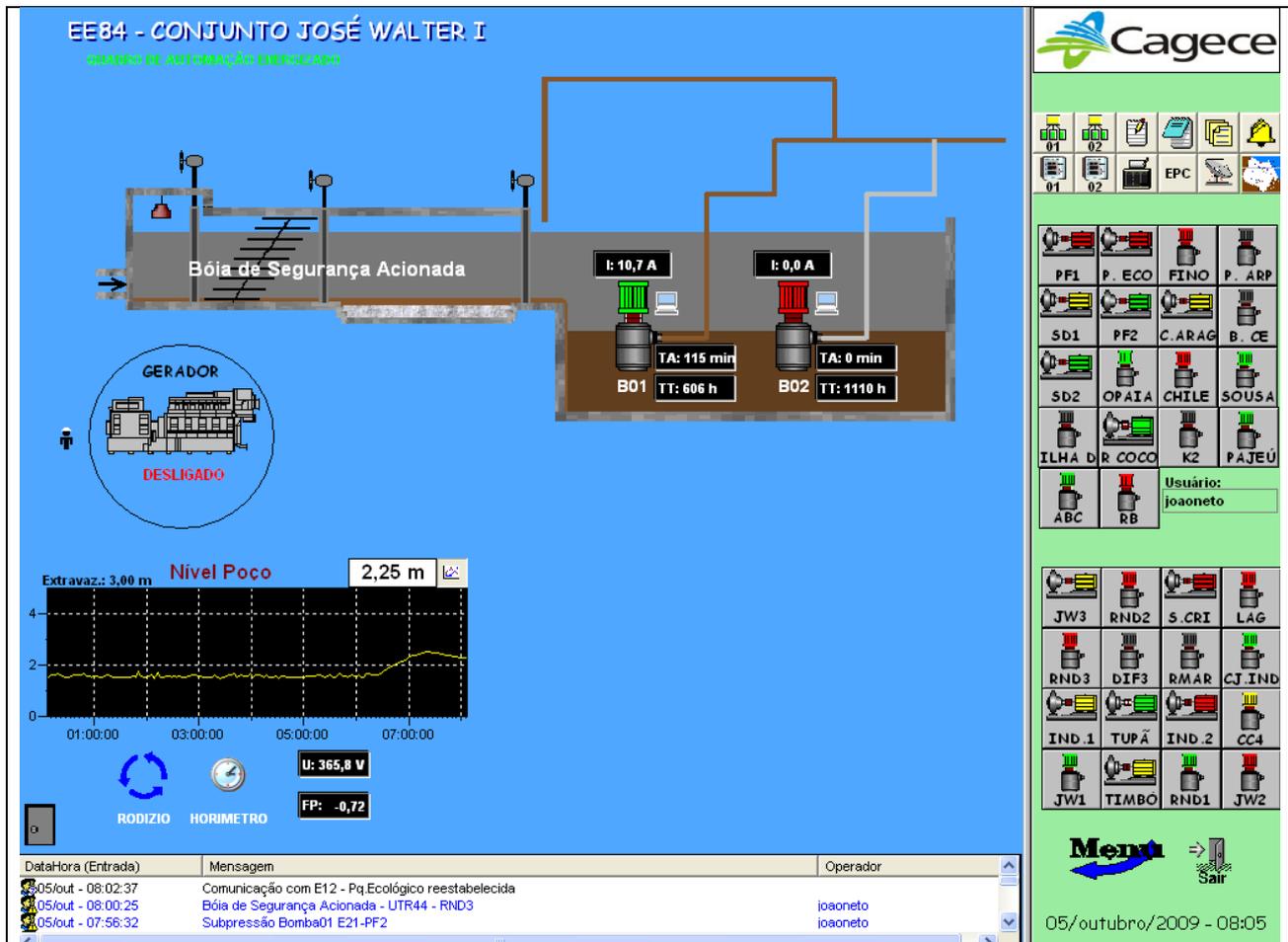
- 1) Indicações de corrente, pressão das bombas e fator de potência não funcionam corretamente.
- 2) Indicações de vazão e volume não funcionam corretamente.
- 3) Defeito na animação da bomba de dreno.

UTR-82 CONJUNTO CEARÁ 4º ETAPA



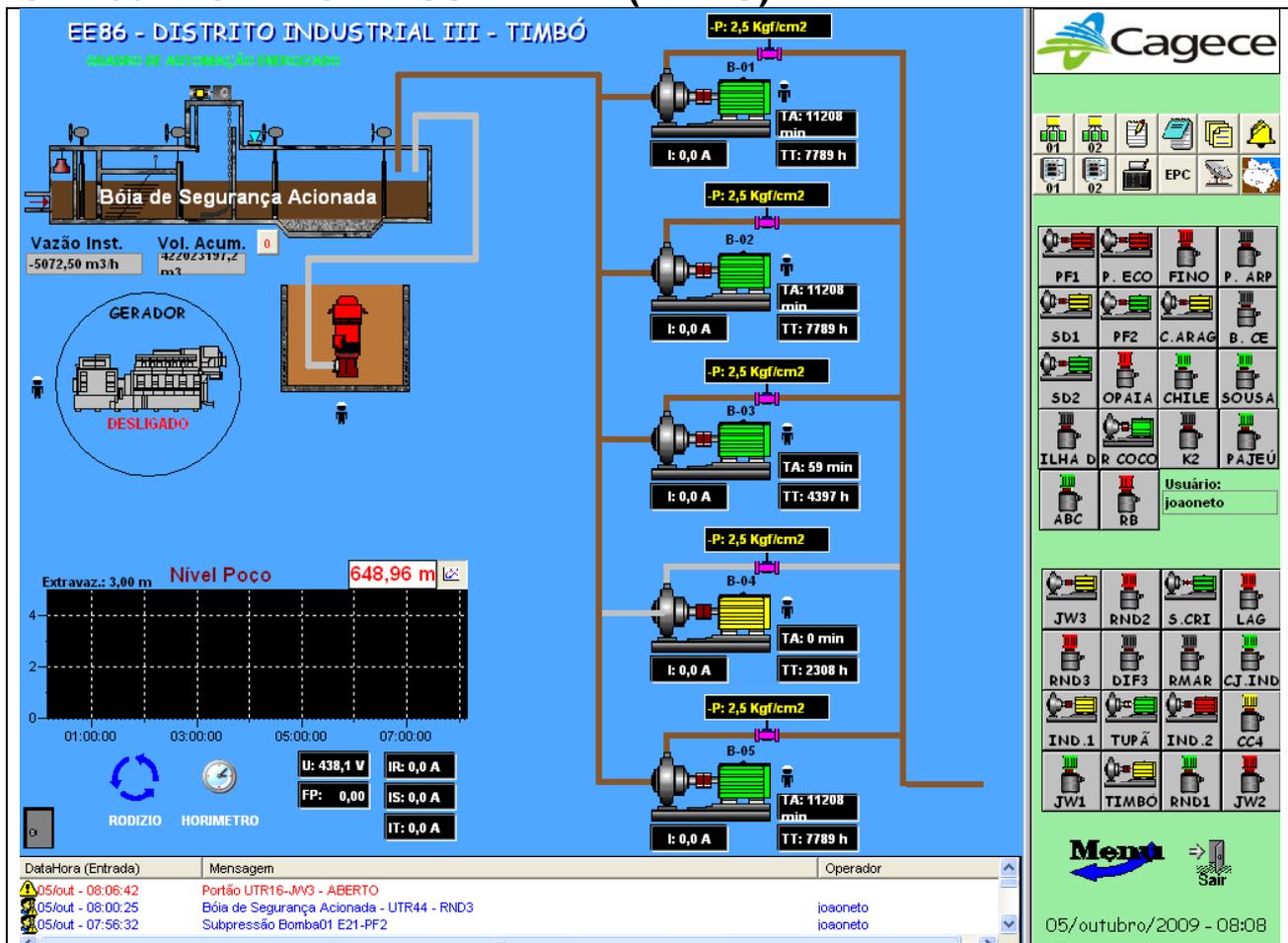
- Indicações de vazão e volume não funcionam corretamente.
 - Indicações de corrente das bombas, tensão do barramento e fator de potência não funcionam corretamente.
- 3) Setpoints dos níveis mudam para zero indevidamente. Mas o rodízio automático continua sendo feito.

UTR-84 CONJUNTO JOSE WALTER I



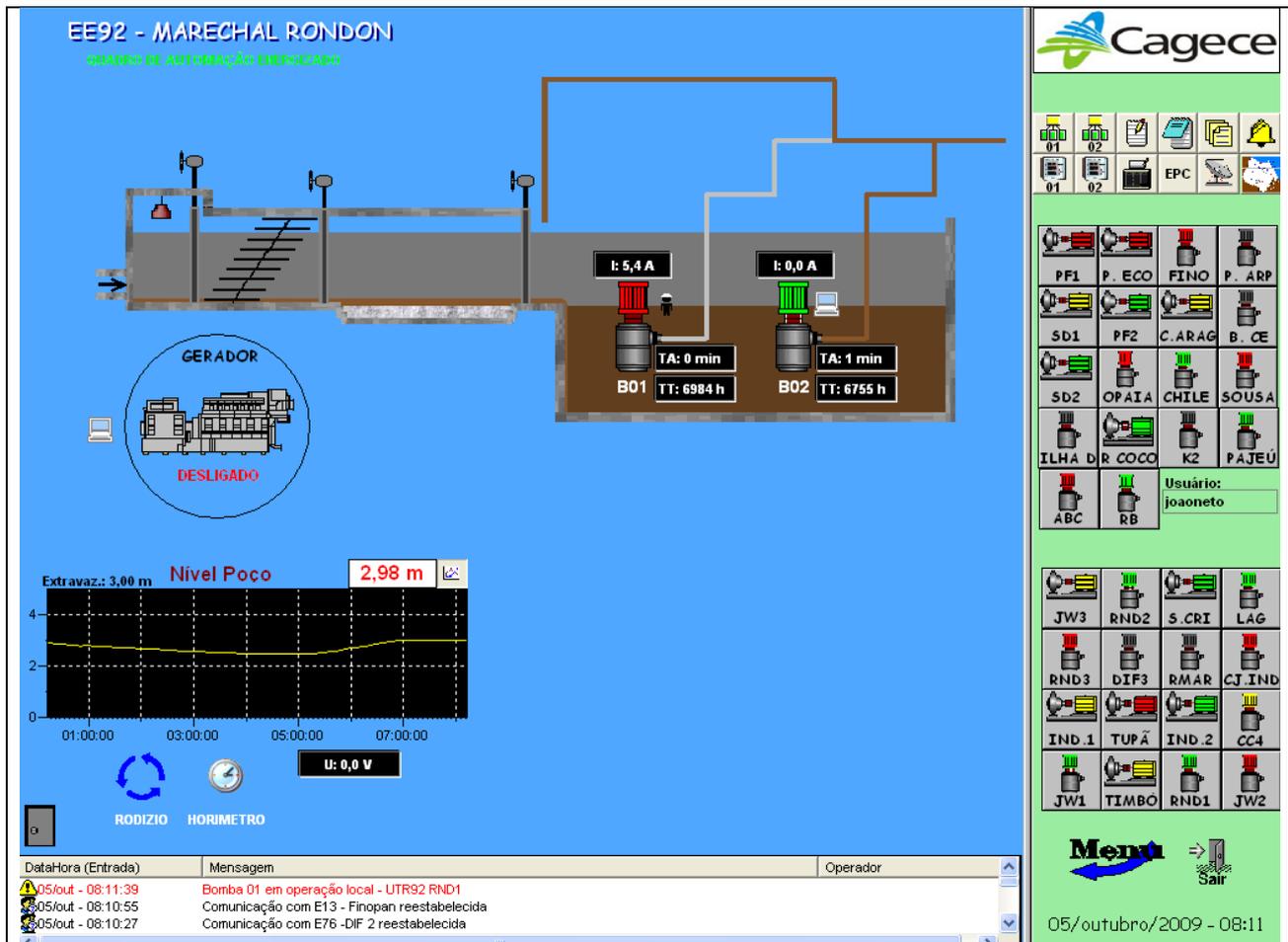
- Consulta de setpoints no histórico com defeito.
- 2) Setpoints dos níveis mudam para zero indevidamente. Mas o rodízio automático continua sendo feito.
- Erro na animação do poço de sucção: indicação “BÓIA DE SEGURANÇA ACIONADA” é mostrada sempre.
- A bóia de segurança esta acionada, mas não esta bloqueando o acionamento das bombas.

UTR-86 DISTRITO INDUSTRIAL III (TIMBÓ)



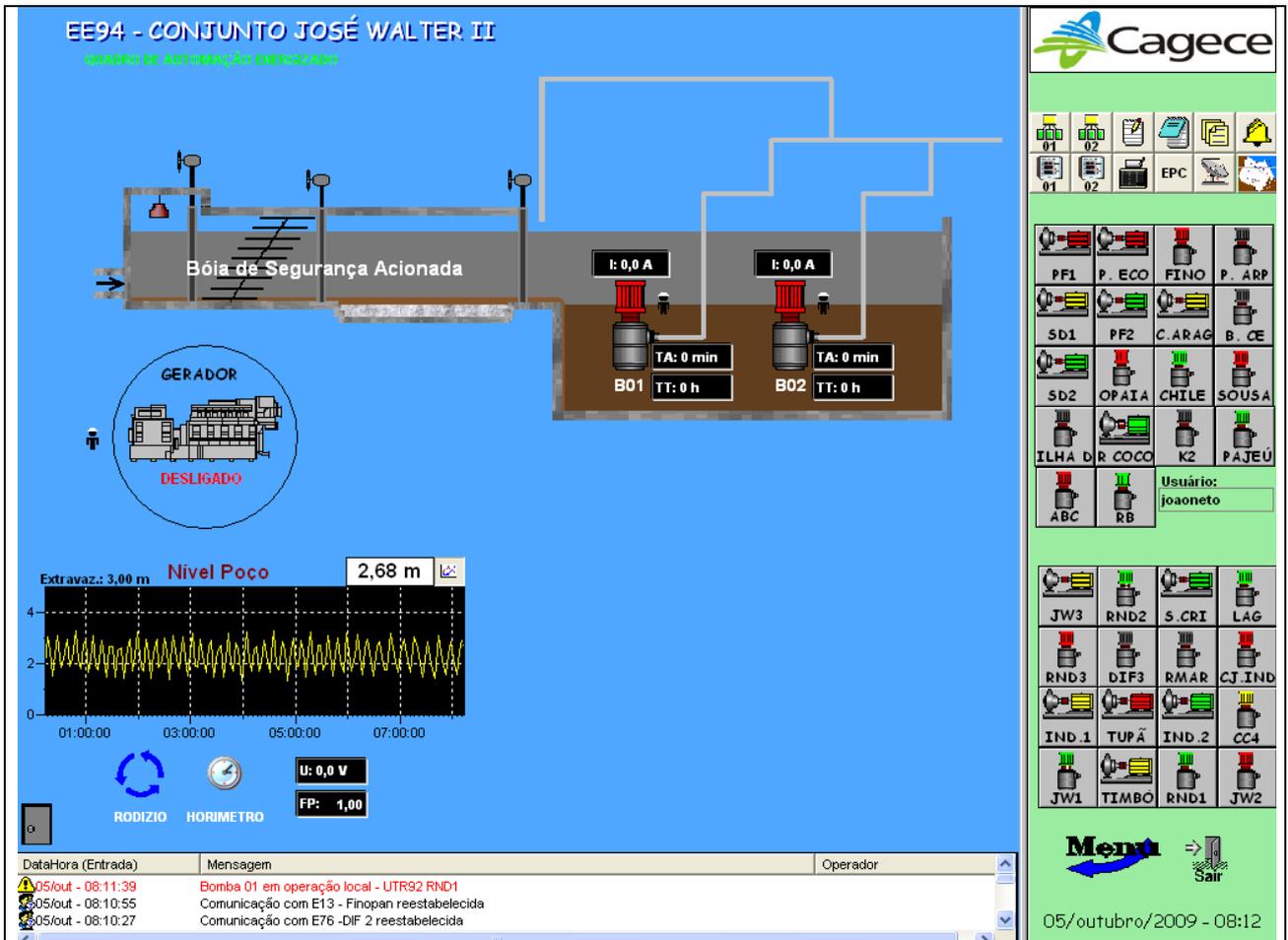
- ✓ Indicações de vazão e volume não funcionam corretamente.
- ✓ Animação do poço de sucção e poço de dreno com defeito.
- ✓ Sensor de nível com defeito.
- ✓ Indicações de corrente das bombas, tensão do barramento e fator de potência não funcionam corretamente.
- ✓ Os sensores de pressão da linha de recalque das bombas principais não estão funcionando corretamente;
- ✓ Esta estação esta dependo da conclusão de uma reforma no quadro de comando, onde estão sendo instalados três Softstarter para o acionamento dos motores, portanto falta a empresa contratada terminar o serviço e integração ao CECO.

UTR-92 MARECHAL RONDON



- Setpoints dos níveis mudam para zero indevidamente. Mas o rodízio automático continua sendo feito.
- Indicações de corrente das bombas e tensão do barramento não funcionam corretamente.

UTR-94 CONJUNTO JOSÉ WALTER II



- Indicações de corrente das bombas, tensão do barramento e fator de potência não funcionam corretamente.
- Setpoints dos níveis mudam para zero indevidamente. Mas o rodízio automático continua sendo feito.

CONCLUSÃO

Observamos a ocorrência vários problemas no sistema de automação que foram se acumulando ao longo do tempo e agora estão precisando de reparo para que se continue operando de forma adequada e segura.

Outra deficiência observada foi a falta de medidores de vazão na maioria das estações de esgoto e nas que haviam medidores hoje não funcionam de forma confiável.

Em resumo se contarmos as Estações Elevatórias, os Sistemas de Tratamento e as novas estações que serão incorporadas através da obra SANIARII totalizam 115 estações, das quais apenas 31 contemplam automação que por sua vez não estão equipadas com medidores de vazão. Com apenas 27% das estações monitoradas parcialmente, não resta dúvida que ainda um grande caminho a ser percorrido.

Fizemos uma análise e separamos em quatro projetos, ficando:

Projeto	Escopo	UN-Resp.	VALOR
Atualização da Automação do Sistema de Esgoto da capital e RMF	Atualizar a automação do sistema de tratamento de esgoto da capital para a adequação desta à Norma Interna de Premissas Básicas para Sistemas de Automação e/ou de Telemetria. Esta atualização compreenderá na reforma e atualização do CECOPE (Centro de Controle Operacional de Esgoto) e atualização das UTR's	GCOPE	R\$ 250.000,00
Complementação da Automação do Sistema de Esgoto da capital e RMF	O sistema atual contempla apenas parte do macrosistema e parte dos sistemas isolados. Este projeto tem como premissa abranger todos os sistemas da RMF.	GCOPE	R\$ 8.400.000,00
Instalação de medidores de vazão nas estações de Esgoto da RMF (Contemplando as 26 novas elevatórias)	Instalação de Medidores de Vazão e Multi-medidores de grandezas energéticas e de estações de telemetria por GPRS para os dados colhidos por esses equipamentos. Com este sistema instalado poder-se-á realizar um gerenciamento tanto da vazão e volume de esgoto tratado e seu respectivo consumo energia.	GCOPE	R\$ 6.795.000,00
Sistema de Controle Operacional, com capacidade de simular futuras intervenções com ênfase para tomadas de decisões.	Concepção de um sistema que importará os dados do supervisor e utilizará a base cadastral do sistema através de um modelo hidráulico, possibilitando a operação antever as alterações das grandezas envolvidas objetivando embasar as tomadas de decisões.	GCOPE	R\$ 190.080,00

Appendix B3.1c
CAGECE Water and Wastewater Systems Automation Upgrade Project
CECOP Planned Improvements

TERMO DE REFERÊNCIA

FORNECIMENTO DE EQUIPAMENTOS E SERVIÇOS PARA ATUALIZAÇÃO DO CENTRO DE CONTROLE OPERACIONAL (CECOP) DO SISTEMA DE ABASTECIMENTO DE ÁGUA DA REGIÃO METROPOLITANA DE FORTALEZA.

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TERMO DE REFERÊNCIA

1- OBJETIVO:

Este documento tem como objetivo, especificar o fornecimento dos equipamentos, materiais e serviços, para a Atualização do Centro de Controle Operacional (CECOP) do Sistema de Abastecimento de Água da Região Metropolitana de Fortaleza.

2. ESCOPO DO FORNECIMENTO

O escopo de fornecimento consiste na execução de Serviços de Engenharia e no Fornecimento de Materiais, conforme especificado a seguir. O detalhamento de cada item do escopo do fornecimento é especificado no item 3.

2.1. SERVIÇOS DE ENGENHARIA

- Projeto Executivo, compreendendo das seguintes partes:
 - Relatório da atual situação do CECOP;
 - Especificação dos materiais e serviços a serem fornecidos:
 - Especificação do No-Break da sala do CECOP;
 - Especificação da Licença E3 Viewer Control;
 - Projeto da Adequação de hardware e programação dos CLPs das Unidades Terminais Remotas (UTRs) para leitura de vazão por pulsos e envio para o CECOP;
 - Projeto do Desenvolvimento e inclusão, no Sistema de Controle de Perdas (SISCOPE), de módulo JAVA para visualização web em tempo real das leituras dos macro-medidores da rede distribuição de água da RMF.
 - Plano de Ação para atualização do Aplicativo Supervisório existente para a versão 3 do Elipse-E3.
- Configuração de Equipamentos e Desenvolvimento de Software:
 - Configuração de hardware e programação dos CLPs das Unidades Terminais Remotas (UTRs) para leitura de vazão por pulsos e envio para o CECOP;
 - Desenvolvimento de Módulo em JAVA, para visualização em tempo real via web, das leituras dos macro-medidores da rede distribuição de água da RMF e inclusão no Sistema SISCOPE;
 - Configuração do programa supervisório atual, biblioteca de símbolos, diretórios, telas, e o que for necessário, para migração para a versão do Elipse-E3 versão 3.
- Comissionamento:
 - Instalação do No-Break do CECOP;
 - Testes de Operação das UTRs e interligação com os medidores de vazão (macro-medidores) para leitura por pulsos;

- Instalação e Testes de Execução do Módulo JAVA para visualização em tempo real das vazões lidas pelos macro-medidores da RMF, desenvolvido para o SISCOPE;
- Testes de Operação do programa supervisor do CECOP na versão atualizada.
- Treinamento: (ver item 6)
 - Configuração e programação do hardware acrescentado ou adequado nos painéis das UTRs;
 - Operação do Módulo JAVA desenvolvido para o SISCOPE;
 - Configuração e operação do programa supervisor do CECOP.

Será de responsabilidade exclusiva do Instalador:

- As apostilas do treinamento;
- Catálogos Técnicos;
- Bancadas Didáticas para treinamento com o CLP;
- Qualquer outra infra-estrutura necessária para o curso.

2.2. SERVIÇOS DE MONTAGEM

- ✓ Montagem mecânica e elétrica para adequação do hardware dos CLPs, nos painéis das UTRs;
- ✓ Interligação, inclusive infra-estrutura adequada para caminhamento de cabos e instalação de módulos ou conversores adicionais (conversão corrente/pulsos), entre os medidores de vazão e CLPs para leitura de pulsos;
- ✓ Montagem e instalação do No-Break do CECOP.

2.3. FORNECIMENTO DE MATERIAL

Serão fornecidos todos os equipamentos e acessórios, bem como todo o material de instalação, conforme especificado neste Termo de Referência.

2.4. INSTALAÇÃO ELÉTRICA

A empresa montadora será responsável pelo fornecimento de todos os materiais para a instalação elétrica de módulos, cartões ou conversores para a interligação das UTRs aos medidores de vazão.

2.5. SOFTWARES

A empresa montadora será responsável pelo fornecimento dos softwares necessários à configuração do hardware dos CLPs das UTRs e atualização do CECOP, conforme especificado neste Termo de Referência.

3. DESCRIÇÃO DETALHADA DO PROJETO EXECUTIVO

A Contratada deverá elaborar, no prazo estabelecido no Cronograma Físico-Financeiro, um Projeto Executivo cujos itens estão listados no item 2.1.1.1 e detalhados a seguir.

3.1. RELATÓRIO DA ATUAL SITUAÇÃO DO CECOP

Este Relatório tem como objetivo informar a atual situação do CECOP, quanto aos itens listados abaixo, com vistas a informar os atuais problemas, bem como apontar as possíveis soluções. Tal Relatório será elaborado a partir das informações colhidas na etapa de Levantamento de Campo.

26. Estrutura Física;
27. Mobiliário (mesas técnicas e cadeiras);
28. Equipamentos instalados (computadores, monitores, impressoras, switches, hacks e clp);
29. Software Supervisório utilizados;
30. Suprimento de energia de emergência;
31. Relatório fotográfico;

A contratada deverá, neste relatório, apresentar uma proposta para a solução dos problemas detectados, que poderão ser, ou não executados no contrato referente a este Termo de Referência, de acordo com aprovação e decisão da CAGECE.

3.2. ESPECIFICAÇÃO DOS MATERIAIS E SERVIÇOS A SEREM FORNECIDOS

3.2.1. ESPECIFICAÇÃO DO NO-BREAK DA SALA DO CECOP

O Projeto Executivo deverá conter a especificação do No-Break (p/ o CECOP) a ser fornecido, inclusive o nome do Fabricante e Modelo, devendo ter, no mínimo (o No-Break proposto poderá superar as características abaixo), as características exigidas na Folha de Especificações (ver item 8).

3.2.2. ESPECIFICAÇÃO DA LICENÇA DO SOFTWARE ELIPSE E3 VIEWER CONTROL

A Empresa contratada deverá apresentar no Projeto Executivo a descrição detalhada do Software de Visualização e Controle Remotos E3 Viewer-Control, de fabricação da Elipse Software. A especificação do fornecimento deverá ser elaborada de acordo com a versão atual do Elipse E3 (programa supervisório utilizado no CECOP atualmente).

3.2.3. PROJETO DE ADEQUAÇÃO DE HARDWARE, INTERLIGAÇÃO DOS MACROMEDIDORES E PROGRAMAÇÃO DOS CLPs PARA LEITURA DE VAZÃO POR PULSOS

O Projeto Executivo deverá especificar materiais, instalações e serviços a serem executados para a adequação de hardware e software e interligação dos macro-medidores aos CLPs das UTRs, para leitura de vazão por pulsos. A tabela 1 lista os macro-medidores contemplados bem como a UTR à qual está conectado.

Tabela-1: Macro-Medidores instalados no SAA da RMF

ITEM	UTR	CLP			TAG MACROMEDIDOR	LOCALIZAÇÃO / ESTAÇÃO PITOMÉTRICA (EP)
		FAB.	CPU	CARTÃO DI		
1	01	SMAR	LC700-E3	M013	FIT-01.1	EE Gavião Novo / EP-65

2					FIT-01.2	EE Gavião Novo / EP-65A
3	1A	SMAR	LC700-E3	M013	FIT-1A.1	EE Gavião Velho / EP-49
4	1B	SMAR	LC700-E3	M013	FIT-1B.1	Canal da ETA / EP-C1
5					FIT-1B.2	Canal da ETA / EP-C2
6	2B	SMAR	LC700-E3	M013	FIT-2B.1	Reservatório Ancuri / EP-182
7	03	SMAR	LC700-E3	M013	FIT-03.1	VRP Conjunto Palmeiras / EP-120
8	04	SMAR	LC700-E3	M013	FIT-04.1	VRP Messejana / EP-61
9	05	SMAR	LC700-E3	M013	FIT-05.1	VRP Cocó / EP-114
10						VRP Dias Macedo / EP-195
11	06	SMAR	LC700-E3	M013	FIT-06.1	Barrilhete Alves Texeira / EP-48
12					FIT-06.2	Barrilhete Alves Texeira / EP-46
13					FIT-06.3	Barrilhete Alves Texeira / EP-154
14	6A	SMAR	LC700-E3	M013	FIT-6A.1	VRP Borges de Melo / EP-63A
15					FIT-6A.2	VRP Borges de Melo / EP-63
16	07	SMAR	LC700-E3	M013	FIT-07.1	Estação Elevatória Aldeota / EP-21
17	09	SMAR	LC700-E3	M013	FIT-09.1	Expedicionários / EP90
18	10A	SMAR	LC700-E3	M013	FIT-10A.1	Benfica / EP-111
19	11	SMAR	LC700-E3	M013	FIT-11.1	Pici / EP-24
20	12	SMAR	LC700-E3	M013	FIT-12.1	Floresta 1 / EP-30
21					FIT-12.2	Floresta 2 / EP-40
22	14	SMAR	LC700-E3	M013	FIT-14.1	VRP Castelão / EP-33
23	15	SMAR	LC700-E3	M013	FIT-15.1	VRP SIQUEIRA / EP-112
24	16	SMAR	LC700-E3	M013	FIT-16.1	Vila Peri / EP-202
25	18	SMAR	LC700-E3	M013	FIT-18.1	VRP Conj. Jereissati / EP-16
26	21	SMAR	LC700-E3	M013	FIT-21.1	VRP Vila Brasil / EP197
27					FIT-21.2	VRP Vila Brasil / EP-34
28	22	SMAR	LC700-E3	M013	FIT-22.1	Vila Brasil Aracapé / EP-163
29					FIT-22.2	Vila Brasil Aracapé / EP-44
30	23/24	SMAR	LC700-E3	M013	FIT-23.1	Jereissati – modubim / EP-80
31					FIT-23.2	Modubim – Jereissati / EP-80A
32					FIT-23.3	Vila Brasil II / EP-43
33	25	SMAR	LC700-E3	M013	FIT-25.1	José Walter / EP-58
34	27A	ATOS ²	4004-09R	INTEGRADO	FIT-27A.1	Messejana – Anel Viário / EP-168
35					FIT-27A.2	Pedras–BR 116–Anel Viário / EP-190
36	27B	ATOS	4004-09R	INTEGRADO	FIT-27B.1	Messejana–Aduora Eusébio / EP-189
37	28	SMAR	LC700-E3	M013	FIT-28.1	Eusébio / EP-184
38	29	ATOS	4004-09R	INTEGRADO	FIT-29.1	VRP Conj. Maracanauzinho / EP-180
39					FIT-29.2	Loteamento Maracanaú / EP-169
40	36	SMAR	LC700-E3	M013	FIT-36.1	Expedicionários–Conj. Ceará / EP-167
41					FIT-36.2	Castelão – Expedicionários / EP-188
42	37A	ATOS	4004-09R	INTEGRADO	FIT-37A.1	Parque Luzardo Viana / EP-179

¹ Os cartões de Entradas Digitais dos CLPs SMAR (CPU LC700-E3) tem tensão nominal de 220 Vac, enquanto que a saída de pulsos dos macro-medidores são em 24 Vdc.

² As entradas digitais do CLP ATOS (CPU 4004-09R) tem tensão nominal de 24 Vdc e são INTEGRADAS ao Cartão da CPU, desta forma podem ser conectadas diretamente à saída de pulsos do macro-medidor.

43	37	ATOS	4004-09R	INTEGRADO	FIT-37.1	Av. Pe Holanda do Vale / EP-170
44	38	ATOS	4004-09R	INTEGRADO	FIT-38.1	Mucunã / EP-175
45	39	ATOS	4004-09R	INTEGRADO	FIT-39.1	Alto Fechado-EE Velho / EP-181
46	42	SMAR	LC700-E3	M013	FIT-42.1	DIF III / EP-178
47	43	ATOS	4004-09R	INTEGRADO	FIT-43.1	Pedras / EP-191
48	44	SMAR	LC700-E3	M013	FIT-44.1	Trilho – Maracanaú / EP-174
49					FIT-44.2	Vila das Flores / EP-203
50	47	ATOS	4004-09R	INTEGRADO	FIT-47.1	Papi Jr. / EP-193
51	48	SMAR	LC700-E3	M013	FIT-48.1	Booster Miranbé / EP-200
52	49	SMAR	LC700-E3	M013	FIT-49.1	Toco – Nova Metrópole / EP-192
53	50	SMAR	LC700-E3	M013	FIT-50.1	BR 116 – DINIT Positivo / EP-199
54					FIT-50.2	BR 116 – DINIT Negativo / EP-199A
55	51	SMAR	LC700-E3	M013	FIT-51.1	Caucaia-Conj. N. Metrópole / EP-137
56	52	ATOS	4004-09R	INTEGRADO	FIT-52.1	Conj. Esplanada do Araturí / EP-155
57	53	ATOS	4004-09R	INTEGRADO	FIT-53.1	Jurema-Av. D. Alm. Lustosa / EP-156
58	54	ATOS	4004-09R	INTEGRADO	FIT-54.1	R. 24 outubro-São Miguel / EP-157
59	55	ATOS	4004-09R	INTEGRADO	FIT-55.1	Praias Oeste / EP-206
60	56	SMAR	LC700-E3	M013	FIT-56.1	Reforço Potira / EP-194
61	57	SMAR	LC700-E3	M013	FIT-57.1	Reforço Pici / EP-196
62	58	SMAR	LC700-E3	M013	FIT-58.1	C. Palmares-R. J. Gentil / EP-204E1
63	59	SMAR	LC700-E3	M013	FIT-59.1	Cidade Nova / EP-205
64	60	SMAR	LC700-E3	M013	FIT-60.1	Santo Amaro / EP-207

O Projeto Executivo deverá conter o fluxograma e programa em Lader para alteração do programa de atualização dos CLPs, para as CPUs SMAR (LC 700-E3) e ATOS (4004-09R). O programa atualizado deverá realizar todas as funções já desempenhadas pelos CLP da UTR, sendo que a leitura de vazão (atualmente implementada por leitura de sinal proporcional de corrente 4~20 mA) será implementada através de contagem de pulsos (saída dos macro-medidores).

O Projeto Executivo deverá especificar a configuração a ser realizada nos macro-medidores com relação à emissão de pulsos a cada quantidade de volume predeterminada, de acordo com a capacidade de leitura de frequência das entradas digitais existentes nos CLPs.

O Projeto Executivo deverá propor um esquema elétrico de caminhamento de cabos e conexão dos macro-medidores aos painéis das UTRs. No caso dos CLPs SMAR (CPU LC 700-E3) (Ver nota-1, Tabela 1) deverão ser instalados relés para interfaceamento entre a saída de pulsos dos macro-medidores (sinal em 24 Vdc) e a entrada digital do CLP SMAR (sinal em 220 Vac). O relé de interfaceamento deverá ter a configuração mínima apresentada na Folha de Especificações (ver item 8). Serão instalados um total de 35 módulos de interfaceamento, conforme Tabela-1.

3.2.4. DESENVOLVIMENTO DE MÓDULO JAVA PARA VISUALIZAÇÃO WEB EM TEMPO REAL DAS LEITURAS DOS MACRO-MEDIDORES DA REDE DE DISTRIBUIÇÃO DO SAA DA RMF

O Projeto Executivo deverá especificar o desenvolvimento do Módulo JAVA para visualização web em tempo real, através do sistema SISCOPE, das leituras dos macro-medidores da rede de distribuição do SAA da RMF.

O Módulo deverá ser elaborado por profissional qualificado, pertencente ao quadro funcional da contratada (comprovação exigida), com certificação JAVA Enterprise Edition (J2 EE). O código do programa deverá obedecer os padrões do Code Convention JAVA.

O Módulo deverá permitir consulta em tela, em tempo real, da leitura dos macro-medidores. Para cada macro-medidor deverá ser elaborado uma tela sinótica com as seguintes informações básicas:

- TAG do macro-medidor, conforme Tabela-1;
- Fabricante e Modelo do macro-medidor;
- UTR a qual está conectado;
- Localização, inclusive foto com indicativa;
- Caixa de Edição Indicativa com a vazão atual (atualização a cada 1 minuto);
- Caixa de Edição Indicativa com o Volume Totalizado Atual (atualização a cada 1 minutos).

Os valores de vazão e volume totalizado deverão ser pesquisados do banco de dados histórico.

O Módulo deverá permitir a elaboração de relatórios de vazão e/ou volume totalizado por macro-medidor. Os relatórios terão estrutura configurada pelo usuário, conforme as seguintes opções, a serem exibidas em uma Janela de Configuração:

- Caixa de Edição para digitação do Título do Relatório (Máximo 30 caracteres com espaços);
- Caixa de Edição de Texto para digitação do resumo do Objeto do Relatório (máximo de 80 caracteres com espaços);
- Lista de todos os macro-medidores listados na Tabela-1, com “caixas de checagem” para escolha, podendo ser escolhidos mais de 1 (um) macro-medidor;
- 2 (duas) Caixas de Edição para escolha do período de abrangência do relatório;
- Caixa de Listagem para escolha do período de registros a serem exibidos, com as seguintes opções: 1 minuto; 10 minutos; 30 minutos; 1 hora; 12 horas; 1 dia. No caso de tempo de registro maior que 1 minuto, o valor de vazão a ser exibido será a média entre os registros;
- Botão Carregar Relatório. Abre uma janela para escolha do nome do relatório, com opção de escolha de pasta e de extensão: “.txt”, “.pdf” ou “.xls”. Esta janela somente deverá ser aberta, se as opções de configuração acima estiverem preenchidas.
- Botão Cancelar. Fecha a Janela de Configuração, cancelando a ação de emissão de relatório.

Somente usuários credenciados poderão ter acesso, através de senha, à Base de Informações e, conseqüentemente, à elaboração de Relatórios. O Relatório deverá informar, no seu cabeçalho, o nome do usuário credenciado, data e hora da emissão do relatório.

A empresa contratada deverá apresentar, no projeto executivo, um plano para de transferência total de tecnologia para a CAGECE, através de seus profissionais.

A empresa contratada cederá à CAGECE toda a literatura pesquisada e utilizada, bem como os códigos fontes do programa, de forma não exclusiva.

3.2.5. PLANO DE AÇÃO PARA ATUALIZAÇÃO DO APLICATIVO SUPERVISÓRIO EXISTENTE PARA A VERSÃO 3 DO ELIPSE-E3

Deverá ser apresentado, no Projeto Executivo, um plano de ação para atualização do programa supervisório para a versão 3 do Elipse-E3. Esta ação abrangerá a atualização e/ou adaptação de bibliotecas gráficas e scripts necessários para viabilizar a atualização.

A atualização não deverá interferir na execução do aplicativo supervisório e, conseqüentemente, na operação remota do SAA da RMF.

4. INSPEÇÃO E TESTES DE ACEITAÇÃO

Deverá ser inspecionado 100% dos equipamentos fornecidos, sendo reservado à Cagece o direito de inspecionar apenas partes destes, sem com isto diminuir a responsabilidade da contratada sobre os equipamentos fornecidos.

Os testes de aceitação serão realizados na empresa contratada ou seus sub-fornecedores devendo o equipamento atender a todas as exigências descritas nas especificações e se enquadrarem nas normas aplicáveis e listadas na Folha de Dados (Projeto Básico – Anexo B).

Os materiais e equipamentos poderão ser inspecionados por técnicos da CAGECE, devendo a contratada colocar a disposição os meios necessários aos testes e ensaios, sem ônus para a CAGECE.

Uma comissão de fiscalização da CAGECE, sob a coordenação da GCOPE, elaborará um Relatório de Final de aceitação, onde serão avaliados a qualidade de todos os materiais e serviços fornecidos.

5. GARANTIA

O fornecedor deverá apresentar junto com a proposta um termo de garantia dos equipamentos e serviços ofertados, cobrindo um período mínimo de 24 meses, contados da data do Recebimento Final da obra por parte da CAGECE. Esta garantia deverá abranger todo e qualquer defeito das obras, projeto, fabricação, equipamentos, instrumentos, atuadores, painéis e desenhos, quando submetidos a uso e conservação normais.

6. ASSISTÊNCIA TÉCNICA

O fornecedor deverá possuir equipe credenciada no Brasil para prestar assistência técnica especializada (em relação aos equipamentos instalados e serviços) durante a montagem, comissionamento, aceitação final, período de garantia e durante o período de vida útil dos equipamentos.

O fornecedor deverá informar, em sua proposta técnica, o período de vida útil dos equipamentos fornecidos e manter, no local de instalação, uma equipe para dar assistência técnica até o recebimento final da obra.

A equipe terá por função:

- Supervisionar as instalações;
- Supervisionar a interligação de equipamentos;
- Supervisionar a elaboração de softwares;
- Supervisionar a execução dos testes de comissionamento;
- Assessorar e supervisionar a manutenção e operação do sistema até sua aceitação final;

O fornecedor deverá, quando solicitado pela CAGECE, prestar assistência técnica no campo, durante o período de garantia.

7. TREINAMENTO

A empresa vencedora ministrará cursos de treinamento à equipe indicada pela CAGECE. A equipe terá um total máximo de 10 participantes.

Os cursos serão realizados em local a ser determinado pela CAGECE sem ônus para a mesma.

Eventualmente, alguns cursos poderão ser realizados nas dependências do fornecedor caso acordado com a CAGECE. Deverão ser fornecidos materiais didáticos em cópia impressa e gravada em CD, tais como: apostilas e manuais para todos os participantes dos cursos. Os materiais didáticos não serão devolvidos após o término dos cursos.

Deverá também ser fornecido em cópia impressa e gravada em CD o manual detalhado de operação e manutenção do sistema (concernente à Atualização) com diretrizes e pontos que devam ser observados para a correta operação e manutenção do sistema.

O curso de operação e manutenção compreenderá os seguintes módulos:

- Descrição funcional e operacional detalhada das UTRs, no que diz respeito às Atualizações de Hardware e Software;
- Utilização do terminal de programação na configuração do hardware atualizado de cada UTR;
- Descrição técnica do sistema e equipamentos;
- Manutenção preventiva;
- Manutenção corretiva;

8. FOLHA DE ESPECIFICAÇÕES

8.1. NO-BREAK CECOP (UPS)

ITEM	CARACTERISTICA	
1	GERAL	
1.1	TIPO	UPS, PADRÃO RACK 19"
1.2	TAMANHO	3U
1.3	POTÊNCIA	6 kVA
1.4	MAX NÍVEL DE RUÍDO A 1 METRO	< 50 Dba
1.5	RENDIMENTO AC/AC	92%
1.6	INTERFACE DE COMUNICAÇÃO	1 x RS232
1.7	AUTONOMIA MÍNIMA C/ BANCO DE BATERIAS EXTERNA E CARGA DE 2kW	60 min
1.8	FUNCIONAMENTO	DUPLA CONVERSÃO: A ENTRADA AC É RETIFICADA PARA DC, CARREGANDO AS BATERIAS EXTERNAS E ALIMENTANDO UM INVERSOR MONOFÁSICO QUE FORNECE A TENSÃO AC ESTABILIZADA PARA A CARGA.
1.9	TEMPERATURA AMBIENTE DURANTE OPERAÇÃO	0 ~ 40° C
1.10	NORMAS APLICÁVEIS	IEC/EN 62040-1-1 (SEGURANÇA) EN 50091-2 (COMPATIBILIDADE ELETROMAGNÉTICA) IEC/ EN 62040-3 (PERFORMANCE E FUNCIONAMENTO)
2	MODOS DE OPERAÇÃO	
2.1	NORMAL	A ALIMENTAÇÃO DA CARGA É FORNECIDA PELO INVERSOR DA UPS. AS BATERIAS SÃO CARREGADAS PELO RETIFICADOR.
2.2	SOBRECARGA	A CARGA É TRANSFERIDA DA SAÍDA DO INVERSOR DA UPS PARA A REDE ELÉTRICA.
2.3	EMERGÊNCIA	NO CASO DE FALTA DA FONTE PRINCIPAL DE ENERGIA, A ALIMENTAÇÃO DA CARGA É FEITA A PARTIR DAS BATERIAS A PARTIR DO INVERSOR DA UPS.
3	ENTRADA	
3.1	NÚMERO DE FASES	MONOFÁSICO
3.2	TENSÃO DE ALIMENTAÇÃO	220 VAC / 230 VAC / 240 VAC TOLERÂNCIA 176 VAC ~ 276 VAC
3.3	FREQUÊNCIA	50 ~ 60 Hz
3.4	FATOR DE POTÊNCIA	> 0.97
4	SAÍDA	
4.1	NÚMERO DE FASES	MONOFÁSICO
4.2	TENSÃO	230 VAC
4.3	FREQUÊNCIA	50 ~ 60 Hz

4.4	FATOR DE POTÊNCIA	0.7
4.5	ESTABILIDADE NA TENSÃO DE SAÍDA PARA ENTRADA CA/CC COM VARIAÇÕES DE TENSÃO DENTRO DOS LIMITES E 100% DE VARIAÇÃO DE CARGA	± 2%
4.6	DISTORÇÃO HARMÔNICA	COMPATÍVEL COM EN 62040-3
5	BANCO DE BATERIAS EXTERNAS (INCLUSO)	
5.1	CAIXA DE MONTAGEM E ACOMODAÇÃO	CAIXA METÁLICA PADRÃO RACK 19", 3U
5.2	DISJUNTOR GERAL	INTEGRADO NA CAIXA DE MONTAGEM
5.3	QUANTIDADE DE BATERIAS	20 x 18 Ah (12 VCC)
5.4	TIPO BATERIA	SELADA

8.2. RELÉ DE INTERFACEAMENTO

ITEM		CARACTERISTICA
1	ENTRADA	
1.1	Tensão Nominal	24 Vdc
1.2	Corrente de Entrada Máxima	9 mA
1.3	Tempo de Operação (ao Ligar)	4 ms a 24 Vdc
1.4	Tempo de Operação (ao Desligar)	8 ms a 24 Vdc
1.5	Proteções	✓ Inversão de Polaridade ✓ Supressão de surtos
1.6	Indicação	Operação (Ligado)
2	SAÍDA	
2.1	Contato	Relé, contato simples, 1NF
2.2	Material de Contato	AgSnO
2.3	Tensão Máxima de Comutação	250 Vac/dc
2.4	Tensão Mínima de Comutação	12 Vac/dc
2.5	Limite de Corrente Contínua	6 A
2.6	Corrente Instantânea de Comutação Máxima	30 A
2.7	Potência Mínima de Comutação	120 mW
3	GERAL	
3.1	Tensão de Isolação Entrada / Saída	4 kV, 50 Hz, durante 1 minuto
3.2	Temperatura de Operação	-20 ~ + 60°C
3.3	Classe de Inflamabilidade	V0 / UL94
3.4	Vida Mecânica	20.000.000 ciclos
3.5	Normas	✓ IEC 664 / IEC 664A / DIN VDE 0110 ✓ IEC 255 / DIN 0435 ✓ DIN VDE 0106-101

**Appendix O1
Contact List**

Firm / Organization	Contact Person (First Name)	Contact Person (Last Name)	Address 1	Address 2	City, State	Zip Code	Country	Phone Number	Fax Number	E-mail Address	Date of Initial Contact	Comments
USTDA	Gabrielle	Mandel	1000 Wilson Blvd.	Suite 1600	Arlington, VA	22209-3901	USA	703 875 4357	703 875 4009	Gmandel@ustda.gov	9/24/2010	Kickoff Meeting
USTDA	Rodrigo	Mota			Sao Paulo		Brazil	55-11-5186-7335	55-11-5186-7396	rmota@ustda.gov	9/24/2010	Kickoff Meeting
US Commercial Service Rio Janeiro	Regina	Cunha	USCS	U.S. Consulate	Rio de Janeiro		Brazil	55-21-3823-2416, cell 55-21-9628-3001	55-21-3823-2424	regina.cunha@mail.doc.gov	10/25/2010	Informed about the USTDA DM and Exchanged emails on Cedae meeting schedule
US Commercial Service Sao Paulo	Teresa	Wagner	Rua Henri Dunant 700	Chacara Santo Antonio 04709-110	Sao Paulo, S.P.		Brazil	55-11-5186-7177		teresa.wagner@mail.doc.gov	10/25/2010	Requested contact information on the Campinas MBR Project
CAGECE	Marcondes	Sobreira	Ave. Lauro Vieira Chaves No. 1030, Barrio Vila Uniao	Fortaleza	Ceara	60420-901	Brazil	55-85-3101-1784	55-11-3133-3958	marcondesr@cagece.com.br	11/17/2010	Meeting to discuss USTDA Potential Projects
Koch Membrane Systems	Sergio	Rodrigues Ribeiro	Rua Tanabi, 248 - Agua Branca		Sao Paulo	CEP 05002-010	Brazil	55 11 3672 4676, Cell 55 11 9615 5949		srribeiro@kochmembrane.com	10/25/2010	Discussed the project business opportunities and their interest.
IDB	Yvon	Mellinger	SEN Quadra 802 Cj. F Lote 39		Brasilia		Brazil	55-61-3317-4271	202 623 1708	Yvonm@iadb.org	10/21/2010	Discussed the project business opportunities and their interest.
IDB	Federico	Basanes	1300 New York Avenue, NW		Washington, DC	20577	USA	202 623 3967	202 623 1708	Federicob@iadb.org	9/27/2010	Discussed the project business opportunities and their interest.
IDModeling	Paul	Hauffen	55 East Huntington		Arcadia, CA	91006	USA	(626) 244-0700	(626) 244-	paulhauffen@idmodeling.com	10/28/2010	Discussed the Fortaleza

			Drive, Suite 130						0702	g.com		project business opportunities and their interest.
PENTAIR WATER	Fernando	de la Masa	Francisco Noguera 217, of. 30 Providencia.		Santiago	7500001	Chile	56-2-3609874		Fernando.Maza@pentair.com	10/28/2010	Discussed the Santos project and related business opportunities and their interest.
PENTAIR WATER	Alyssa	Hernández	3601 Fairbanks Ave.		Kansas City, KS	66106	USA	(913) 371 5000	(913) 748 4025	alyssa.hernandez@pentair.com	10/28/2010	Discussed the Santos project and related business opportunities and their interest.
CAGECE	Adriano	de Souza	Av. Dr. Lauro Vieira Chaves, 1030	Vila Uniao	Fortaleza	CEP:6 0.420-901	Brazil	55-85-3101-1875	55-85-3101-1877	adrianos@cagece.com.br	11/17/2010	Met to discuss the CAGECE Projects
CAGECE	Andre	Macedo Facó	Av. Dr. Lauro Vieira Chaves, 1030	Vila Uniao	Fortaleza	CEP:6 0.420-901	Brazil	55-85-3101-1723	55-85-3101-1718	andrefaco@cagece.com.br	11/17/2010	Met to discuss the CAGECE Projects
CAGECE	Lucio	Castro	Av. Dr. Lauro Vieira Chaves, 1030	Vila Uniao	Fortaleza	CEP:6 0.420-901	Brazil	55-85-3101-5626	55-85-3101-1877	lucio@cagece.com.br	11/17/2010	Met to discuss the CAGECE Projects
CAGECE	Hildel	Leite	Av. Carneiro de Mendoca	Pici	Fortaleza	CEP:6 0.510.430	Brazil	55-85-3101-5629	55-85-3101-5628	hildel@cagece.com.br	11/17/2010	Met to discuss the CAGECE Projects
CAGECE	Marcio	Borges	Av. Dr. Lauro Vieira Chaves, 1030	Vila Uniao	Fortaleza	CEP:6 0.420-901	Brazil	55-85-3101-1784	55-85-3101-1769		11/17/2010	Met to discuss the CAGECE Projects
CAGECE	Marcondes	Sobreira	Av. Dr. Lauro Vieira Chaves, 1030	Vila Uniao	Fortaleza	CEP:6 0.420-901	Brazil	55-85-3101-2001		marcondesr@cagece.com.br	11/17/2010	Met to discuss the CAGECE Projects

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

GRANT AGREEMENT

APR 19 2012

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 Ceará Water and Sewage Treatment Company (CAGECE) ("Grantee"). USTDA agrees to provide the Grantee under the terms of this Grant Agreement a feasibility study ("Study") on the proposed CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project ("Project") in Brazil ("Host Country"). The cost of the goods and services required for the preparation of the study, in the amount of US\$579,895 ("USTDA Grant") will be paid directly by USTDA.

1. USTDA Funding

The funding to be provided under this Grant Agreement shall be used to fund the costs of an Agreement of Understanding to Perform the Feasibility Study ("Agreement of Understanding") between the Grantee and the U.S. firm selected by the Grantee ("U.S. Firm") under which the U.S. Firm will perform the Study. Payment to the U.S. Firm 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 Study ("Terms of Reference") are attached as Annex I and are hereby made a part of this Grant Agreement. The Study will examine the technical, financial, environmental and other critical aspects of the proposed Project. The Terms of Reference shall also be included in the Agreement of Understanding.

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. The parties to this Grant Agreement and the U.S. Firm shall observe these standards, which include not accepting payment of money or anything of value, directly or indirectly, from any person for the purpose of illegally or improperly inducing anyone to take any action favorable to any party in connection with the Study.

4. Grantee Responsibilities

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

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5. USTDA as Financier

(A) USTDA Approval of Competitive Selection Procedures

Selection of the U.S. Firm 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 Approval of U.S. Firm Selection

The Grantee shall notify USTDA at the address of record set forth in Article 17 below upon selection of the U.S. Firm to perform the Study. Upon approval of this selection by USTDA, the Grantee and the U.S. Firm shall then enter into an Agreement of Understanding. The Grantee shall notify in writing the U.S. firms that submitted unsuccessful proposals to perform the Study that they were not selected.

(C) USTDA Approval of the Agreement of Understanding

The Grantee and the U.S. Firm shall enter into the Agreement of Understanding. The Agreement of Understanding, and any amendments thereto, including assignments and changes in the Terms of Reference, must be approved by USTDA in writing. To expedite this approval, the Grantee (or the U.S. Firm on the Grantee's behalf) shall transmit to USTDA, at the address set forth in Article 17 below, a photocopy of an English language version of the signed Agreement of Understanding or a final negotiated draft version of the Agreement of Understanding.

(D) USTDA Not a Party to the Agreement of Understanding

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 Agreement of Understanding and any amendments thereto, including assignments, the selection of all contractors, the Terms of Reference, the Final Report (as defined in Clause I of Annex II), and any and all documents related to any agreement of understanding funded under the Grant Agreement. The parties hereto further understand and agree that USTDA, in reserving the foregoing approval rights, has acted solely as an intermediate 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 Study and shall not be construed as making USTDA a party to the Agreement of Understanding. 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 Agreement of Understanding or any sub-agreement, jointly or separately, without thereby incurring any responsibility or liability to such parties.

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Any approval or failure to approve by USTDA shall not bar the Grantee or USTDA from asserting any right they might have against the U.S. Firm, or relieve the U.S. Firm of any liability which the U.S. Firm 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 Agreement of Understanding or any sub-agreement thereunder must be consistent with this Grant Agreement. In the event of any inconsistency between the Grant Agreement and the Agreement of Understanding or any sub-agreement funded by the Grant Agreement, the Grant Agreement shall be controlling.

6. Disbursement Procedures

(A) USTDA Approval of Agreement of Understanding Required

USTDA will make disbursements of USTDA Grant funds directly to the U.S. Firm only after USTDA approves the Agreement of Understanding.

(B) U.S. Firm Invoice Requirements

The U.S. Firm should request disbursement of USTDA Grant funds by USTDA to the U.S. Firm for performance of the Study by submitting invoices in accordance with the procedures set forth in the USTDA Mandatory Clauses in Annex II. The Grantee shall not be responsible for any payment to the U.S. Firm under this Grant Agreement.

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.

8. Study Schedule

(A) Study Completion Date

The completion date for the Study, which is June 30, 2013, is the date by which the parties estimate that the Study will have been completed.

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(B) Time Limitation on Disbursement of USTDA Grant Funds

Except as USTDA may otherwise agree, (a) no USTDA funds may be disbursed under this Grant Agreement for goods and services which are provided prior to the Effective Date; and (b) all funds made available under the Grant Agreement must be disbursed within four (4) years from the Effective Date.

9. USTDA Mandatory Clauses

The Agreement of Understanding and any other agreement funded under this Grant Agreement shall include the USTDA mandatory clauses set forth in Annex II. All sub-agreements funded or partially funded with USTDA Grant funds shall include the USTDA mandatory 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 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.

(B) 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.

11. Nationality, Source and Origin

Except as USTDA may otherwise agree, the following provisions shall govern the delivery of goods and services funded by USTDA under the Grant Agreement: (a) for professional services, the U.S. Firm must be either a U.S. firm or U.S. individual; (b) the U.S. Firm 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 sub-agreement; (c) employees of the U.S. Firm or U.S. subcontractors 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 performance 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 provisions upon request.

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12. 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. Neither the Grantee nor the U.S. Firm will seek reimbursement from USTDA for such taxes, tariffs, duties, fees or other levies.

13. Cooperation Between Parties and Follow-Up

The parties will cooperate to assure that the purposes of this 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.

14. Implementation Letters

To assist the Grantee in the implementation of the Study, USTDA may, from time to time, issue implementation letters that will provide additional information about matters covered by the Grant Agreement. The parties may also use jointly agreed upon implementation letters to confirm and record their mutual understanding of matters covered by the Grant Agreement.

15. Recordkeeping and Audit

The Grantee agrees to maintain books, records and other documents relating to the Study and the Grant Agreement adequate to demonstrate implementation of its responsibilities under the Grant Agreement, including the selection of U.S. Firms, receipt and approval of the Agreement of Understanding deliverables, and approval or disapproval of U.S. firm 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 Study and the Grant Agreement.

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16. 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 the Superintendent of CAGECE. The parties hereto may, by written notice, designate additional representatives for all purposes under this Grant Agreement.

17. 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 a wire or electronic medium which produces a tangible record of the transmission, such as a telegram, cable or facsimile, and will be deemed duly given or sent when delivered to such party at the following:

To: CAGECE
Av. Dr. Lauro Vieira Chaves, 1030 - Vila União
Fortaleza, CE CEP 60420-280
Brazil

Phone: 011 55 (85) 3101-2001
Fax: 011 55 (85) 3101-1769
Email: marcondes.sobreira@cagece.com.br

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

All such communications shall be in English, as well as Portuguese, unless the parties otherwise agree in writing. In addition, the Grantee shall provide the Commercial 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.: 1112/131001
Activity No.: 2012-51013A

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Reservation No.: 2012127
Grant No.: GH201251127

18. Termination

Either party may terminate this Grant Agreement by giving the other party thirty (30) days advance written notice. The termination of this Grant Agreement will end any obligations of the parties to provide financial or other resources for the Study, except for payments which they are committed to make pursuant to noncancellable commitments entered into with third parties prior to the written notice of termination.

19. Non-waiver of Rights and Remedies

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

20. U.S. Technology and Equipment

By funding this Study, 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, although the Grantee is not required by any means to adopt the recommendations or implement the project, it agrees that it will allow U.S. suppliers to compete in the procurement of technology, goods and services needed for Project implementation.

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IN WITNESS WHEREOF, the Government of the United States of America and the Grantee, 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

For the Ceará Water and Sewage Treatment Company

By: [Signature]

By: [Signature]
Gotardo Gurgel
Diretor-Presidente-Cagece

[Signature]
José Alberto A. de Albuquerque Júnior
Diretor de Gestão Empresarial
DGE - CAGECE

Date: 3/30/12

Date: 30/03/12

Witnessed:

Witnessed:

By: [Signature]

By: [Signature]
André Macêdo Facó
Diretor de Operações-Cagece

Annex I -- Terms of Reference

Annex II -- USTDA Mandatory Clauses



Annex I

Terms of Reference

Objective

The objective of the feasibility study for the CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project ("Study") is to assist the Ceará Water and Sewage Treatment Company (CAGECE) assess wastewater tertiary treatment technologies for sewage generated in the Siqueira and Miriu areas of Fortaleza that will provide wastewater reclamation and reuse capability within the metropolitan area.

The Study will also evaluate improvements to the automated water supply control system and automated sewage control system operated in Fortaleza, as well as the possibility of adding remote process control and monitoring capability at its Gaviao water treatment plant, and assessment of technology for an enhanced integrated automated water supply and wastewater management control center.

The Study tasks are as follows:

Task 1: Detailed Data Collection and Review

Some data may be in Portuguese, and it will be the U.S. Firm's responsibility to translate the information for its use, if needed.

The U.S. Firm shall commence the work by becoming familiar with the wastewater treatment plants environmental setting. CAGECE shall provide to the U.S. Firm all information it has that is necessary for completing this Study. The U.S. Firm shall review all information provided by CAGECE and any other available information applicable to the Project. As a result of this task the U.S. Firm shall become fully acquainted with the service areas, its potential water reuse customers, the requirements of the wastewater treatment plant effluent, and the scope of technical services to satisfy the requirements of the assignment and begin drafting an Inception Report.

The U.S. Firm shall also review and become familiar with CAGECE's automated water supply control (CECOP) and automated sewage control (CECOE) systems, the Gaviao water treatment plant, and the integrated automated water supply and wastewater management control center (CIWWSA) planning details. The U.S. Firm shall review all information provided by CAGECE and any other available information applicable to the Project including the technical details of the CAGECE water supply and wastewater management systems and commercial operations. As part of this task, the U.S. Firm shall meet with CAGECE officials, CECOP and CECO systems' operators and other relevant stakeholders. At the end of this task, the U.S. Firm shall become thoroughly familiar

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with CAGECE's expectations in order to successfully satisfy the requirements of the Study. Local transportation within Fortaleza shall be provided by CAGECE.

Task 2: Project Management Plan and Kickoff

The U.S. Firm shall meet with all relevant stakeholders, including CAGECE personnel, regulatory agencies and stakeholders identified while performing Task 1. The U.S. Firm shall organize a one-day kickoff meeting for the stakeholders including the U.S. Firm staff, CAGECE personnel, CECOP and CECO operators, and Gaviao and CIWWSA representatives at the start of the Project to exchange ideas and develop an integrated work plan for all components of the Project. The U.S. Firm shall prepare an Inception Report that includes a detailed project management plan outlining the responsibilities of each entity and professionals participating in the Study.

Deliverable #1: The U.S. Firm shall prepare and submit the Inception Report and Project Management Plan at the end of Task 2.

Task 3: Reclaimed Water Potential and Demand Assessment Survey

With the assistance of CAGECE personnel, the U.S. Firm shall conduct a survey to identify and establish the potential universe of customers for reclaimed water in the Study area. The survey shall identify specific reclaimed water quality and quantity requirements and assess the willingness to pay for the proposed service. The U.S. Firm and CAGECE shall contact institutions with vested interests in the use of treated wastewater in the Study area. The survey shall identify the location of all potential customers. Data obtained from the survey shall be compiled in a computerized Excel database and shall be presented in a report using a Geographic Information System (GIS). The U.S. Firm shall present the results of the survey in a one-day presentation with appropriate CAGECE officials to discuss the estimated reclaimed water demand and pricing policy.

Deliverable #2: The U.S. Firm shall prepare and submit the Reclaimed Water Demand Survey Report at the end of Task 3.

Task 4: Review of Reclaimed Water Quality and Regulatory Requirements

The U.S. Firm shall investigate, obtain and review all reclaimed water regulatory requirements under current applicable regulations. These shall include, but will not be limited to, water quality requirements for water reuse and environmental discharge. In the event that the water quality standards specified in the local regulations preclude the use of reclaimed water for the intended use, the U.S. Firm, in agreement with accepted professional practice, shall propose the adoption of international standards, such as the State of California water quality standards, for water reuse.

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The U.S. Firm shall identify the necessary reclaimed water system sampling and analysis required to assert that it meets the water quality demanded by the potential reclaimed water users and any regulatory permits.

Deliverable #3: The U.S. Firm shall prepare and submit the Reclaimed Water Quality and Regulatory Requirements Report at the end of Task 4.

Task 5: Establish Projected Reclaimed Water Flows for Wastewater Treatment

The U.S. Firm shall assess the wastewater flow to be treated at the wastewater treatment plant (WWTP). The design flow shall be determined based on CAGECE's specific community master plan and survey conducted in Task 3 and on the technological constraints identified by the U.S. Firm. The U.S. Firm shall establish the quantity of wastewater to be treated at the WWTP including a definition of the average, peak and seasonal variations of the flow in terms of quality and quantity.

Deliverable #4: The U.S. Firm shall prepare and submit the Tertiary Treatment Wastewater Flow Rate Report at the end of Task 5.

Task 6: Wastewater Treatment Technologies Evaluation

The U.S. Firm shall assess various wastewater treatment technologies to meet the water quality requirements of the Project.

Subtask 6.1 Establishing Design Criteria

The U.S. Firm shall work closely with CAGECE to establish the appropriate design criteria for the various components of the WWTP, including sludge management facilities. In concert with CAGECE, the U.S. Firm shall establish the power source and cost for the Project. The U.S. Firm shall prepare the design criteria for the reclaimed water storage, conveyance and distribution pipelines and related appurtenances such as pump stations. As indicated in Task 4, when establishing appropriate design parameters, the U.S. Firm shall take local and international regulations on wastewater treatment for industrial and municipal reuse into account.

Subtask 6.2 Evaluation of Wastewater Treatment Alternatives

The U.S. Firm shall identify, describe and evaluate viable wastewater treatment alternatives. The U.S. Firm shall identify alternatives based on:

- actual wastewater characteristics (quantity and quality);
- water quality requirements for reuse;
- land availability;
- implementation costs;
- energy requirements; and

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- operation and maintenance (O&M) factors.

The U.S. Firm shall identify all components of the tertiary wastewater management systems including, but not limited to:

- Pumps;
- MBRs;
- SBRs;
- Ultra Filtration (UF);
- Reverse Osmosis; and
- UV units.

The U.S. Firm shall prepare a conceptual design for each tertiary wastewater management alternative and sludge handling facility including the potential for energy generation systems such as anaerobic digestion, gasifiers and reciprocating engines. The technical details of each alternative shall include:

- pipeline sizes and alignment;
- pump stations;
- process flow diagrams;
- site layouts;
- hydraulic profiles; and
- equipment lists.

In addition, the U.S. Firm shall assess alternative pipeline materials. The U.S. Firm shall perform a detailed evaluation of potentially viable alternatives. Criteria to be used in the evaluation shall include, but will not be limited to:

- expected effectiveness and reliability;
- health risks and environmental concerns;
- implementability and constructability;
- expandability;
- operational considerations;
- energy cost-effectiveness; and ability to be implemented in phases.

As part of the evaluation the U.S. Firm shall prepare and articulate a comprehensive cost analysis of the alternatives that includes life cycle costs, present costs, and cost/benefits ratio. At the end of this subtask CAGECE, in consultation with the U.S. Firm, shall select the preferred alternative.

Deliverable #5: The U.S. Firm shall prepare and submit the Tertiary Wastewater Treatment Alternatives Evaluation Report at the end of subtask 6.2.

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Subtask 6.3 Preliminary Design

The U.S. Firm shall prepare the preliminary design of the infrastructure under the preferred alternative selected in subtask 6.2. The infrastructure shall include, but will not be limited to, pump stations, electrical, mechanical and process automation equipment for the wastewater and sludge treatment systems, discharge pipelines, and the preliminary design of reclaimed water storage, conveyance and distribution pipelines. Any required topographic and geotechnical surveys will be conducted by CAGECE. The overall preliminary design for the Project shall be presented in a descriptive and schematic form. The preliminary design will be discussed with CAGECE prior to its completion.

Deliverable #6: The U.S. Firm shall prepare and submit the Preliminary Design Report at the end of Task 6.

Task 7: Current Automated Water Supply Control System (CECOP) and Automated Sewage Control System (CECOE) Technology Evaluation

The U.S. Firm shall assess the CECOP and CECOIE capabilities in relation to the objectives and requirements of the Study. The U.S. Firm shall work closely with CAGECE to establish the framework to improve supervisory control and data acquisition (SCADA) technologies for CECOP and CECOIE operation and meet the objectives of the Project. The U.S. Firm shall establish a baseline starting-point to compare any anticipated improvements that can be measured after implementation of the Project.

The U.S. Firm shall evaluate and identify data, hardware, software, staffing levels, and other resource requirements for implementing and supporting the long-term operation of the improved CECOP and CECOIE systems. The U.S. Firm shall provide the software and hardware's technical specifications for the successful implementation of the Project.

Task 8: Gaviao Water Treatment Plant Scada Technology Evaluation

The U.S. Firm shall conduct a study to identify and select the Gaviao water treatment control and monitoring technology. The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system.

The study shall take into account data availability, data formats, water treatment staff availability and their skill levels, and other factors identified by the U.S. Firm to insure the success of the Gaviao remote control and monitoring system. The Project involves developing the SCADA capability necessary to establish the water quality monitoring and reporting processes and meet the Project objectives. The U.S. Firm shall provide the monitoring equipment, software and hardware technical specifications for the successful implementation of the Project.

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Task 9: Wastewater Management Control Center (CIWWSA) Scada Technology Evaluation

The U.S. Firm shall conduct a study to identify and select the CIWWSA information management technology. The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system.

The study shall take into account CECOP, CECOFE and ETA GAVIAO data availability, data formats, staff availability and their skill-levels, and other factors identified by the U.S. Firm to insure the success of the CIWWSA remote operation control and monitoring system. The Project involves developing the SCADA capability necessary to establish monitoring and reporting and meet Project objectives. The U.S. Firm shall provide the software and hardware technical specifications for the successful implementation of the Project.

Task 10: Technical and Economic Analysis of the Wastewater Treatment Project

The U.S. Firm shall conduct and articulate a detailed feasibility analysis of the WWTP design developed in Task 6.

Subtask 10.1 Technical Assessment

The technical assessment shall include, but will not be limited to, the analysis of the following factors:

- Engineering and design parameters, complexity, and limitations;
- Constructability with identification of major problem areas;
- Operability including operating costs;
- Maintenance requirements, personnel needs and costs;
- Long-term adaptability and effects on the wastewater treatment system;
- Cost-effectiveness of the sludge management system; and
- Life cycle costs.

Subtask 10.2 Economic Analysis

The U.S. Firm shall conduct an economic assessment of the Project based on a set of indicators that may include, but will not be limited to, the effect of wastewater reclamation and reuse on municipal water use and industrial output.

The U.S. Firm shall examine the economic benefits of using reclaimed water in the service area as opposed to using the utility water system. The U.S. Firm shall estimate the economic and financial impacts of the investment by comparing current water use and availability conditions (without the Project) to future potential water use and availability scenarios (with the Project).

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Subtask 10.3 Financial Analysis

The U.S. Firm shall prepare a financial plan for the implementation of the Project that addresses CAGECE's needs in seeking donor or capital market financing. This shall include an assessment of alternative financing approaches such as Public Private Partnerships (e.g. Build-Own-Transfer, or BOT). The financial plan shall also satisfy the requirements of all prospective funding institutions that will be identified by CAGECE at the onset of the Study. In consultation with CAGECE, the U.S. Firm shall assess the potential interest of the U.S. Export-Import Bank, Inter-American Development Bank, World Bank and other local and international financial institutions interested in lending support to the Project.

The financial plan shall include, but will not be limited to, a detailed analysis of the proposed debt-equity structure and a full description of the cost-recovery program required for the self-sustainability of the Project. The cost-recovery program shall take into account:

- the costs associated with the operation and maintenance of the Project;
- equipment and facilities depreciation;
- debt service; and
- anticipated equipment replacement costs.

The cost-recovery program shall contemplate a replacement account such as a trust fund for the self-sustainability of the Project. All sources of revenue must be identified.

Subtask 10.4 Socioeconomic Impacts

The U.S. Firm shall identify, discuss and analyze short-term and long-term impacts on human health and wellbeing, employment, income, education, agricultural production, and commercial, municipal and industrial activity that may result from the implementation of the Project.

Deliverable #7: The U.S. Firm shall prepare and submit a WWTP Feasibility Evaluation Report at the end of Task 10.

Task 11: Technical and Economic Analysis for the Automated Water and Sewage Control System

The U.S. Firm shall conduct a study to evaluate software and hardware alternatives for the SCADA system. Evaluations shall include, but shall not be limited to, controllers, communications, and control centers for the implementation and the successful operation of all components of the Project outlined in Tasks 7, 8 and 9.

The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system. Specific actions to be carried out shall include, but will not be limited to:

1. Review of the Brazilian telemetry regulatory framework;



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2. Review of any existing telemetry system and required expansion and upgrade;
3. Coordination of the telemetry system's planning aspects with CAGECE;
4. Evaluation of the telemetry system and SCADA workstation system;
5. Review of current telemetry system topology, transmission modes and link media;
6. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in water treatment at Gaviao;
7. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in water conveyance and distribution;
8. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in wastewater conveyance, treatment and disposal;
9. Development of a telemetry/SCADA system to meet intended expansion and upgrade requirements;
10. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the CECO, CECOP and Gaviao at the CIWWSA;
11. Preparation of block diagrams for the proposed SCADA systems;
12. Estimation of cost of the required SCADA system;
13. Development of information and data for the feasibility study report; and
14. Development of information and data for the telemetry network and SCADA system presentation required in Task 16.

The U.S. Firm shall evaluate the benefits of the Project as they relate to CAGECE operations management and commercial and business reporting requirements.

The U.S. Firm shall conduct and articulate a detailed analysis of the Project developed above. The U.S. Firm shall assess the technical, economic, financial, and regulatory feasibility associated with the Project. The Study shall include a detailed estimate of what the Project's full implementation would cost. The Study shall also estimate the economic and financial impacts of the investment by comparing current (without the Project) socioeconomic conditions to future (with successful implementation of the Project) anticipated socioeconomic conditions.

The Study shall also provide documentation required to competitively procure the equipment and information technology systems needed for full implementation of the Project.

Subtask 11.1 Technical Assessment

The U.S. Firm shall prepare a technical assessment that includes, but will not be limited to, the analysis of the following factors:

- Water and wastewater system operational reliability;
- Ease of access to real-time and historical data;
- SCADA systems capital and operating costs (life cycle costs);
- SCADA modular design;



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- SCADA system maintenance;
- SCADA communication reliability;
- SCADA operator training requirements;

Subtask 11.2 Economic Analysis

The U.S. Firm shall prepare an economic analysis to assess the full implementation of the Project based on a set of socioeconomic indicators including, but not limited to, the increased/decreased cost of implementing the Project on water and wastewater systems users. The U.S. Firm shall examine the economic benefits of the Project as compared to using the existing water system management technology. The analysis shall take into account all avoidable non-revenue water and improved water and wastewater operation as well as water management costs associated with the Project.

The U.S. Firm shall estimate the economic and financial impacts of investment by comparing current socioeconomic conditions (without the full implementation of the Project) to future potential socioeconomic scenarios (with the full implementation of the Project).

Subtask 11.3 Financial Analysis

As part of the study the U.S. Firm shall prepare a financial analysis to fully implement the Project. The financial analysis shall satisfy CAGECE's requirements. The financial analysis shall include, but will not be limited to, a detailed analysis of the proposed debt-equity structure and a full description of the cost-recovery program required for self-sustainability of the Project.

The cost-recovery program shall take into account costs associated with the operation and maintenance of the Project in addition to the debt service and the cost of software and hardware replacement as needed. As future significant capital expenditures will be made to replace, update, and/or upgrade the Project equipment, the U.S. Firm shall include these cost components in the financial analysis. All potential sources of revenue shall be identified.

As part of this task, the U.S. Firm shall meet with CAGECE to discuss the financial analysis results and obtain support for the implementation of the Project.

Subtask 11.4 Socioeconomic Impact Analysis

The U.S. Firm shall identify, discuss and analyze the short-term and long-term impacts on human health and well-being, employment, income, education, business growth, economic production, and commercial and industrial activity that may result from the implementation of the Project.

Deliverable #8: The U.S. Firm shall prepare and submit the Automated Water and Sewage Control System Feasibility Evaluation Report at the end of Task 11.



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Task 12: Preliminary Environmental Assessment

CAGECE shall provide the required data and information for the analysis of the Project's potential ecological impacts.

The U.S. Firm shall conduct a preliminary environmental impact study for the implementation of the Project with reference to local requirements and multi-lateral lending agencies (such as the World Bank). This review shall identify potential negative impacts of the Project. The U.S Firm shall briefly discuss the extent to which potential negative impacts can be mitigated, and develop plans for full environmental impact assessment or other studies in anticipation of the Project moving forward to the implementation stage, if necessary.

Task 13: Developmental Impact Assessment

The U.S. Firm shall analyze the developmental impacts of implementing the recommendations for water technologies in Brazil. The developmental impact analysis shall include an assessment of each of the following categories:

Infrastructure: A description of the infrastructure created as a result of the Project such as municipal infrastructure that reduces public health risks, enhances economic productivity, deters environmental deterioration and promotes social wellbeing and economic growth.

Building Human Capacity: The number and type of positions that will likely be created as a result of the Project. The U.S. Firm shall distinguish between temporary jobs and permanent jobs and comment on the prospect of any training recommended in the Final Report, including an estimate of the number of people to be trained, type of training required and desired outcome of training.

Technology Transfer and Productivity Improvement: A description of any advanced technologies that may be implemented as a result of the Project. The U.S. Firm shall provide a description of any efficiency that has or would be gained through the implemented technologies. The U.S. Firm shall discuss how the Project can be replicated in other parts of Brazil to generate water and wastewater systems tangible economic benefits.

Other: Any other direct or indirect developmental benefits to the Project. These may include spin-off or demonstration effects; improved security; increases in industrial productivity; investments; employment generation, collection of taxes, and impacts on businesses; and the creation of indirect jobs that are not captured in the four categories listed above.

Task 14: Analysis of US Sources of Supply

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The U.S. Firm shall estimate the scale of the expected acquisition of technology for the implementation of the Project. The U.S. Firm shall assess the availability of U.S. manufactured equipment and products for all components of the Project. The U.S. Firm shall provide detailed technical specifications of the U.S. manufactured equipment and include business name, website, point of contact, address, telephone and fax numbers, and an email address for each manufacturer. The U.S. Firm shall contact the U.S. manufacturers identified in Task 14 and discuss their potential interest in the Project and include this information in the Final Report.

Deliverable #9: Report on U.S. Manufacturers of Wastewater Treatment and Reclamation Technology and SCADA Technology

Task 15: Project Implementation Plans

The U.S. Firm shall prepare an Implementation Plan that describes and documents the timeframe and financial resources available for the implementation of the Project. The Implementation Plan shall provide detailed information on CAGECE's confirmed schedule for the design, acquisition and deployment of the wastewater reclamation system. The Implementation Plan shall contain an overview of the wastewater reclamation system, a brief description of the major tasks involved in the implementation, the overall resources needed to support the implementation effort (such as hardware, software, facilities, materials, and personnel), and any site-specific implementation requirements. The Implementation Plan shall be developed by the U.S. Firm in concert with CAGECE and shall take into account other requirements of local government institutions and stakeholders with vested interest in the Project including the stakeholders identified during Tasks 1, 2, 3, 7, 8 and 9.

The U.S. Firm shall prepare an overall plan for the implementation of each of the Project's components (primary, secondary, tertiary wastewater treatment, sludge facilities and reclaimed water conveyance for reuse).

Deliverable #10: Project Implementation Plan

Task 16: Presentation of Draft Final Report

The U.S. Firm shall present the findings of the Study in Brazil. The presentation shall be a full day event divided into two sessions. The first session shall discuss the results and recommendations of the Study. The second session is aimed at addressing audience questions regarding specific applications. The presentation audience shall include personnel from CAGECE and other stakeholders identified while performing Tasks 1, 2, 3, 7, 8, and 9.

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Task 17: Final Report

The U.S. Firm shall prepare and provide a comprehensive Final Report to CAGECE, which shall contain an Executive Summary, key findings, recommendations and conclusions of the Study, and shall incorporate all other documents and/or reports provided pursuant to Tasks 1 through 16 above. Each task of these Terms of Reference shall form a separate chapter of the Final Report.

The U.S. Firm shall also identify the availability of potential U.S. sources of supply and prepare a U.S. supplier list which shall outline potential U.S. sources for procurement of goods and services necessary to develop the solid waste derived energy recovery facilities. The list shall include business name, point of contact, address, telephone and fax numbers for each commercial source, as well as a general description of products and services that may be procured

The U.S. Firm shall ensure that the Final Report is submitted in accordance with Clause I of Annex II of the Grant Agreement. The U.S. Firm shall provide six (3) hard copies and one (1) electronic version of both the confidential and public versions of the Final Report to CAGECE and one (1) hard copy of both the confidential and public versions of the Final Report. The CD-ROM version of the final report will include:

- Portable Document File (PDF) readable copies of all documents;
- Source files for all drawings in AutoCad or Visio format; and
- Source files for all documents.

The U.S. Firm shall provide a copy to USTDA and the U.S. Consulate in Sao Paulo in English in accordance with Clause I of Annex II of the Grant Agreement.

Notes:

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

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Annex II

USTDA Mandatory Agreement of Understanding Clauses

A. USTDA Mandatory Clauses Controlling

The parties to this Agreement of Understanding to Perform the Feasibility Study ("Agreement of Understanding") acknowledge that this Agreement of Understanding 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 the Ceará Water and Sewage Treatment Company (CAGECE) ("Client"), dated _____ ("Grant Agreement"). The Client has selected _____ ("U.S. Firm") to perform the Study ("Study") for the CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project ("Project") in Brazil ("Host Country"). Notwithstanding any other provisions of this Agreement of Understanding, the following USTDA Mandatory Agreement of Understanding Clauses shall govern. All sub-agreements entered into by the U.S. Firm funded or partially funded with USTDA Grant funds shall include these USTDA Mandatory Agreement of Understanding 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 Agreement of Understanding or sub-agreement thereunder, the Grant Agreement shall be controlling.

B. USTDA as Financier

(1) USTDA Approval of Agreement of Understanding

All agreements of understanding funded under the Grant Agreement, and any amendments thereto, including assignments and changes in the Terms of Reference, 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 Agreement of Understanding has been formally approved by USTDA or until the Agreement of Understanding conforms to modifications required by USTDA during the Agreement of Understanding review process.

(2) USTDA Not a Party to the Agreement of Understanding

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 this Agreement of Understanding and amendments thereto, including assignments, the selection of all U.S. Firms, the Terms of Reference, the Final Report, and any and all documents related to any Agreement of Understanding 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



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exercising these approval rights shall be made as an intermediate financier in the course of financing the Study and shall not be construed as making USTDA a party to the Agreement of Understanding. 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 Agreement of Understanding or any sub-agreement, 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 Client or USTDA from asserting any right they might have against the U.S. Firm, or relieve the U.S. Firm of any liability which the U.S. Firm 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 services funded by USTDA under the Grant Agreement: (a) for professional services, the U.S. Firm must be either a U.S. firm or U.S. individual; (b) the U.S. Firm 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 sub-agreement; (c) employees of the U.S. Firm or U.S. subcontractors 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 performance 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 provisions upon request.

D. Recordkeeping and Audit

The U.S. Firm 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 Agreement of Understanding. 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 Agreement of Understanding term and for a period of three (3) years after final disbursement by USTDA. The U.S. Firm 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.

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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 U.S. Firm shall provide adequate Workman's Compensation Insurance coverage for work performed under this Agreement of Understanding.

G. Reporting Requirements

The U.S. Firm 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 Study. In addition, if at any time the U.S. Firm receives follow-on work from the Client, the U.S. Firm shall so notify USTDA and designate the U.S. Firm's contact point including name, telephone and fax number. Since this information may be made publicly available by USTDA, any information which is confidential shall be designated as such by the U.S. Firm 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 Agreement of Understanding

Disbursement of Grant funds will be made only after USTDA approval of this Agreement of Understanding. To make this review in a timely fashion, USTDA must receive from either the Client or the U.S. Firm a photocopy of an English language version of a signed Agreement of Understanding or a final negotiated draft version to the attention of the General Counsel's office at USTDA's address listed in Clause M below.

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(2) Payment Schedule Requirements

A payment schedule for disbursement of Grant funds to the U.S. Firm shall be included in this Agreement of Understanding. 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 Agreement of Understanding performance milestones; and (3) the final payment may be no less than fifteen percent (15%) of the total USTDA Grant amount, payable upon receipt by USTDA of an approved Final Report in accordance with the specifications and quantities set forth in Clause I below. Invoicing procedures for all payments are described below.

(3) U.S. Firm Invoice Requirements

USTDA will make all disbursements of USTDA Grant funds directly to the U.S. Firm. The U.S. Firm 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 U.S. Firm for performance of the contract by submitting the following to USTDA:

(a) U.S. Firm's Invoice

The U.S. Firm's invoice shall include reference to an item listed in the Agreement of Understanding payment schedule, the requested payment amount, and an appropriate certification by the U.S. Firm, as follows:

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

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

(ii) For Agreement of Understanding performance milestone payments:

"The U.S. Firm has performed the work described in this invoice in accordance with the terms of its Agreement of Understanding with the Client and is entitled to payment thereunder. To the extent the U.S. Firm has not complied with the terms and conditions of the Agreement of Understanding, including the USTDA mandatory provisions contained therein, it will, upon USTDA's request, make an appropriate refund to USTDA."

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(iii) For final payment:

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

(b) Client's Approval of the U.S. Firm's Invoice

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

(ii) For Agreement of Understanding 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 U.S. Firm have been performed satisfactorily, in accordance with applicable Agreement of Understanding 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 U.S. Firm have been performed satisfactorily, in accordance with applicable Agreement of Understanding provisions and terms and conditions of the USTDA Grant Agreement. The Final Report submitted by the U.S. Firm has been reviewed and approved by the Client. "

(c) USTDA Address for Disbursement Requests

Requests for disbursement shall be submitted by courier or mail to the attention of the Finance Department at USTDA's address listed in Clause M below.

(4) Termination

In the event that the Agreement of Understanding is terminated prior to completion, the U.S. Firm will be eligible, subject to USTDA approval, for reasonable and documented costs which have been incurred in performing the Terms of Reference prior to termination, as well as reasonable wind down expenses. Reimbursement for such costs shall not exceed the total amount of undisbursed Grant funds. Likewise, in



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the event of such termination, USTDA is entitled to receive from the U.S. Firm all USTDA Grant funds previously disbursed to the U.S. Firm (including but not limited to mobilization payments) which exceed the reasonable and documented costs incurred in performing the Terms of Reference prior to termination.

I. 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 U.S. Firm shall provide the following to USTDA:

(a) One (1) complete version 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 U.S. Firm 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) 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 U.S. Firm to ensure that no confidential information is contained on the CD-ROMs.

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The U.S. Firm shall also provide one (1) copy of the Public Version of the Final Report to the Foreign Commercial Service Officer or the 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 U.S. Firm who prepared the report, a report title, USTDA's logo, USTDA's mailing and delivery addresses. If the complete version of the Final Report contains confidential information, the U.S. Firm shall be responsible for labeling the front cover of that version of the Final Report with the term "Confidential Version." The U.S. Firm 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 mailing and delivery addresses, and USTDA's mission statement. Camera-ready copy of USTDA Final Report specifications will be available from USTDA upon request.

(c) The U.S. Firm 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 U.S. Firm who prepared the report, a report title and the following language:

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

(d) The U.S. Firm 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 shall be included for U.S. Firm and each subcontractors.

(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 shall be included for each commercial source.



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(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.

J. Modifications

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

K. Study Schedule

(1) Study Completion Date

The completion date for the Study, which is December 31, 2013, is the date by which the parties estimate that the Study 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 Agreement of Understanding for goods and services which are provided prior to the Effective Date of the Grant Agreement; and (b) all funds made available under the Grant Agreement must be disbursed within four (4) years from the Effective Date of the Grant Agreement.

L. Business Practices

The U.S. Firm agrees not to pay, promise to pay, or authorize the payment of any money or anything of value, directly or indirectly, to any person (whether a governmental official or private individual) for the purpose of illegally or improperly inducing anyone to take any action favorable to any party in connection with the Study. The Client agrees not to receive any such payment. The U.S. Firm and the Client agree that each will require that any agent or representative hired to represent them in connection with the Study will comply with this paragraph and all laws which apply to activities and obligations of each party under this Agreement of Understanding, including but not limited to those laws and obligations dealing with improper payments as described above.

M. USTDA Address and Fiscal Data

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

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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.: 1112/131001
Activity No.: 2012-51013A
Reservation No.: 2012127
Grant No.: GH201251127

N. Definitions

All capitalized terms not otherwise defined herein shall have the meaning set forth in the Grant Agreement.

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. Neither the Client nor the U.S. Firm will seek reimbursement from USTDA for such taxes, tariffs, duties, fees or other levies.

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ANNEX 5

Annex I

Terms of Reference

Objective

The objective of the feasibility study for the CAGECE Tertiary Wastewater Treatment Plants and Automated Water and Sewage Control System Project ("Study") is to assist the Ceará Water and Sewage Treatment Company (CAGECE) assess wastewater tertiary treatment technologies for sewage generated in the Siqueira and Miriu areas of Fortaleza that will provide wastewater reclamation and reuse capability within the metropolitan area.

The Study will also evaluate improvements to the automated water supply control system and automated sewage control system operated in Fortaleza, as well as the possibility of adding remote process control and monitoring capability at its Gaviao water treatment plant, and assessment of technology for an enhanced integrated automated water supply and wastewater management control center.

The Study tasks are as follows:

Task 1: Detailed Data Collection and Review

Some data may be in Portuguese, and it will be the U.S. Firm's responsibility to translate the information for its use, if needed.

The U.S. Firm shall commence the work by becoming familiar with the wastewater treatment plants environmental setting. CAGECE shall provide to the U.S. Firm all information it has that is necessary for completing this Study. The U.S. Firm shall review all information provided by CAGECE and any other available information applicable to the Project. As a result of this task the U.S. Firm shall become fully acquainted with the service areas, its potential water reuse customers, the requirements of the wastewater treatment plant effluent, and the scope of technical services to satisfy the requirements of the assignment and begin drafting an Inception Report.

The U.S. Firm shall also review and become familiar with CAGECE's automated water supply control (CECOP) and automated sewage control (CECOE) systems, the Gaviao water treatment plant, and the integrated automated water supply and wastewater management control center (CIWWSA) planning details. The U.S. Firm shall review all information provided by CAGECE and any other available information applicable to the Project including the technical details of the CAGECE water supply and wastewater management systems and commercial operations. As part of this task, the U.S. Firm shall meet with CAGECE officials, CECOP and CECO systems' operators and other relevant stakeholders. At the end of this task, the U.S. Firm shall become thoroughly familiar

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with CAGECE's expectations in order to successfully satisfy the requirements of the Study. Local transportation within Fortaleza shall be provided by CAGECE.

Task 2: Project Management Plan and Kickoff

The U.S. Firm shall meet with all relevant stakeholders, including CAGECE personnel, regulatory agencies and stakeholders identified while performing Task 1. The U.S. Firm shall organize a one-day kickoff meeting for the stakeholders including the U.S. Firm staff, CAGECE personnel, CECOP and CECO operators, and Gaviao and CIWWSA representatives at the start of the Project to exchange ideas and develop an integrated work plan for all components of the Project. The U.S. Firm shall prepare an Inception Report that includes a detailed project management plan outlining the responsibilities of each entity and professionals participating in the Study.

Deliverable #1: The U.S. Firm shall prepare and submit the Inception Report and Project Management Plan at the end of Task 2.

Task 3: Reclaimed Water Potential and Demand Assessment Survey

With the assistance of CAGECE personnel, the U.S. Firm shall conduct a survey to identify and establish the potential universe of customers for reclaimed water in the Study area. The survey shall identify specific reclaimed water quality and quantity requirements and assess the willingness to pay for the proposed service. The U.S. Firm and CAGECE shall contact institutions with vested interests in the use of treated wastewater in the Study area. The survey shall identify the location of all potential customers. Data obtained from the survey shall be compiled in a computerized Excel database and shall be presented in a report using a Geographic Information System (GIS). The U.S. Firm shall present the results of the survey in a one-day presentation with appropriate CAGECE officials to discuss the estimated reclaimed water demand and pricing policy.

Deliverable #2: The U.S. Firm shall prepare and submit the Reclaimed Water Demand Survey Report at the end of Task 3.

Task 4: Review of Reclaimed Water Quality and Regulatory Requirements

The U.S. Firm shall investigate, obtain and review all reclaimed water regulatory requirements under current applicable regulations. These shall include, but will not be limited to, water quality requirements for water reuse and environmental discharge. In the event that the water quality standards specified in the local regulations preclude the use of reclaimed water for the intended use, the U.S. Firm, in agreement with accepted professional practice, shall propose the adoption of international standards, such as the State of California water quality standards, for water reuse.

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The U.S. Firm shall identify the necessary reclaimed water system sampling and analysis required to assert that it meets the water quality demanded by the potential reclaimed water users and any regulatory permits.

Deliverable #3: The U.S. Firm shall prepare and submit the Reclaimed Water Quality and Regulatory Requirements Report at the end of Task 4.

Task 5: Establish Projected Reclaimed Water Flows for Wastewater Treatment

The U.S. Firm shall assess the wastewater flow to be treated at the wastewater treatment plant (WWTP). The design flow shall be determined based on CAGECE's specific community master plan and survey conducted in Task 3 and on the technological constraints identified by the U.S. Firm. The U.S. Firm shall establish the quantity of wastewater to be treated at the WWTP including a definition of the average, peak and seasonal variations of the flow in terms of quality and quantity.

Deliverable #4: The U.S. Firm shall prepare and submit the Tertiary Treatment Wastewater Flow Rate Report at the end of Task 5.

Task 6: Wastewater Treatment Technologies Evaluation

The U.S. Firm shall assess various wastewater treatment technologies to meet the water quality requirements of the Project.

Subtask 6.1 Establishing Design Criteria

The U.S. Firm shall work closely with CAGECE to establish the appropriate design criteria for the various components of the WWTP, including sludge management facilities. In concert with CAGECE, the U.S. Firm shall establish the power source and cost for the Project. The U.S. Firm shall prepare the design criteria for the reclaimed water storage, conveyance and distribution pipelines and related appurtenances such as pump stations. As indicated in Task 4, when establishing appropriate design parameters, the U.S. Firm shall take local and international regulations on wastewater treatment for industrial and municipal reuse into account.

Subtask 6.2 Evaluation of Wastewater Treatment Alternatives

The U.S. Firm shall identify, describe and evaluate viable wastewater treatment alternatives. The U.S. Firm shall identify alternatives based on:

- actual wastewater characteristics (quantity and quality);
- water quality requirements for reuse;
- land availability;
- implementation costs;
- energy requirements; and

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- operation and maintenance (O&M) factors.

The U.S. Firm shall identify all components of the tertiary wastewater management systems including, but not limited to:

- Pumps;
- MBRs;
- SBRs;
- Ultra Filtration (UF);
- Reverse Osmosis; and
- UV units.

The U.S. Firm shall prepare a conceptual design for each tertiary wastewater management alternative and sludge handling facility including the potential for energy generation systems such as anaerobic digestion, gasifiers and reciprocating engines. The technical details of each alternative shall include:

- pipeline sizes and alignment;
- pump stations;
- process flow diagrams;
- site layouts;
- hydraulic profiles; and
- equipment lists.

In addition, the U.S. Firm shall assess alternative pipeline materials. The U.S. Firm shall perform a detailed evaluation of potentially viable alternatives. Criteria to be used in the evaluation shall include, but will not be limited to:

- expected effectiveness and reliability;
- health risks and environmental concerns;
- implementability and constructability;
- expandability;
- operational considerations;
- energy cost-effectiveness; and ability to be implemented in phases.

As part of the evaluation the U.S. Firm shall prepare and articulate a comprehensive cost analysis of the alternatives that includes life cycle costs, present costs, and cost/benefits ratio. At the end of this subtask CAGECE, in consultation with the U.S. Firm, shall select the preferred alternative.

Deliverable #5: The U.S. Firm shall prepare and submit the Tertiary Wastewater Treatment Alternatives Evaluation Report at the end of subtask 6.2.

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Subtask 6.3 Preliminary Design

The U.S. Firm shall prepare the preliminary design of the infrastructure under the preferred alternative selected in subtask 6.2. The infrastructure shall include, but will not be limited to, pump stations, electrical, mechanical and process automation equipment for the wastewater and sludge treatment systems, discharge pipelines, and the preliminary design of reclaimed water storage, conveyance and distribution pipelines. Any required topographic and geotechnical surveys will be conducted by CAGECE. The overall preliminary design for the Project shall be presented in a descriptive and schematic form. The preliminary design will be discussed with CAGECE prior to its completion.

Deliverable #6: The U.S. Firm shall prepare and submit the Preliminary Design Report at the end of Task 6.

Task 7: Current Automated Water Supply Control System (CECOP) and Automated Sewage Control System (CECOE) Technology Evaluation

The U.S. Firm shall assess the CECOP and CECOIE capabilities in relation to the objectives and requirements of the Study. The U.S. Firm shall work closely with CAGECE to establish the framework to improve supervisory control and data acquisition (SCADA) technologies for CECOP and CECOIE operation and meet the objectives of the Project. The U.S. Firm shall establish a baseline starting-point to compare any anticipated improvements that can be measured after implementation of the Project.

The U.S. Firm shall evaluate and identify data, hardware, software, staffing levels, and other resource requirements for implementing and supporting the long-term operation of the improved CECOP and CECOIE systems. The U.S. Firm shall provide the software and hardware's technical specifications for the successful implementation of the Project.

Task 8: Gaviao Water Treatment Plant Scada Technology Evaluation

The U.S. Firm shall conduct a study to identify and select the Gaviao water treatment control and monitoring technology. The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system.

The study shall take into account data availability, data formats, water treatment staff availability and their skill levels, and other factors identified by the U.S. Firm to insure the success of the Gaviao remote control and monitoring system. The Project involves developing the SCADA capability necessary to establish the water quality monitoring and reporting processes and meet the Project objectives. The U.S. Firm shall provide the monitoring equipment, software and hardware technical specifications for the successful implementation of the Project.

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Task 9: Wastewater Management Control Center (CIWWSA) Scada Technology Evaluation

The U.S. Firm shall conduct a study to identify and select the CIWWSA information management technology. The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system.

The study shall take into account CECOP, CECOFE and ETA GAVIAO data availability, data formats, staff availability and their skill-levels, and other factors identified by the U.S. Firm to insure the success of the CIWWSA remote operation control and monitoring system. The Project involves developing the SCADA capability necessary to establish monitoring and reporting and meet Project objectives. The U.S. Firm shall provide the software and hardware technical specifications for the successful implementation of the Project.

Task 10: Technical and Economic Analysis of the Wastewater Treatment Project

The U.S. Firm shall conduct and articulate a detailed feasibility analysis of the WWTP design developed in Task 6.

Subtask 10.1 Technical Assessment

The technical assessment shall include, but will not be limited to, the analysis of the following factors:

- Engineering and design parameters, complexity, and limitations;
- Constructability with identification of major problem areas;
- Operability including operating costs;
- Maintenance requirements, personnel needs and costs;
- Long-term adaptability and effects on the wastewater treatment system;
- Cost-effectiveness of the sludge management system; and
- Life cycle costs.

Subtask 10.2 Economic Analysis

The U.S. Firm shall conduct an economic assessment of the Project based on a set of indicators that may include, but will not be limited to, the effect of wastewater reclamation and reuse on municipal water use and industrial output.

The U.S. Firm shall examine the economic benefits of using reclaimed water in the service area as opposed to using the utility water system. The U.S. Firm shall estimate the economic and financial impacts of the investment by comparing current water use and availability conditions (without the Project) to future potential water use and availability scenarios (with the Project).

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Subtask 10.3 Financial Analysis

The U.S. Firm shall prepare a financial plan for the implementation of the Project that addresses CAGECE's needs in seeking donor or capital market financing. This shall include an assessment of alternative financing approaches such as Public Private Partnerships (e.g. Build-Own-Transfer, or BOT). The financial plan shall also satisfy the requirements of all prospective funding institutions that will be identified by CAGECE at the onset of the Study. In consultation with CAGECE, the U.S. Firm shall assess the potential interest of the U.S. Export-Import Bank, Inter-American Development Bank, World Bank and other local and international financial institutions interested in lending support to the Project.

The financial plan shall include, but will not be limited to, a detailed analysis of the proposed debt-equity structure and a full description of the cost-recovery program required for the self-sustainability of the Project. The cost-recovery program shall take into account:

- the costs associated with the operation and maintenance of the Project;
- equipment and facilities depreciation;
- debt service; and
- anticipated equipment replacement costs.

The cost-recovery program shall contemplate a replacement account such as a trust fund for the self-sustainability of the Project. All sources of revenue must be identified.

Subtask 10.4 Socioeconomic Impacts

The U.S. Firm shall identify, discuss and analyze short-term and long-term impacts on human health and wellbeing, employment, income, education, agricultural production, and commercial, municipal and industrial activity that may result from the implementation of the Project.

Deliverable #7: The U.S. Firm shall prepare and submit a WWTP Feasibility Evaluation Report at the end of Task 10.

Task 11: Technical and Economic Analysis for the Automated Water and Sewage Control System

The U.S. Firm shall conduct a study to evaluate software and hardware alternatives for the SCADA system. Evaluations shall include, but shall not be limited to, controllers, communications, and control centers for the implementation and the successful operation of all components of the Project outlined in Tasks 7, 8 and 9.

The U.S. Firm shall work with CAGECE to identify and determine the requirements of the overall SCADA and telemetry communication system. Specific actions to be carried out shall include, but will not be limited to:

1. Review of the Brazilian telemetry regulatory framework;



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2. Review of any existing telemetry system and required expansion and upgrade;
3. Coordination of the telemetry system's planning aspects with CAGECE;
4. Evaluation of the telemetry system and SCADA workstation system;
5. Review of current telemetry system topology, transmission modes and link media;
6. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in water treatment at Gaviao;
7. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in water conveyance and distribution;
8. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the processes involved in wastewater conveyance, treatment and disposal;
9. Development of a telemetry/SCADA system to meet intended expansion and upgrade requirements;
10. Identification and design of a telemetry/SCADA system to enable the proper monitoring and control of the CECOE, CECOP and Gaviao at the CIWWSA;
11. Preparation of block diagrams for the proposed SCADA systems;
12. Estimation of cost of the required SCADA system;
13. Development of information and data for the feasibility study report; and
14. Development of information and data for the telemetry network and SCADA system presentation required in Task 16.

The U.S. Firm shall evaluate the benefits of the Project as they relate to CAGECE operations management and commercial and business reporting requirements.

The U.S. Firm shall conduct and articulate a detailed analysis of the Project developed above. The U.S. Firm shall assess the technical, economic, financial, and regulatory feasibility associated with the Project. The Study shall include a detailed estimate of what the Project's full implementation would cost. The Study shall also estimate the economic and financial impacts of the investment by comparing current (without the Project) socioeconomic conditions to future (with successful implementation of the Project) anticipated socioeconomic conditions.

The Study shall also provide documentation required to competitively procure the equipment and information technology systems needed for full implementation of the Project.

Subtask 11.1 Technical Assessment

The U.S. Firm shall prepare a technical assessment that includes, but will not be limited to, the analysis of the following factors:

- Water and wastewater system operational reliability;
- Ease of access to real-time and historical data;
- SCADA systems capital and operating costs (life cycle costs);
- SCADA modular design;



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- SCADA system maintenance;
- SCADA communication reliability;
- SCADA operator training requirements;

Subtask 11.2 Economic Analysis

The U.S. Firm shall prepare an economic analysis to assess the full implementation of the Project based on a set of socioeconomic indicators including, but not limited to, the increased/decreased cost of implementing the Project on water and wastewater systems users. The U.S. Firm shall examine the economic benefits of the Project as compared to using the existing water system management technology. The analysis shall take into account all avoidable non-revenue water and improved water and wastewater operation as well as water management costs associated with the Project.

The U.S. Firm shall estimate the economic and financial impacts of investment by comparing current socioeconomic conditions (without the full implementation of the Project) to future potential socioeconomic scenarios (with the full implementation of the Project).

Subtask 11.3 Financial Analysis

As part of the study the U.S. Firm shall prepare a financial analysis to fully implement the Project. The financial analysis shall satisfy CAGECE's requirements. The financial analysis shall include, but will not be limited to, a detailed analysis of the proposed debt-equity structure and a full description of the cost-recovery program required for self-sustainability of the Project.

The cost-recovery program shall take into account costs associated with the operation and maintenance of the Project in addition to the debt service and the cost of software and hardware replacement as needed. As future significant capital expenditures will be made to replace, update, and/or upgrade the Project equipment, the U.S. Firm shall include these cost components in the financial analysis. All potential sources of revenue shall be identified.

As part of this task, the U.S. Firm shall meet with CAGECE to discuss the financial analysis results and obtain support for the implementation of the Project.

Subtask 11.4 Socioeconomic Impact Analysis

The U.S. Firm shall identify, discuss and analyze the short-term and long-term impacts on human health and well-being, employment, income, education, business growth, economic production, and commercial and industrial activity that may result from the implementation of the Project.

Deliverable #8: The U.S. Firm shall prepare and submit the Automated Water and Sewage Control System Feasibility Evaluation Report at the end of Task 11.



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Task 12: Preliminary Environmental Assessment

CAGECE shall provide the required data and information for the analysis of the Project's potential ecological impacts.

The U.S. Firm shall conduct a preliminary environmental impact study for the implementation of the Project with reference to local requirements and multi-lateral lending agencies (such as the World Bank). This review shall identify potential negative impacts of the Project. The U.S Firm shall briefly discuss the extent to which potential negative impacts can be mitigated, and develop plans for full environmental impact assessment or other studies in anticipation of the Project moving forward to the implementation stage, if necessary.

Task 13: Developmental Impact Assessment

The U.S. Firm shall analyze the developmental impacts of implementing the recommendations for water technologies in Brazil. The developmental impact analysis shall include an assessment of each of the following categories:

Infrastructure: A description of the infrastructure created as a result of the Project such as municipal infrastructure that reduces public health risks, enhances economic productivity, deters environmental deterioration and promotes social wellbeing and economic growth.

Building Human Capacity: The number and type of positions that will likely be created as a result of the Project. The U.S. Firm shall distinguish between temporary jobs and permanent jobs and comment on the prospect of any training recommended in the Final Report, including an estimate of the number of people to be trained, type of training required and desired outcome of training.

Technology Transfer and Productivity Improvement: A description of any advanced technologies that may be implemented as a result of the Project. The U.S. Firm shall provide a description of any efficiency that has or would be gained through the implemented technologies. The U.S. Firm shall discuss how the Project can be replicated in other parts of Brazil to generate water and wastewater systems tangible economic benefits.

Other: Any other direct or indirect developmental benefits to the Project. These may include spin-off or demonstration effects; improved security; increases in industrial productivity; investments; employment generation, collection of taxes, and impacts on businesses; and the creation of indirect jobs that are not captured in the four categories listed above.

Task 14: Analysis of US Sources of Supply



The U.S. Firm shall estimate the scale of the expected acquisition of technology for the implementation of the Project. The U.S. Firm shall assess the availability of U.S. manufactured equipment and products for all components of the Project. The U.S. Firm shall provide detailed technical specifications of the U.S. manufactured equipment and include business name, website, point of contact, address, telephone and fax numbers, and an email address for each manufacturer. The U.S. Firm shall contact the U.S. manufacturers identified in Task 14 and discuss their potential interest in the Project and include this information in the Final Report.

Deliverable #9: Report on U.S. Manufacturers of Wastewater Treatment and Reclamation Technology and SCADA Technology

Task 15: Project Implementation Plans

The U.S. Firm shall prepare an Implementation Plan that describes and documents the timeframe and financial resources available for the implementation of the Project. The Implementation Plan shall provide detailed information on CAGECE's confirmed schedule for the design, acquisition and deployment of the wastewater reclamation system. The Implementation Plan shall contain an overview of the wastewater reclamation system, a brief description of the major tasks involved in the implementation, the overall resources needed to support the implementation effort (such as hardware, software, facilities, materials, and personnel), and any site-specific implementation requirements. The Implementation Plan shall be developed by the U.S. Firm in concert with CAGECE and shall take into account other requirements of local government institutions and stakeholders with vested interest in the Project including the stakeholders identified during Tasks 1, 2, 3, 7, 8 and 9.

The U.S. Firm shall prepare an overall plan for the implementation of each of the Project's components (primary, secondary, tertiary wastewater treatment, sludge facilities and reclaimed water conveyance for reuse).

Deliverable #10: Project Implementation Plan

Task 16: Presentation of Draft Final Report

The U.S. Firm shall present the findings of the Study in Brazil. The presentation shall be a full day event divided into two sessions. The first session shall discuss the results and recommendations of the Study. The second session is aimed at addressing audience questions regarding specific applications. The presentation audience shall include personnel from CAGECE and other stakeholders identified while performing Tasks 1, 2, 3, 7, 8, and 9.

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Task 17: Final Report

The U.S. Firm shall prepare and provide a comprehensive Final Report to CAGECE, which shall contain an Executive Summary, key findings, recommendations and conclusions of the Study, and shall incorporate all other documents and/or reports provided pursuant to Tasks 1 through 16 above. Each task of these Terms of Reference shall form a separate chapter of the Final Report.

The U.S. Firm shall also identify the availability of potential U.S. sources of supply and prepare a U.S. supplier list which shall outline potential U.S. sources for procurement of goods and services necessary to develop the solid waste derived energy recovery facilities. The list shall include business name, point of contact, address, telephone and fax numbers for each commercial source, as well as a general description of products and services that may be procured

The U.S. Firm shall ensure that the Final Report is submitted in accordance with Clause I of Annex II of the Grant Agreement. The U.S. Firm shall provide six (3) hard copies and one (1) electronic version of both the confidential and public versions of the Final Report to CAGECE and one (1) hard copy of both the confidential and public versions of the Final Report. The CD-ROM version of the final report will include:

- Portable Document File (PDF) readable copies of all documents;
- Source files for all drawings in AutoCad or Visio format; and
- Source files for all documents.

The U.S. Firm shall provide a copy to USTDA and the U.S. Consulate in Sao Paulo in English in accordance with Clause I of Annex II of the Grant Agreement.

Notes:

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

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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]*

Activity Type <i>[To be completed by USTDA]</i>	Feasibility Study	Technical Assistance	Other (specify)
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Activity Title *[To be completed by USTDA]*

Full Legal Name of U.S. Firm

Business Address (street address only)

Telephone		Fax		Website	
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Year Established (include any predecessor company(s) and year(s) established, if appropriate).
Please attach additional pages as necessary.

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 (please specify)

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(s). 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.	
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Identify any specific information which is needed from the Grantee before commencing negotiations.	
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U.S. Firm may attach additional sheets, as necessary.

U.S. Firm's Representations

U.S. Firm shall certify to the following (or provide any 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:
 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:
 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.
3. Neither the U.S. Firm nor any of its principal officers have, within the three-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	<input type="text"/>	Signature	<input type="text"/>
Title	<input type="text"/>		
Organization	<input type="text"/>	Date	<input type="text"/>



ATTACHMENT B

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

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

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]	
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Activity Title [To be completed by USTDA]	
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Full Legal Name of U.S. Firm	
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Full Legal Name of Shareholder	
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Business Address of Shareholder (street address only)	
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Telephone number		Fax Number	
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Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary.	
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Country of Shareholder’s Principal Place of Business	
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Please provide a list of directors and principal officers as detailed in Attachment A. Attached?	Yes
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Type of Ownership	<input type="checkbox"/> Publicly Traded Company
	<input type="checkbox"/> Private Company
	<input type="checkbox"/> 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.	
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Is the Shareholder a wholly-owned or partially owned subsidiary?	<input type="checkbox"/> Yes
	<input type="checkbox"/> No

If so, please provide the name of the Shareholder’s parent(s). In addition, for any parent identified, please complete Attachment B.	
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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]	
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Activity Title [To be completed by USTDA]	
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Full Legal Name of Prime Contractor U.S. Firm ("U.S. Firm")	
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Full Legal Name of Subcontractor	
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Business Address of Subcontractor (street address only)	
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Telephone Number	
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Fax Number	
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Year Established (include any predecessor company(s) and year(s) established, if appropriate). Please attach additional pages as necessary.	
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Subcontractor Point of Contact

Name	Surname	
	Given Name	

Address	
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Telephone	
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Fax	
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Email	
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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 <i>[check one]</i>	<input type="checkbox"/> Corporation	<input type="checkbox"/> LLC	<input type="checkbox"/> Partnership	<input type="checkbox"/> Sole Proprietor	<input type="checkbox"/> Other
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duly organized, validly existing and in good standing under the laws of: _____ .

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 three-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	