GOVERNMENT OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY´S 10-YEAR INFRASTRUCTURE PLAN – DECEMBER 2020	**CASE NO.**: NEPR-MI-2021-0002 **SUBJECT**: Fourth Motion to Submit Additional Generation Projects SOWs

FOURTH MOTION TO SUBMIT ADDITIONAL GENERATION PROJECTS SOWS

COMES NOW the Authority[1], through its counsel of record, and respectfully submits and requests as follows:

I. RELEVANT BACKGROUND

On November 15, 2021, PREPA filed a *Motion to Submit Fourth Group of Generation Projects* (the "November 15 Motion"), with a comprehensive list of Generation Projects which consist of repair work projects of generation assets and for which PREPA will seek reimbursement under several FEMA programs. November 15 Motion at Attach. A.

After several procedural events, PREPA was served with the January 4 Order, by which the Energy Bureau conditionally approved the projects described in attachments A to H of the referenced order ("Conditionally Approved Projects"), pending the submittal by PREPA of the SOW of each project and deferred the approval of projects are listed in Attachment I of the January 4 Order (the "Deferred Projects") until further evaluation. The January 4 Order additionally provides directives regarding both set of projects for which PREPA was ordered to submit on January 14, 2022, the SOW for both the Conditionally Approved Projects and the Deferred

[1] Capitalized terms not defined herein shall be considered with the meaning provided to them in the *Third Motion to Submit Additional Generation Projects SOWs,* presented to the Energy Bureau on February 2, 2022.

Projects for the Energy Bureau's evaluation. January 4 Order at p. 3, Sec. III. Additionally, the Energy Bureau directed PREPA to answer, on or before January 19, 2022, a set RFIs listed in the order.

On January 13, 2022, PREPA submitted a motion titled *Partial Compliance with the January 4 Order and Request for Extension of Time* (the "January 13 Motion") together with a total of 25 Generation Projects SOWs for the review and approval of the Energy Bureau. January 13 Motion at Attach. A. Further, PREPA requested an extension of time until February 14, 2022, to submit the Outstanding SOWs. PREPA asserted that, even though it was asking until February 14, 2022, to complete the submittal of the Outstanding SOWs, it was going to submit them on a rolling basis as they were completed and approved by PREPA.

Thereafter, on January 18, 2022, PREPA filed *Request for Extension of Time to Submit Responses to RFI Included in the January 4 Order* (the "January 18 Motion") asking the Energy Bureau to grant until February 14, 2022, to submit the responses to the RFI.

On January 22, 2022, the Energy Bureau entered an order granting, *inter alia*, the requests for extension made by PREPA in the January 13 and January 18 motions. Therefore, the operative deadline to file the Outstanding SOWs and responses to the RFI is February 14, 2022.

PREPA has submitted four (4) motions presenting Generation Projects SOWs for the Energy Bureau's review and approval.[2] However, to date, the Energy Bureau has not ruled on these requests.

[2] *See*, January 13 Motion; *Motion to Submit Additional Generation Projects SOWs; Second Motion to Submit Additional Generation Projects SOWS*; and *Third Motion to Submit Additional Generation Projects SOWs,* presented to the Energy Bureau on January 13, 25 and 28 and February 2, 2022, respectively.

II. SUBMITTAL OF ADDITIONAL GENERATION PROJECTS SOWS

In compliance with the January 4 and January 18 orders, PREPA completed a total of 10 additional Generation Projects SOWs which are submitted herein for the review and approval of the Energy Bureau. Attach. A. Out of these Generation SOWs, 6 pertain to the Deferred Projects, while 4 pertain to the Conditionally Approved Projects.[3]

To facilitate the evaluation of the Generation Projects SOWs submitted, PREPA hereby includes a table that details and breakdowns the SOWs as follows: project number assigned by the Energy Bureau to each Generation Project SOW (first column), the SOW number assigned by PREPA (second column), project name (third column) and a summary of the proposed scope of work (fourth column). *See*, Attach. B.

With this submittal, PREPA has tendered a total of 79 Generation Projects SOWs to the Energy Bureau.

III. REQUEST FOR APPROVAL OF THE GENERATION PROJECTS SOWS

PREPA respectfully request the Energy Bureau to approve the Generation Projects SOWs as submitted herein. As stated in several submittals, PREPA's goal to move in a direction that leads to lower costs and cleaner energy requires maintaining its system's reliability and stability during such transition. Consequently, the Generation Projects SOWs submitted for the review and approval of the Energy Bureau consist of repair works *necessary* to increase the current dependable available generation and provide the People of Puerto Rico a safe and reliable electrical service – while the integration of reliable new resources is completed– and thus prevent future major outages in compliance with the SOP and POR reliability criteria. In conclusion, the proposed Generation

[3] The Deferred Projects are marked with asterisks in Exhibit B.

Projects are *crucial* for PREPA to maintain the reliability of the generation system during the process of integrating new resources and therefore, PREPA requests the Energy Bureau to approve the Generation Projects SOWs submitted herein.

Should the Energy Bureau have any concerns or questions regarding the Generation Projects SOWs herein submitted, PREPA respectfully request that a technical conference through which PREPA representatives can discuss the Generation Projects SOWs be scheduled. During the proposed conference, PREPA's personnel shall address any concerns or questions the Energy Bureau may have, so these projects are approved and PREPA can move forward and make the relevant funding requests to COR3 and FEMA.

IV. REQUEST FOR CONFIDENTIAL DESIGNATION AND TREATMENT `

The Generation Projects SOWs presented herein contain global positioning system ("GPS") coordinates of PREPA's power plants, which is critical energy infrastructure information ("CEII") that cannot be disclosed to the public (*i.e.,* Attach. A, SOW 1012, p. 4 9 at secs. 2.1, 10.3, respectively). To protect such confidentiality, PREPA has redacted the GPS information from the Generation Projects SOWs herein submitted (Attach. A) and requests the Energy Bureau to determine that the GPS information is CEII and thus, confidential, and to maintain the public files with the redaction already provided.

The following is a detailed list of the information that PREPA asserts is confidential and must be kept under seal:

SOW NO.	PROJECT NAME	CONFIDENTIAL INFORMATION	LEGAL BASIS
1009	Cooling Tower Repair Work, San Juan Steam Plant – Unit 10	GPS Location Page 4, Sec. 2.1 Page 10, Sec. 10.3	CEII
1021	Unit 8 Turbine Rehabilitation	GPS Location Page 4, Sec. 2.1 Page 25, Sec. 10.3	CEII
1022	Unit 7 Turbine Rehabilitation	GPS Location Page 4, Sec. 2.1 Page 26, Sec. 10.3	CEII
1027	Unit 7 – Major Outage – Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work	GPS Location Page 4, Sec. 2.1 Page 12, Sec. 10.3	CEII
1028	Unit 8 – Major Outage – Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work	GPS Location Page 4, Sec. 2.1 Page 14, Sec. 10.3	CEII
3051	Replacement of Air Preheater's Baskets Unit 5	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3058	CS 5 Major Inspection Unit 5 – HP IP LP Turbine Rotor Replacement	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3061	Caustic Soda & Acid Tanks Replacement Works Costa Sur Water Plant	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
3062	Unit 6 – HP/IP/LP Inspection (Failure)	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII
4070	Low Pressure Turbine Rotor Refurbished Unit 3 Palo Seco Steam Plant	GPS Location Page 4, Sec. 2.1 Page 9, Sec. 10.3	CEII

Article 6.15 of the *Puerto Rico Energy Transformation and RELIEF Act*, Act no. 57 of 2014, as amended ("Act 57")[4], provides that "any person who is required to submit information to the Energy [Bureau] believes that the information to be submitted has any confidentiality privilege, such person may request the [Bureau] to treat such information as such[.]" *Id.* at Sec. 6.15. "If the Energy [Bureau], after the appropriate evaluation, believes such information should be protected, it shall grant such protection in a manner that least affects the public interest, transparency, and the rights of the parties involved in the administrative procedure in which the allegedly confidential document is submitted." *Id.* at Sec. 6.15(a). If the Energy Bureau determines that the information is confidential, "the information shall be duly safeguarded and delivered exclusively to the personnel of the Energy [Bureau] who needs to know such information under nondisclosure agreements." *Id.* at Sec. 6.15(b). "The Energy [Bureau] shall swiftly act on any privilege and confidentiality claim made by a person subject to its jurisdiction by means of a resolution to such purposes before any allegedly confidential information is disclosed." *Id.* at Sec. 6.15(c).

Pursuant to its vested powers, the Energy Bureau approved the *Regulation on Adjudicative, Notices of Compliance, Rate Review, and Investigations Proceedings* ("Regulation 8543").[5] Regarding the safeguards that the Energy Bureau gives to confidential information, Regulation 8543 provides that:

> [i]f in compliance with the provisions of [Regulation 8543] or any of the Energy Bureau's orders, a person has the duty to disclose to the Energy Bureau information considered to be privileged pursuant to the Rules of Evidence, said person shall identify the allegedly privileged information, request the Energy Bureau the protection of said information, and provide supportive arguments, in writing, for a claim of information of privileged nature. The Energy Bureau shall evaluate the petition and, if it understands

[4] *Puerto Rico Energy Transformation and RELIEF Act,* Act no. 57 of May 27, 2014, 22 L.P.R.A. §§ 1051-1056.

[5] Energy Bureau, *Regulation on Adjudicative, Notices of Compliance, Rate Review and Investigations Proceedings*, No. 8543 (December 16, 2015).

> the material merits protection, proceed according to what is set forth in Article 6.15 of Act No. 57-2014, as amended.

Regulation 8543 at Sec. 1.15.

Federal and Puerto Rico law protect the confidentiality of CEII, the public disclosure of which may pose a security threat in that the information could be useful to a person or group in planning an attack on critical infrastructure. *See, e.g.*, 18 C.F.R. § 388.113, as amended by Federal Energy Regulatory Commission ("FERC") Order No. 683, *Critical Energy Infrastructure Information* (issued September 21, 2006); *USA Patriot Act of 2001*, § 1016, creating the *Critical Infrastructures Protection Act of 2001*, including 42 U.S.C. § 5195c(e) (defining Critical Infrastructure). FERC regulations subject such information to limitations on use and disclosure to "ensure that information deemed CEII stays out of the possession of terrorists." 18 C.F.R. § 388.113(d)(4). *Off. of People's Counsel v. Pub. Serv. Comm'n*., 21 A.3d 985, 991, Util. L. Rep. P 27157, 2011 WL 2473405 (D.C. App. 2011).

Under the Critical Infrastructures Protection Act of 2001, the term "critical infrastructure" means "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." 42 U.S.C. § 5195c(e). In 2006, FERC Order no. 683 amended the regulations for gaining access to CEII and simplified procedures for obtaining access to CEII without increasing vulnerability of the energy infrastructure and ensuring that access to CEII does not facilitate acts of terrorism.

A utility is not required to obtain FERC or other federal government approval to designate information as CEII. For example, information required by FERC's Annual Transmission Planning and Evaluation Report, Form No. 715 ("FERC No. 715"), is *de facto* considered CEII and is automatically afforded the heightened protections. FERC No. 715 requires that any

transmitting utility that operates integrated (non-radial) transmission facilities at or above 100 kV must annually submit information including but not limited to: Power Flow Base Cases, Transmitting Utility Maps and Diagrams, Transmission Planning Reliability Criteria, Transmission Planning Assessment Practices, and Evaluation of Transmission System Performance. Any utility that submits the required transmission information pursuant to FERC No. 715 does so with the knowledge that, as stated in the Form's Instructions, FERC "considers the information collected by this report to be CEII and will treat it as such." *See also* 18 C.F.R. § 141.300(d) relating to the Form and CEII.

Mainland regulators typically do not require a utility that designates material as CEII to follow any process before the federal government to make or support such a designation, and, further, that the regulator, in its informed discretion, can establish limits on how information that it considers CEII can be accessed.

Furthermore, and regarding the foregoing argument, FERC has ruled on several occasions that GPS coordinates of any project features "qualify as CEII because it provides more than just location." *See e.g.,* Final Rule, Docket Nos. RM02-4-000, PL02-1-000; Order No. 630, Note 31, entered on February 21, 2003 (ruling that FERC considered the global positioning system coordinates of any project features (precise surveyed or GPS coordinates at or above two decimal points of accuracy of equipment and structures) gas information to qualify as CEII because it provides more than just location).[6]

The aforementioned request for relief has been granted in other matters and dockets, and for requests made under the captioned case, in which PREPA has had to produce information that included CEII, more specifically GPS. For example, two weeks ago PREPA submitted January 13

[6] Federal Register: March 3, 2003 (Volume 68, Number 41); Rules and Regulations, pp. 9857-9873.

Motion, which included several statements of works like the Generation Projects SOWs tendered with this motion. The January 13 Motion Generation Projects SOWs included GPS information that PREPA redacted from the public filing and asserted that should remain under seal and declared confidential because, pursuant to federal and local law, it qualified as CEII. After evaluating PREPA's arguments, on January 21, 2022, the Energy Bureau granted confidential designation and treatment to the GPS information that had been redacted from the public versions of the filing. January 21 Order at pp. 3-5, Sec. III.

Is its respectfully submitted that the redacted GPS information qualifies as CEII and thus, should remain redacted. Furthermore, it is asserted that the redactions made are the manner that least affect the public interest, transparency, and the rights of the parties involved in this administrative procedure. *See*, Act 57-2014 at Sec. 6.15(a). Accordingly, and pursuant to the above, it is respectfully requested that the Honorable Energy Bureau find that the information identified by PREPA as CEII is confidential and that the Secretary of the Energy Bureau be directed to keep the confidential CEII under seal.

V. CONCLUSION

WHEREFORE, PREPA respectfully requests the Honorable Energy Bureau to determine that PREPA has partially complied with the January 4 and January 21 orders; to approve the Generation Projects SOWs as submitted herein; to schedule a technical conference to discuss the submitted Generation Projects SOWs, if the Energy Bureau deems it necessary; to determine that the GPS information redacted from Attachment A is CEII and thus, confidential information; and to enter an order directing the Secretary of the Energy Bureau to maintain the CEII under seal.

RESPECTFULLY SUBMITTED.

In San Juan Puerto Rico, this 8th day of February 2022.

s/ Maralíz Vázquez-Marrero
Maralíz Vázquez-Marrero
mvazquez@diazvaz.law
TSPR No. 16,187

s/ Katiuska Bolaños-Lugo
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CERTIFICATE OF SERVICE

It is hereby certified that I have filed the foregoing with the Clerk of the Energy Bureau using the electronic filing system using https://radicacion.energia.pr.gov/login and also, that I have served a copy on LUMA Energy, LLC and LUMA Energy ServCo, LLC through their counsel of record at laura.rozas@us.dlapiper.com and margarita.mercado@us.dlapiper.com.

In San Juan Puerto Rico, this 8th day of February 2022.

s/ Katiuska Bolaños-Lugo
Katiuska Bolaños-Lugo

Attachment A

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Cooling Tower Repair Work,

San Juan Steam Plant - unit 10

1/20/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	San Juan Steam Plant, unit 10 – Cooling Tower Repair Work
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Steam Plant, Unit 10	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

San Juan Steam Plant needs the design, manufacture, delivery and erection of one (1) new cell of 3,000 GPM, and the dismantling of the one (1) existing cell of unit 10 Cooling Tower. Unit 10 will have a new counter flow design to operate independently from unit 9.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the new Cooling Tower of unit 10 at the San Juan Steam Plant will consist of the following:

A. Mechanical Design

- The Contractor shall consider in its design the use of 40 hp motor and a single reduction Amarillo Gear box. The reducer has the following description: service factor 2.0; 60 hp service hp rating with internal backstop (anti-windmilling); design and rating must exceed AGMA (American Gear Mfg. Association) and CTI (Cooling Tower Institute). Addax composite drive shaft and Hudson Fan assembly.
- The Contractor shall be responsible for installation, arrangement and alignment of the mechanical equipment. This shall include motor, gear, reducer, drive shaft and Hudson Fan and mounted in a 316 L stainless steel torque tube system with outriggers supports attached to fiberglass structure. The equipment selected and installed shall be designed to prevent any vibration or movement in operation as same as the mechanical support structure of this equipment.
- The Contractor shall install in the gear reducer, shaft and motor arrangement a vibration monitoring system using the industrial accelerometer CMPP 1100 "General Purpose Industrial Accelerometers" and its accessories from "Sales Technology Inc." company, or the model 746 accelerometer and its accessories from Wilcoxon Research, Inc. This equipment shall be installed in place covered with a stainless steel 316 L housing or other material as PVC to prevent any corrosion.
- The Contractor shall install a vibration switch system designed to shut down the motor in case of excessive vibration.
- The Contractor shall install the oil level, drain and fill lines for the gear box. At the gear box end those lines shall be flexible oil or gasoline type hose connected to stainless steel 316L pipe running to the outside of the fan stack.
- The lubricant for the gear reducer shall use a Mobil lubricant product or the Contractor shall recommend its Mobil equivalent.

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B. Structural Design

- The structural materials shall be Fiberglass Pultruded Structural Product, Fire Retardant that shall comply with the following specifications:
  - The manufacture shall be guided by the 137 STD. (latest revision) of the CTI.
  - The supplied material shall have a type III Classification.
  - The resin shall be a grade I type with UV inhibitors.
  - The flame retardancy shall be achieved with any of the techniques described in the 137 STD.
  - The dimensional tolerances shall be in accordance with the ASTM D-3917. As 137 STD.
- All (FRP) structural support members shall be assembled with 316L stainless steel hardware fasteners or bolt.
- All (FRP) louvers, siding walls, hand and knee rails, stairs, fan deck, and fan stack shall be assembled, supported or mounted with 316L stainless steel material (bolts, nuts, washers, plates, fasteners, etc.).
- All piping installed in the structure shall be hanged or supported with 316L stainless steel material. Or other means of corrosion resistance materials.
- The fan deck shall be designed for the loading specified by the (CTI) standard. Also the fan deck shall have a skid resistant top surface, according with the 137 STD, and an access with safety handrails to the inside of the cell for the piping, nozzles, and internal equipment maintenance.

- The Fan deck shall be accessed by a (FRP) stairway designed and constructed to the latest OSHA standards including the hand and knee rail at the top of the deck. Stairway and rails structural elements shall be safety yellow color. PREPA shall construct the concrete base if needed.
- The fans stacks shall be designed for the wind loading specified by (CTI) according to the geographic area up to 155 mph. An access panel shall be provided for the removal and maintenance of the mechanical equipment at deck level.
- The Contractor will clean the Basin (inside area) using water pressure machine.
- The design of the Tower shall be in such a way that provides access for schedule maintenance and inspections by the plant personnel.

C. Thermal Design
- The drift eliminators and fills shall be a high performance material to assure the required performance of the Tower. Fill shall be manufactured from 15 mil PVC sheet material and shall be cross– fluted for optimum performance.
- The main water distribution system (header) shall be (FRP) material with PVC laterals pipes attached with stainless steel 316 L hardware and heavy duty nozzles for easy maintenance. Except for the FRP main header, any piping branch using PVC shall be schedule 40 as minimum.
- The design shall comply with the drift rate of 0.005% or better. The CTI Performance Test shall be mandatory.
- The Bidder/Contractor will include information about wind load resistance (according to the geographic area) in the design of both cells.
- The louvers shall be honeycomb type supported with fiber glass structure.

D. Existing Cell Dismantling
- The existing cell dismantling shall be done with the other cell of Unit 9 in operation.
- The structure removed material (steel, PVC sheets, PVC louvers, galvanized steel), fills and drifts shall be deposit in containers supplied by PREPA and located in a place designated by Plant personnel.
- The existing mechanical equipment shall be located in a place designated by Plant personnel.
- The contractor shall supply materials, re-design and install the supports of the main water (inlet) line pipe supported in the existing cells

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($)
Design, manufacture, delivery and erection	$385,000.00
Total Project Estimated Cost	**$385,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name	Date
Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

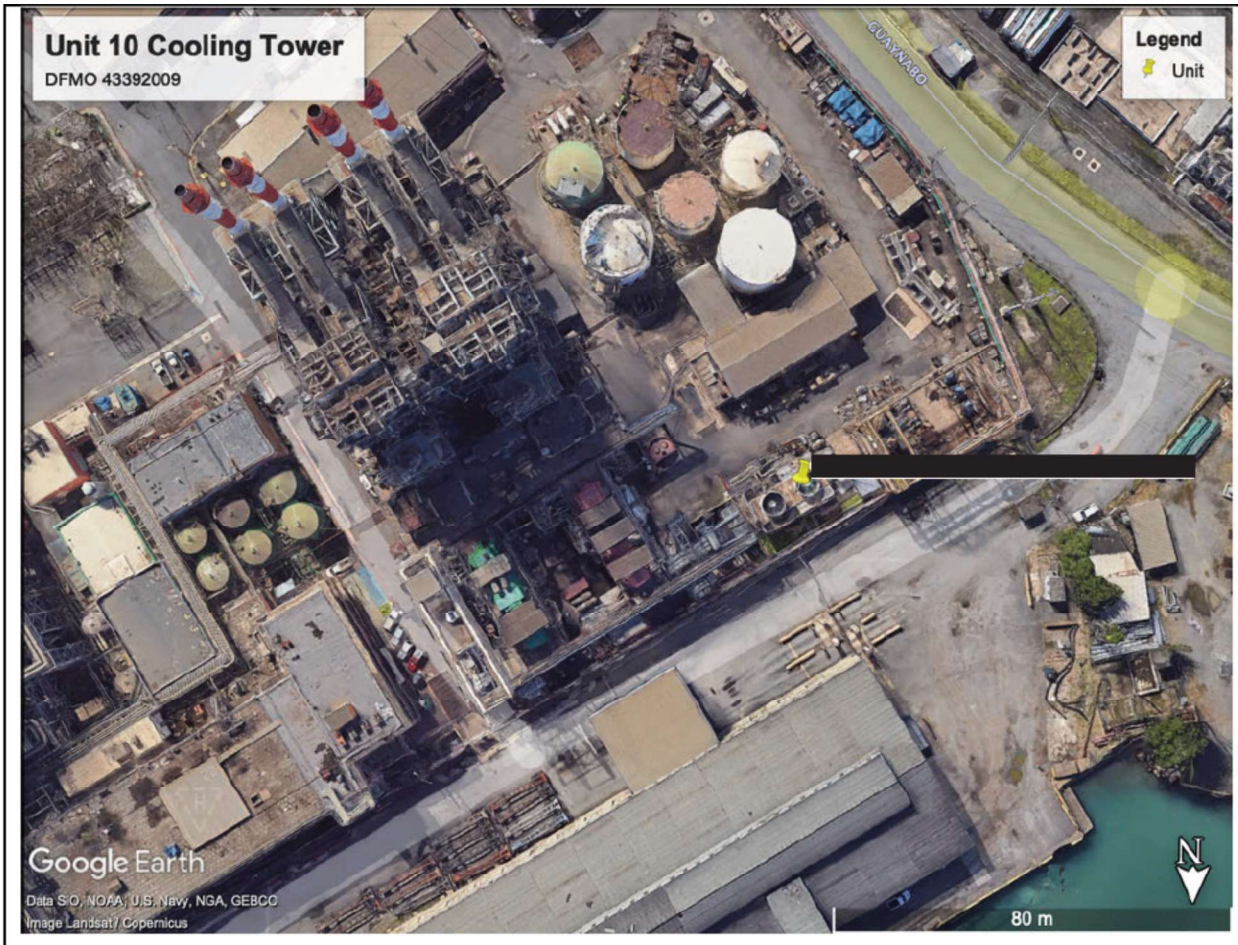
Please see attached the following:

- Special Conditions and Technical Specifications

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

CONTRACT REQUISITION 243924
SUBASTA FORMAL RFP 0003111

SAN JUAN STEAM PLANT UNIT 10 COOLING TOWER

SPECIAL CONDITIONS AND TECHNICAL SPECIFICATIONS

ARTICLE 1. The Requirements

1.1 Bidders and/or subcontractors shall furnish evidence about their capacity and experience for performing Cooling Towers works for Utilities and its technology, not less than five (5) years. Provide name of the company, telephone and contact person for evaluation by PREPA on similar projects been constructed in United States and its territories. Bidders and/or subcontractors shall be included in PREPA's Register of Qualified Suppliers, as evaluated and qualified suppliers for the required work under these Specifications. Proposals without these requirements shall be rejected. Also shall have a current membership with the Cooling Technology Institute (CTI).

1.2 The Contractor is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, job administration and superintendence required, as requested by PREPA and shall perform all repair work expeditiously and to the entire satisfaction of the Contracting Officer. The work shall be conducted in accordance with this specification, as directed by the Contracting Officer; and as described in Article 2, Scope of Work.

1.3 All work performed under this Specifications shall be done in a safe and workmanlike manner and in strict conformance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved and including the American National

1.4 Standards Institute (ANSI), the American Society of Mechanical Engineers (ASME), the National Board of Inspection Codes (NBIC), the Environmental Protection Agency (EPA), the Occupational Safely and Health Office (OSHO) requirements, the Cooling Technology Institute (CTI) and the latest edition of all other applicable codes and standards.

1.5 The Contractor shall develop a schedule of the activities to be performed in connection with the work of the Contract and shall submit the same to PREPA for the approval of the Engineer.

1.6 All work on a particular unit shall be carried out on a continuous schedule following the commencement date specified by PREPA and the proposed work schedule submitted by the Contractor and accepted by PREPA.

1.7 The Contractor shall furnish the Engineer summary weekly reports of the various divisions of the work under the Service Order, whether in the mills or shops or in the field, stating the existing status, rate of progress, estimated time of completion and cause of delays, if any.

1.8 Concurrent to all work, a written report of conditions as found, work performed, clearances and test data recorded should be submitted. A final report should be submitted within fourteen (14) consecutive days after completion of all work.

1.9 The Contractor shall furnish all tools and equipment required to perform the inspection, adjustments, repairs and/or replacements expeditiously and to the satisfaction of the Engineer.

1.9. All welding performed under this Contract shall be in accordance with welding procedures, which have been qualified with section IX of the ASME Boiler and Pressure Vessel Code and ANSI B31,1 (as amended> Para. 127). All welders engaged in work under this Contract shall be qualified in accordance with the test requirements of Section IX of the ASME Boiler and Pressure Vessel Code, welding and brazing qualifications. The Contractor shall submit the welding procedures and welder's qualifications before commencement of the work. Each welder's certification shall be on file at the prefabrication shop and available to PREPA's inspector upon request. Welding records shall be kept according to ANSI B 31.1, Para. 127.6. Roots passes in piping shall be made by the GTAW (Gas Tungsten Arc Welding) process. The balance of the welds may then be completed by the use of coated electrodes - shield metal arc welding (SMAW) -. Backing rings are not allowed. Preheat and post-heat treatments shall be in accordance with ANSI B3 1.1, Sections 131 and 132, latest addenda. Structural steel welding shall be performed by the SMAW method. Preparation of the welds and weld design shall be according to ANSI B 31.1, Section 127. To the extent that they apply, the Contractor shall impose on each of his sub suppliers/subcontractors the complete requirements of the technical specifications under this Contract. He shall be directly responsible to see that the sub-suppliers/sub-contractors are completely aware of all these requirements and those they abide thereby.

1.10. Documents Submittals with Proposal

Design GENERAL ARRAGEMENTS drawings and technical documentation shall be submitted by Bidder with the proposal in original and two copies. These drawings and documents should be presented in a professional manner with clear dimensions included and all details. Proposals not complying with this requirement will not be considered by PREPA and will be

rejected. The drawings and documentation should present the general aspects of the new tower including:

- **Dimensions and Layout of Tower Cells and Components**
- **Mechanical equipment to be supplied**
- **Materials Technical Specifications**
- **Design Specifications**
- **Company information and current CTI membership**
- **Certificate of compliance: This is a document certifying that all aspects of this order and specifications should be met if awarded with order and must be signed by the responsible contractor representative.**

1.11. Exceptions

Any exceptions to the requirements of this specification or its references shall be explicitly stated in the proposal. Exceptions taken shall include reasons for such exceptions and describe in detail the alternatives.

ARTICLE 2. Scope of Work

2.1 General Scope

These technical specifications cover the work required under this Contract for the design, manufacture, delivery and erection for one (1) new cell of 3,000 GPM, and the dismantling of the one (1) existing cell of the cooling towers of the units 10 PREPA's San Juan Plant. Unit 10 to be new Counterflow design to operate independently from unit 9.

Contractor is required to comply with several special conditions herewith detailed for the work.

A. General Requirement

The design, manufacture, delivery of materials, erection of the new cell, and the dismantling of the existing tower cell shall be completed in 16 weeks

The design (size) of the new cell shall be **custom fit** and anchored to existing concrete cold water basin (equal to the area of the existing tower basin), **to get the best benefit of this area.**

B. General Information

These specifications detail the technical and quality assurance requirements for the design, manufacture, delivery and erection of one (1) new pultruded fiberglass cell, and the dismantling of one (1) existing cell of the Unit 10 Cooling Tower at San Juan Steam Plant.

The existing Cooling Tower is an Induced Draft Cross-flow type for fresh water consisting of one cell with a concrete basin of 24' X 24', X 3 ft depth, a structure consisting of a combination of carbon and galvanized steel. The outer casing or sidings walls are PVC corrugated sheets and PVC louvers panels. Fan Deck and floor support of carbon steel material.

C. Design Parameters and Performance Require new cell

1. <u>Performance- Induce draft Counterflow</u>

Flow Rate	2,500 gpm
Hot water temperature	101°F T water in
Cold water temperature	91°F T water out
Inlet air wet bulb temperature	78.0°F Twb air
Inlet air dry bulb temperature	90°F Tdb air
Static Head	15.75 FT.
Evaporation loss	1.5
Drift loss	0.0005% or better
Relative Humidity	70%
Horse power	40 max (limitation)

2. <u>Description (existing cell)</u>

Tower Type	Induced draft cross flow
Tower Shape	In line
Number of cells	ONE (1)
Cooling tower size (basin)	24 x 24
Basin	concrete
Depth of Basin	3 feet
Tower height to deck	20'- 0"
Motor size	40 hp
Outer casing	Fiberglass AND PVC
Structure	Carbon and galvanized steel

Height of main water supply line 14′ -3″
Deck Galvanized steel plate

D. Scope of Work

The Contractor shall be responsible for the design, performance and complete erection of the new counter flow fiberglass cell. The design shall include the mechanical equipment, structural and thermal design. The contractor shall be responsible for the dismantling of the existing cell.

1. Mechanical design

The Contractor shall consider in its design the use of 40 hp motor and a single reduction Amarillo Gear box. The reducer has the following description: service factor 2.0; 60 hp service hp rating with internal back-stop (anti-windmilling); design and rating must exceed AGMA (American Gear Mfg. Association) and CTI (Cooling Tower Institute).
Addax composite drive shaft and Hudson Fan assembly.

The Contractor shall be responsible for installation, arrangement and alignment of the mechanical equipment. This shall include motor, gear, reducer, drive shaft and Hudson Fan and mounted in a 316 L stainless steel torque tube system with outriggers supports attached to fiberglass structure. The equipment selected and installed shall be designed to prevent any vibration or movement in operation as same as the mechanical support structure of this equipment.

The Contractor shall install in the gear reducer, shaft and motor arrangement a vibration monitoring system using the industrial accelerometer CMPP 1100 "General Purpose Industrial Accelerometers" and its accessories from "Sales Technology Inc." company, or the model 746 accelerometer and its accessories from Wilcoxon Research, Inc. This equipment shall be installed in place covered with a stainless steel 316 L housing or other material as PVC to prevent any corrosion.

The Contractor shall install a vibration switch system designed to shut down the motor in case of excessive vibration.

The Contractor shall install the oil level, drain and fill lines for the gear box. At the gear box end those lines shall be flexible oil or gasoline type hose connected to stainless steel 316L pipe running to the outside of the fan stack.

The lubricant for the gear reducer shall use a Mobil lubricant product or the Contractor shall recommend its Mobil equivalent.

2. Structural design

a) The structural materials shall be Fiberglass Pultruded Structural Product, Fire Retardant that shall comply with the following specifications:

1) The manufacture shall be guided by the 137 STD. (latest revision) of the CTI.

2) The supplied material shall have a type III Classification.

3) The resin shall be a grade I type with UV inhibitors.

4) The flame retardancy shall be achieved with any of the techniques described in the 137 STD.

5) The dimensional tolerances shall be in accordance with the ASTM D-3917. As 137 STD.

b) All (FRP) structural support members shall be assembled with 316L stainless steel hardware fasteners or bolt.

c) All (FRP) louvers, siding walls, hand and knee rails, stairs, fan deck, and fan stack shall be assembled, supported or mounted with 316L stainless steel material (bolts, nuts, washers, plates, fasteners, etc.).

d) All piping installed in the structure shall be hanged or supported with 316L stainless steel material. Or other means of corrosion resistance materials

e) The fan deck shall be designed for the loading specified by the (CTI) standard. Also the fan deck shall have a skid resistant top surface, **according with the 137 STD**, and an access with safety handrails to the inside of the cell for the piping, nozzles, and internal equipment maintenance.

f) The Fan deck shall be accessed by a (FRP) stairway designed and constructed to the latest OSHA standards including the hand and knee rail at the top of the deck. **Stairway and rails structural**

elements shall be safety yellow color. PREPA shall construct the concrete base if needed.

g) The fans stacks shall be designed for the wind loading specified by (CTI) according to the geographic area up to 155 mph. An access panel shall be provided for the removal and maintenance of the mechanical equipment at deck level.

h) The Contractor will clean the Basin (inside area) using water pressure machine.

i) The design of the Tower shall be in such a way that provides access for schedule maintenance and inspections by the plant personnel.

3. Thermal design

a) The drift eliminators and fills shall be a high performance material to assure the required performance of the Tower. Fill shall be manufactured from 15 mil PVC sheet material and shall be cross– fluted for optimum performance.

b) The main water distribution system (header) shall be (FRP) material with PVC laterals pipes attached with stainless steel 316 L hardware and heavy duty nozzles for easy maintenance. Except for the FRP main header, any piping branch using PVC shall be schedule 40 as minimum.

c) The design shall comply with the drift rate of 0.005% or better. The CTI Performance Test shall be mandatory.

d) The **Bidder/Contractor** will include information about wind load resistance (according to the geographic area) in the design of both cells.

e) The louvers shall be honeycomb type supported with fiber glass structure.

4. Existing cell dismantling

    a) The existing cell dismantling shall be done with the other cell of Unit 9 in operation.

    b) The structure removed material (steel, PVC sheets, PVC louvers, galvanized steel), fills and drifts shall be deposit in containers supplied by PREPA and located in a place designated by Plant personnel.

    c) The existing mechanical equipment shall be located in a place designated by Plant personnel.

    d) The contractor shall supply materials, re-design and install the supports of the main water (inlet) line pipe supported in the existing cells.

5. The Contractor shall also furnish all accessories, services, labors, materials and appurtenances as called for on the technical specifications or which he deems necessary to make a complete and well-integrated installation within the scope of work.

6. The Contractor will comply with all local, state, and federal regulations in addition to the latest codes and standards of ASTM, CTI, ANSI, NFPA, UL, and OSHA.

ARTICLE 3. To be furnished by Contractor

3.1. All labor forces and supervision, job administration and superintendence personnel required, as requested by PREPA.

3.2. Necessary tools, all installation hardware (springs, lock screws, dowel pins, bolting, seal rings with springs) and equipment to perform the work such as hoists, drills, grinders, air triggers, fork lifts, cherry picker, chain falls, hydraulic and air jacks, welding machines, ladders, scaffolds, welding equipment, air compressors, tubes expansion and cutting machines, etc.

33. All materials and spare parts shall be purchased by the Contractor at PREPA's request.

3.4. The Contractor shall provide field office facilities for Contractor's personnel.

3.5. The Contractor shall provide sanitary and first aid facilities for his personnel. These arrangements shall be coordinated with and approved by PREPA's Project Manager.

3.6. Safety equipment, such as helmets, welder's jackets, goggles, gloves, etc.

3.7. Adequate and proper identification of Contractor's personnel.

3.8. The Contractor shall furnish materials and accessories, expendable materials like cleaning agents, solvents, thread and gasket compounds, greases, wiping cloths, blasting materials, welding rod, drinking cups, ice, paper towels, toilet paper, etc.

3.9. Adequate field facilities and vigilance to keep safe all materials, tools, equipment and spares.

3.10. Changing facilities for the Contractor's personnel.

3.11. All other resources or activities needed for performing the job, not furnished by PREPA, according to the Scope of Work.

3.12. Transportation of components to and from shop, as applicable.

3.13. Fabrication and delivery of parts that were broken in such a way that repair is impossible, and of which there are no replacement spare parts, as applicable.

3.14. Cleaning and painting equipment and material required for painting equipment components and others, as applicable.

3.15. Concrete foundations for equipment skids, as applicable.

3.16. Materials, components and hardware for electrical and controls installations, as applicable.

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Unit 8 Turbine Rehabilitation

2/2/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	2/4/2022	

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Unit 8 Turbine Rehabilitation
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Power Plant Unit 8 Turbine Rehabilitation	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

The Contractor is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the disassembly, inspection and reassemble of the HP-IP, LPB and Turbine Steam Valves of San Juan Power Plant Unit 8 in accordance the Terms and Conditions as requested by PREPA.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for Unit 8 Turbine Rehabilitation for San Juan Power Plant willll consist of the following:

Activities covered by the scope of services shall include:

1) Disassembly and reassembly of pedestals and bearings 1,2,3.
2) HP outer casing and steam inlet piping heat thermal removal and reinstalling.
3) Disassembly and reassembly of HIP turbine upper outer casing, inner casings, diaphragm carrier, diaphragms, rotor, gland seals and crossover.
4) Disassembly and reassembly of LP turbine; outer casing, diaphragms, rotor, gland seals. Cross Over and Inner casing are currently out.
5) HIP and LP pedestal anchoring inspection and maintenance.
6) HIP and LP catenary survey verification.
7) HIP and LP rotor repair in GE Workshop
8) Inspection and NDT's of disassembled HIP and LP steam turbine components and pedestals 1, 2 and 3.
9) Alignment of the HIP/LP rotors.
10) HIP and LP Turbine Assembly
11) Cold and hot commissioning

Bearings and Couplings

1) Couplings A/B

a) Loosen and remove coupling windage covers (coupling B only).
b) Loosen and remove coupling bolts
c) Separate couplings enough to record alignment
d) Record parallel alignment on both couplings
e) Clean and measure coupling bolts, compare to original dimensions o Inspect coupling nut locking plates for damage, replace as necessary
f) Clean coupling face and all threaded holes
g) Record final parallel alignment and runout
h) Record offset alignment on coupling B
i) Ensure bolts are stretched to the correct length and nuts secured correctly
j) Complete sling check coupling A (T-1 removed)
k) Inspect coupling A radius for steam erosion from packing case leakage
l) Supply shims for coupling alignment moves and perform the coupling alignment if required.

2) Bearings 1-3

a) The following minimum scope of work will be completed on each of the radial/axial bearings.
b) Record as-found/final oil seal clearance

c) Record rotor position as-found/final
d) Record bearing inside diameter and journal outside diameter
e) Perform NDT on babbitted surfaces
f) Photograph wear pattern
g) Inspect all components for mechanical looseness (fretting/damaged shims, etc.)
h) Fit bearing pads to the turbine standards for correct contact. A photo will be taken of the contact pattern of each bearing.
i) Supply shims for bearing alignment moves. If a bearing is required to be moved over .010" the blue contact checks MUST be performed again to verify the required contact.
j) Install bearings
k) Measure twist/tilt. Correct as required
l) Ensure bearings are square to joint at final installation
m) Perform a bearing pinch check
n) Measure thrust float of the assembled thrust bearing
o) Perform as-found/as-left thrust check
p) Record radial alignment position of the thrust runners to the thrust bearing housing
q) Remove and install the thermocouples
r) Record thrust oil seal clearances
s) Ultrasonically inspect lands
t) Perform flatness check of copper side of thrust plate on precision surface plate
u) Perform 15 pt. taper check of lands
v) Perform stack check of thrust bearing components
w) Check bearing to ball fit contact. 80% minimum contact.
x) Perform a pinch check
y) Machine thrust shims for specified clearance and rotor position

3) HP/IP Turbine

Initial Disassembly

a) Record radial and axial position of HP/IP rotor to outer casing. Record radial and axial position of casing to bearing pedestals.
b) Perform shell arm loading checks
c) Transfer the shell running keys to the building keys maintain elevation as close as practical, ensure a safety key is installed at no more than 0.060" clearance.
d) Record as-found crossover flange gap at the HP/IP crossover flange after the bolts are loosened and prior to removal of the pipe and prior to the installation of the crossover braces. Notify owner of any differential greater than 0.080".
e) Record the as-left crossover flange gaps.
f) The as left crossover gaps will have no more than 0.080" of asymmetry.
g) Record tight as found casing gap.
h) Loosen casing bolts (induction heat required).
i) Record loose as-found casing gap
j) Remove gib keys
k) Raise upper casing with jack bolts, rig and remove
l) Remove outer casing bolts and nuts, organize for grit blasting
m) Record internal reference positions
n) Raise upper inner casings high enough with jack bolts, rig and remove

o) Remove UH packing
p) Removed UH diaphragms
q) Record radial and axial positions on all stationary and rotating components.
4) HP/IP Turbine Cleaning and Inspection

Rotor (Take it to a Workshop to perform the following tasks:

a) Sandblast steam path
b) Magnetic particle check rotating and stationary buckets
c) Perform run outs. All runouts will be matched to the number one bolt hole on the coupling. All runout points will reference the same location. 8 data points are to be recorded at each location.
d) Coupling – check for flatness. NDT rabbet fit
e) Oil deflector lands - Clean and visually inspect. Record diameter
f) Packing lands – NDT as part of steam path. Visually inspect for rubs
g) Journals – clean inspect for roundness and taper. Visually inspect for wear
h) Thrust runner inspection - clean inspect for flatness and parallelism. Record runner spacing. Visually inspect for wear
i) Map balance weights (if applicable)
j) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion
k) Blades exchange:
i. Rows 1-5 HP
ii. Rows 1-3 IP
l) Burnish vibration probe areas.
m) Visual and NDE inspection of the control rotor.
n) Boresonic Inspection
o) Low Speed Balancing

Stationary (Work On site):

a) Grit blast crossover line flanges and welds.
b) Inspect the crossover bolting. Identify crossover bolting that is damaged or otherwise unusable for re-assembly.
c) Nozzle block bores are to be measured at 3 elevation

(Work on Vendor's Workshop):

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Minor repair in 7 stages
e) Major repair in 8 stages – GE Shop
f) Replace strips – 7 stages
g) HP Nozzle – in-Shop repair – Atlanta
h) Inspection on site
i) Transportation to Vendor's Facilities
j) Major repair
k) ransportation to Prepa's Facilities

5) HP/IP Turbine Internal Alignment

a) Clean and inspect front standard
b) Ensure correct clearance of the emergency governor button to trip lever.
c) Inspect turbine anchor bolts and through bolts for proper torque.
d) Inspect welds, bellows and tie rods (bellows inspection will require a boroscope)
e) Clean the crossover flanges and mating flanges.
f) Complete tightwire or laser alignment check of internal components HP/IP.
g) Turbine Assembly
h) Internal boroscope close out inspections for FME.
i) Install LH components
j) Install rotor
k) Measure and record all clearances on buckets and packing segments
l) Install upper components
m) Stretch HP inner casing bolts and record final length
n) Install outer casing
o) Stretch outer casing bolts and record final length
p) Lower casing on to running keys and record final radial and axial position
q) Record the as-left crossover flange gaps
r) The as left crossover gaps will have no more than 0.080" of asymmetry
s) Remove the crossover bellows bracing

LP Pressure Turbine

Disassembly

a) Record radial and axial position of LP rotor to outer casing.
b) Record radial position of LP packing gland
c) Unbolt the last stage UH flow cones and secure to the hood and remove LP Hood
d) Record radial and axial positions on all stationary and rotating blades and gland segments
e) Rig and remove turbine rotor
f) Immediately cover exposed ends of shaft with gasket material and plastic sheet
g) Remove lower half of diaphragms
h) Remove packing from all locations. Ensure components are labeled correctly for assembly.
i) Record internal reference positions

LP Turbine Cleaning and Inspection

Rotor (In Vendor's Workshop)

a) Sandblast steam path components
b) Magnetic particle check rotor and diaphragms.
c) Map balance weights (if applicable)
d) Record runouts
e) Coupling – check for flatness. NDT rabbet fit
f) Oil deflector lands - Clean and visually inspect. Record diameter
g) Packing lands – NDT as part of steam path. Visually inspect for rubs
h) Journals – clean inspect for roundness and taper. Visually inspect for wear

i) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion and erosion shield condition
j) Burnish vibration probe areas.
k) Replace spill strips and packing segments as required by steam path audit
l) Replace L-0 and L-1 Blades (2 flows)
m) Boresonic Inspection
n) Low Speed balancing

Stationary (Vendor's Workshop)

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Perform minor repair on site
e) Replace strips – 6 stages
f) Perform major repair in shop

Valves (On Site)

Main Stop Valve

a) Disconnect actuator
b) Remove jackbolts and pull down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Check bushing clearance and alignment with try bar
h) Perform back seat contact check
i) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
j) Inspect stem seal and backseat
k) Replace metallic gasket for valve stem bushing assembly
l) Record free length of springs and compare to design data
m) Assemble stem, pressure seal head and disk
n) Contact check valve disk to seat
o) Tighten jackbolts on pull down ring
p) Measure total stroke of valve
q) Install steam strainer
r) Assemble valve head
s) Install actuator
t) Record closed end over travel
u) Remove crosshead, stem and valve
v) Clean and measure lockhead and guide for proper clearance
w) Remove stem from crosshead/lockhead
x) Inspect stem threads
y) nspect crosshead threads
z) Dye penetrant check of cross head to lock head fits
aa) Check stem run-out
bb) Clean and record stem and bushing diameters
cc) Check bushing with "try" bar.

dd) Clean seat and body area NDE inspections for cracking
ee) Replace body to stand gasket
ff) Measure and record body to stand fit
gg) Inspect cams for flat spots (roller damage)
hh) Inspect all cam shaft bearings
ii) Inspect all rack and pinion bearings
jj) Inspect the lever/fulcrum pins and bearings
kk) Inspect valve disk for stellite cracks and general condition
ll) Reassemble valve
mm) Blue contact check of disk to seat
nn) Assemble cam shaft
oo) Assemble rack and pinion
pp) Adjust valve crack and intercept points
qq) Clean and inspect snout rings
rr) NDT of diffusers

Intercept Stop Valve Left & Right

a) Disconnect actuator
b) Remove jack bolts and pull-down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Evaluate bushing clearance and alignment with try bar
h) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
i) Perform back seat contact check
j) Replace metallic gasket for valve stem bushing assembly
k) Record free length of springs and compare to design data
l) Assemble disks and stem
m) Contact check valve disk to seat
n) ighten jack bolts on pull down ring
o) o Measure total stroke of valve
p) Install steam strainer
q) Install valve cover
r) Install actuator
s) Record closed end over travel

Intercept Control Valve Left and Right

a) Record as-found lengths of linkages
b) Disconnect actuator from linkage
c) Remover outer flange
d) Disassemble valve and remove stem/head assembly
e) Disassemble bypass valve
f) Record stem run-out
g) Clean and measure diameters of stem and bushings
h) Evaluate bushing clearance and alignment with try bar
i) Complete NDT on valve disk, valve seat, stem bushing assembly and valve stem
j) Perform back seat contact check

k) Contact check valve disk to seat
l) Replace flange gasket
m) Assemble valve
n) Measure total stroke of valve
o) Install actuator
p) Record closed end over trave
q) Connect actuator linkage

Reheater Bypass Stop Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem bushing assembly
c) Disassemble coupling
d) Remove valve head and stem
e) Disassemble valve head
f) Clean and measure bypass valve
g) Record stem run-out
h) Clean and measure diameters of stem and bushings
i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check valve head to seat
l) Assemble valve
m) Measure total stroke of valve
n) Contact check flange
o) Install flange
p) Install actuator
q) Record closed end over travel.

Reheater Bypass Control Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem
c) bushing assembly
d) Disassemble coupling
e) Disassemble valve disk and stem
f) Disassemble valve disk
g) Clean and measure bypass valve
h) Record stem run-out
i) Clean and measure diameters of stem and bushings
j) Inspect stem seal
k) Record free length of spring and compare to design data
l) Contact check valve disk to seat
m) Assemble valve
n) Measure total stroke of valve
o) Contact check flange
p) Install flange
q) Install actuator
r) Record closed end over travel.

Blowdown Valve

a) Remove actuator
b) Remove valve
c) Remove shaft
d) Disassemble valve disk, shaft and piston rings
e) Clean and inspect
f) Grit blast components and complete NDT on valve disk, valve seat and main valve guide bushing
g) Record stem run-out
h) Clean and measure diameters of stem and bushings
i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check bypass valve to seat
l) Contact check valve head to seat
m) Replace flange gasket
n) Assemble valve
o) Tighten flange bolts
p) Measure total stroke of valve
q) Install actuator
r) Record closed end over travel.

Vacuum Breaker

a) Disassemble, clean, inspect and assemble the motorized valve.

Non-Return Valves

For each of the listed valves, complete the following scope (as applicable):

a) Remove actuator
b) Remove cover flange
c) Remove stem
d) Remove flapper
e) Measure diameters of bushings and shaft
f) Complete run-out on shaft
g) Replace shaft seals
h) Grit blast flapper
i) NDT flapper and seat
j) Assemble stem and shaft
k) Contact check flapper to seat
l) Replace cover flange seal
m) Inspect actuator, replace seals
n) Install actuator
o) Install cover flange
p) Adjust counterweight per OEM specifications
q) Confirm valve freedom of movement and functionality

Valves to be inspected:

a) 6” row 13 uncontrolled extraction
b) 10” row 15 uncontrolled extraction
c) 10” row 17 uncontrolled extraction
d) 16” row 18 uncontrolled extraction
e) 6” cold reheat (no actuator)

Cold Commissioning of Valves

Main and Intercept Stop Valves

a) HP control fluid tank temperature.
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure.

Intercept Control Valves

a) HP control fluid tank temperature
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure
f) Control Linearity Position Pressure Curve

LP Turbine Internal Alignment

a) Install lower components
b) Complete tightwire or laser alignment check of internal components

LP Turbine Assembly

a) Perform internal borescope close out inspections
b) Install lower diaphragms
c) Install rotor
d) Measure and record all clearances on buckets and packing segments
e) Install upper components
f) Install UH inner casing
g) Install outer casing
h) Install the last stage flow cones

Auxiliary Components

The contractor will disassemble/clean/inspect/assemble the following auxiliary components:

a) drain and fill lube oil tank
b) Auxiliary Components (PREPA)
c) The contractor will disassemble/clean/inspect/assemble the following auxiliary components:
d) drain and fill lube oil tank

e) Auxiliary oil pump (1)
f) Emergency oil pump (1)
g) Lube oil vapor extractors (2)
h) Lube oil pressure regulator (1)
i) AMOT temperature control valve (1)
j) Return oil screen (1)
k) Lube oil coolers (hydro blast by others) (2)
l) Lube oil cooler transfer valve
m) Lube oil level indicator
n) Main oil pump suction strainer
o) Jacking oil pump suction strainers

Contractor shall check for leakages, function check and commission lube oil system, recording all pertinent measurement according to quality procedures and test certificates.

a) Bearing header pressure regulator.
b) Pressure and temperature switches and/or transmitters.
c) Lube oil emergency automatic start up system (The performance of a complete
d) emergency response test, of the type specified by the OEM is highly
e) recommended.)
f) Lube oil cooling temperature/cooling water control system.
g) Remotely (motor operated) and/or (manual) operated valves.
h) Pressure gauges and temperature indicators.
i) Thrust and journal bearing oil inlet and discharge thermocouples (located in the unit).
j) Thrust and journal bearing metal thermocouples.

<u>Lube Oil Recirculation – Preparation</u>

a) Prepare and check that flushing accessories (pipe, adapters, bypasses, spool piece, banks, etc.) at bearings 1-5, main oil pump and gaskets are clean in good condition.
b) Remove main oil pump and install a bypass between inlet and outlet.
c) Remove temperature control valve, pressure control valve relieves valve and fit spool.
d) Remove and clean bearing oil feed lines, inspect and check for the correct orifice size.
e) Remove feed lines to turning gear
f) Install temporary flushing pipes and adapters, verify the correct installation to avoid leaks
g) Install temporary filter elements (20-micron filters bags) to the open ends of the temporary pipes and directs the pipes to the bearing pedestal drains.
h) Prior start AC pump ensure the oil temperature in tank is above 50°C as in work condition, use a temporary heater if necessary do not allow temperature in tank to rise above 75°C

<u>Lube Oil Recirculation – Cleaning</u>

a) Flush the system using the auxiliary AC oil pump
b) Periodically check the solid contents and cleaning of filter bags.

Stop the flush in the lesser of: (i) the cleanliness of bags is acceptable or (ii) 7 days of flushing already performed. Any additional flushing day would be charged as extra.

c) Remove bags and temporary flushing pipes and adapters
d) Return the lube oil system to operating configuration, take precautions to ensure that no dirt enters the system during this operation
e) Remove all temporary flushing accessories
f) Refill lube oil tank

Alignment check of HIP/LP and LP GEN Couplings (Centering, Parallelism and Run-out).

a) Perform alignment corrections according to Contractor recommendations as required.
b) Record of axial and radial position of rotor to outer casing and axial and radial
c) position of casing to bearing pedestal
d) Coupling of HIP/LP and LP/Generator Rotors
e) Install axial plate of LP/Generator Coupling.
f) Install axial plate of HIP/LP Coupling
g) Check of coupling bolts prior installation
h) Install and tighten coupling bots using hydraulic device
i) Install pedestal 1, 2, 3, 4 & 5 cover
j) Install upper half oil catcher and record the clearance of oil catcher
k) Assembly of HIP/LP and LP/Gen coupling guard

Cold Commissioning

TURBINE HMI AND INSTRUMENTATION

a) Identification and conformance of system equipment
b) Verification of instrumentation Calibration
c) Visual checks
d) Operational test sequences
e) System Alarms
f) Supervisory system verification

LUBE OIL SYSTEM VERIFICATION

a) Test with lubricating oil system in final state.
b) Verify turning gear operation

GLAND SEAL AND DRAIN SYSTEM

a) Gland Sealing system verification
b) Turbine Drain system verification

Hot Commissioning

START UP RUN-UP AND LOAD RISING (Check Valve sequence and Hysteresis).

a) Turbine run-up

b) Emergency trip button test
c) ETD Test
d) Primary Overspeed test simulated
e) Emergency Overspeed test
f) Turbine at nominal speed
g) Turbine run down
h) Reverse power test protection
i) Turbine at load Raising
j) Gland Sealing system verification
k) Turbine Drain system verification
l) Turbine Monitoring System verification

VIBRATION SURVEY DURING START UP / LOAD RISING OF THE UNIT.

a) Data Collecting during unit start up
b) Vibration Analysis and recommendation to Owner
c) Balance rotor as required to operate within manufactures recommendations

Quality Assurance

a) Inspection & Test plan will be prepared by Contractor.
b) Technical report will be prepared upon completion of work.

Generator Rehabilitation (Major Inspection)

Scope of On-Site Service - General Works

Mechanical Works:

a) Degas H2 during LOTO; before disassembly. Check H2 usage customer data for potential leakage
b) Dis- and reconnect generator electrically (Customer Scope)
c) Disassembly, inspection and reassembly of bearings
d) Alignment check, coupled run-out (CRO) check
e) Dis- and reassembly of oil pipelines
f) Dis- and reassembly of hydrogen coolers and cooler pipelines
g) Dis- and reassembly of NDE and DE oil deflector and seal assembly
h) Dis- and reassembly of NDE and DE end shields
i) Preparation of field rotor removal and assembly equipment
j) Rotor thread out
k) Check of baffle ring carrier; DP testing of fixed and moving blades
l) Rotor thread in
m) Dis- and reassembly of lower frame extension
n) Disassembly of fan nozzle ring
o) Air leakage check after reassembly, before filling generator with H2
p) Installation of scaffolding and work platforms (unless provided by Buyer)

Visual Inspection and Cleaning

a) Cleaning and inspection of disassembled components Visual Inspection of disassembled parts, all accessible areas (Fans, Filtration System, Mist Precipitator, Rotor Earthen,Seals, Vent pipe, Oil supply lines, Jacking Oil System, Air Inlets, Bearings, Thrust Bearing (where applicable), Cooler (where applicable), Line/neutral cubicles, Heater, Frame, Stator End Winding)
b) Bearing shaft alignment, insulation and clearance
c) Colector rings, brush holders and exciter inspection
d) Rotor borescope Inspection (Cooling paths, Insulation, Balancing Weights, Poles, Bearing journals, End Winding)

Generator Stator Major Inspection - Stator Visual Inspection

e) All visible components within the end winding compartment
a) Perform Borescope inspection on accessible areas at:
b) Magnetic core ends at bottom bars exits.
c) Magnetic core ventilation ducts.
d) Stator end windings. (Look for dirt, dust, and grease deposits. Visible loose ties, corona marks, cracks, blocks displacement, etc.).
e) Check/map the stator wedges (wedge tightening control).
f) Perform a strong winding cleaning, with the objective remove foreign materials, lose or displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined during the inspection, it will depend on how the winding will be, followed by drying process using hot blowers and insulation temperature control.
g) High Voltage Bushings.
h) Surface condition and wear, cracks, burning, oil contamination, deterioration
i) Inspect Coolers or suitability of service.
j) Inspect bearings for suitability of service.

Stator Test

a) RTD Element Resistance: gas and winding RTD's; checks for calibration and poor connections
b) Winding Copper Resistance: stator winding; checks for poor connections and breaks
c) Insulation Resistance (Megger): NDE bearing; contamination and/or deterioration of insulation
d) Insulation Resistance (Megger): Hydrogen seal casing; contamination and/or deterioration of insulation
e) Insulation Resistance (Megger) and Polarization Index (PI): stator winding contamination and/or deterioration of insulation
f) DC Leakage Current: stator winding; contamination and/or deterioration of insulation (reduced voltage level value to be agreed with the customer before executing)
g) DC Hipot: stator winding; ground wall insulation integrity (reduced voltage level value to be agreed with the customer before executing)
h) Wedge Tightness Map: stator wedges; detect wedge tightness deterioration
i) End winding Tightness Check: torque measurement.
j) Corona test in dark cabin (AC voltage)
k) Tan Delta; Stator Winding: check for stator insulation degradation.

Generator Rotor Major Inspections - Rotor Visual Inspection

a) All visible components within the end winding compartment
- Perform a strong winding cleaning, with the objective remove foreign materials, lose or
- displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning
- process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined
- during the inspection, it will depend on how the winding will be, followed by drying
- process using hot blowers and insulation temperature control
- Disassembly fans blades
- Clean/polish retaining rings
- On retaining rings, look for overheating marks or discoloration on accessible
- surface.
- Perform hand cleaning and vacuum on accessible areas.
- Perform Boroscope inspection in the rotor (on accessible areas like: ducts, coils,
- under the retaining rings, etc.)
- Check/map the rotor wedges
- Check balancing weights
- Check/map the rotor wedges (wedge tightening control)

Slip ring System

a) Surface condition and wear, cracks, burning, oil contamination, deterioration
b) Slip rings polishing ("manually").
c) Check of channels
d) Mechanical cleaning of slip rings
e) Roughness check
f) Dimensional control

Journals

a) Check for suitability of service

Rotor run out

a) Perform the run-out check under rollers device, due to was not performed the procedure of periodic running of the generator rotor in the last 6 years on standstill.

Rotor Test

a) Rotor Winding: Winding Copper Resistance; checks for poor connection and breaks
b) Rotor Winding: Insulation Resistance (Megger); contamination and/or deterioration of insulation
c) Rotor Inter-Turn Insulation: Shorted Turn Test; turn shorts (RSO and AC Impedance testing) .

Visual Inspection and Non-Destructive Essays (NDE's) on Generator Components

a) Perform visual inspection on accessible areas at:
b) Accessible areas on outer surface of Retaining Rings.
c) Generator rotor axial fan blades.
d) Journal bearing segments.
e) Generator rotor and extension shaft bearing journals.
f) Generator rotor slip rings.
g) Generator rotor coupling face.
h) Oil and H2 seals segments.
i) Coupling bolts and assembly hardware

Perform Non-Destructive Essays (NDE's) with Die Check on:

a) Generator rotor coupling face.
b) Journal bearing segments.
c) Rotor fan Blades.
d) Retaining rings (external side).
e) Oil and H2 seals segments.
f) Coupling bolts and assembly hardware.
g) Perform Non-Destructive Essays (NDE's) with Ultrasound on:
h) Generator rotor coupling face.
i) Journal bearing segments.
j) Adherence test.
k) Rotor fan Blades.
l) Retaining rings (external side).

Bearings - (Bearing pedestal without bearings. Bearing scope is included in the turbine scope)

a) Check for oil leaks
b) Dis- and reassembly of instrumentation
c) Check of bearing temperature instrumentation
d) Opening of bearing covers
e) Inspection of bearing insulation (pipe flange and bearing)
f) Bearing insulation resistance test
g) Closing of bearing covers
h) Visual inspection of bearing Babbitt for serviceability

Couplings

a) Opening of couplings
b) Coupling guard clearance check and removal.
c) Coupling CRO check, decoupling and alignment check
d) Coupling bolts ultrasonic and bolt hardness test.
e) Radial and axial alignment of shaft train
f) Closing couplings
g) Coupling insulation check

Exciter (Brushes and Brush Holders)

a) Dis- and reassemble the brush holders, brushes, cableClean and inspect of complete exciter and components (visual check for abnormalities, dust and dirt, charring, etc.)
b) Check the performance of new brushes
c) Check of brushes alignment
d) Check of connections torque

Seal Oil system

a) AC Seal Oil Pump - Visual inspection, cleaning and checking of coupling & pads
b) Emergency Seal Oil Pumps -Visual inspection, cleaning and checking of coupling & pads
c) Inspect clearance of labyrinth rings, seal strips & Lift oil components.

Seal Oil Coolers

a) Check and Inspect condition of coolers, cooling water inlet and outlet pipes. Mounting of all coolers, valves at drain and vent pipes

Hydrogen Gas System

a) Functional test of all valves, pressure reducers.
b) Leakage test of Hydrogen – System
c) Check filters

Hydrogen Dryer

a) Replacement of adsorbent material and cover gaskets
b) Inspection of dryers and functional test

Coolers

a) Inspection of Coolers
b) Back flushing of Cooler
c) Inspection of Cooling water inlet and outlet pipes
d) Inspection of Temperature and pressure measuring devices
e) Testing of Valves at drain and vent pipes

Outer Case

a) Repair and painting of the generator outer casing.

Generator Start up

Verification of the operational data of the generator during startup of the unit.

a) Verification along with the Customer that all generator systems were properly normalized.
b) During the startup of the unit under 100% loaded register the following operating parameters of the electric generator:

- Electrical parameters.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
Repair	$10,000,000.00
Total Project Estimated Cost	**$10,000,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name	Date
Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

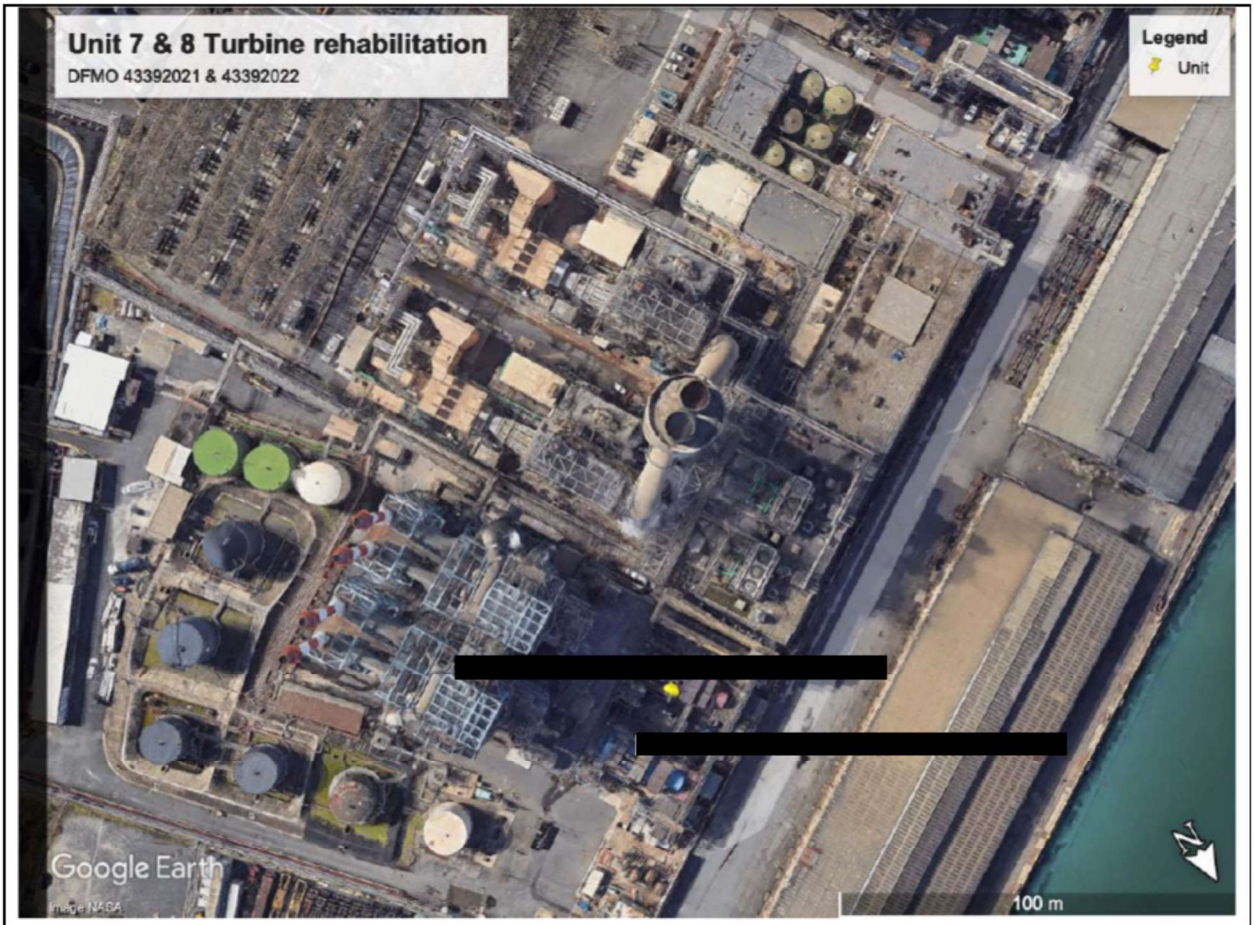
10.1. Project Detailed Cost Estimates

- Please see attached Scope of Work.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Scope of Work – HP/IP/LP Replacement Work San Juan 8

The Contractor is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the disassembly, inspection and reassemble of the HP-IP, LPB and Turbine Steam Valves of San Juan Power Plant Unit 8 in accordance the Terms and Conditions as requested by PREPA.

Activities covered by the scope of services shall include:

1) Disassembly and reassembly of pedestals and bearings 1,2,3.
2) HP outer casing and steam inlet piping heat thermal removal and reinstalling.
3) Disassembly and reassembly of HIP turbine upper outer casing, inner casings, diaphragm carrier, diaphragms, rotor, gland seals and crossover.
4) Disassembly and reassembly of LP turbine; outer casing, diaphragms, rotor, gland seals. Cross Over and Inner casing are currently out.
5) HIP and LP pedestal anchoring inspection and maintenance.
6) HIP and LP catenary survey verification.
7) HIP and LP rotor repair in GE Workshop
8) Inspection and NDT's of disassembled HIP and LP steam turbine components and pedestals 1, 2 and 3.
9) Alignment of the HIP/LP rotors.
10) HIP and LP Turbine Assembly
11) Cold and hot commissioning

Bearings and Couplings

1) Couplings A/B

    a) Loosen and remove coupling windage covers (coupling B only).
    b) Loosen and remove coupling bolts
    c) Separate couplings enough to record alignment
    d) Record parallel alignment on both couplings
    e) Clean and measure coupling bolts, compare to original dimensions o Inspect coupling nut locking plates for damage, replace as necessary
    f) Clean coupling face and all threaded holes
    g) Record final parallel alignment and runout
    h) Record offset alignment on coupling B
    i) Ensure bolts are stretched to the correct length and nuts secured correctly
    j) Complete sling check coupling A (T-1 removed)
    k) Inspect coupling A radius for steam erosion from packing case leakage
    l) Supply shims for coupling alignment moves and perform the coupling alignment if required.

2) Bearings 1-3

a) The following minimum scope of work will be completed on each of the radial/axial bearings.
b) Record as-found/final oil seal clearance
c) Record rotor position as-found/final
d) Record bearing inside diameter and journal outside diameter
e) Perform NDT on babbitted surfaces
f) Photograph wear pattern
g) Inspect all components for mechanical looseness (fretting/damaged shims, etc.)
h) Fit bearing pads to the turbine standards for correct contact. A photo will be taken of the contact pattern of each bearing.
i) Supply shims for bearing alignment moves. If a bearing is required to be moved over .010" the blue contact checks MUST be performed again to verify the required contact.
j) Install bearings
k) Measure twist/tilt. Correct as required
l) Ensure bearings are square to joint at final installation
m) Perform a bearing pinch check
n) Measure thrust float of the assembled thrust bearing
o) Perform as-found/as-left thrust check
p) Record radial alignment position of the thrust runners to the thrust bearing housing
q) Remove and install the thermocouples
r) Record thrust oil seal clearances
s) Ultrasonically inspect lands
t) Perform flatness check of copper side of thrust plate on precision surface plate
u) Perform 15 pt. taper check of lands
v) Perform stack check of thrust bearing components
w) Check bearing to ball fit contact. 80% minimum contact.
x) Perform a pinch check
y) Machine thrust shims for specified clearance and rotor position

3) HP/IP Turbine

<u>Initial Disassembly</u>

a) Record radial and axial position of HP/IP rotor to outer casing. Record radial and axial position of casing to bearing pedestals.
b) Perform shell arm loading checks
c) Transfer the shell running keys to the building keys maintain elevation as close as practical, ensure a safety key is installed at no more than 0.060" clearance.
d) Record as-found crossover flange gap at the HP/IP crossover flange after the bolts are loosened and prior to removal of the pipe and prior to the installation of the crossover braces. Notify owner of any differential greater than 0.080".
e) Record the as-left crossover flange gaps.
f) The as left crossover gaps will have no more than 0.080" of asymmetry.
g) Record tight as found casing gap.
h) Loosen casing bolts (induction heat required).
i) Record loose as-found casing gap

j) Remove gib keys
k) Raise upper casing with jack bolts, rig and remove
l) Remove outer casing bolts and nuts, organize for grit blasting
m) Record internal reference positions
n) Raise upper inner casings high enough with jack bolts, rig and remove
o) Remove UH packing
p) Removed UH diaphragms
q) Record radial and axial positions on all stationary and rotating components.

4) HP/IP Turbine Cleaning and Inspection

<u>Rotor (Take it to a Workshop to perform the following tasks</u>:

a) Sandblast steam path
b) Magnetic particle check rotating and stationary buckets
c) Perform run outs. All runouts will be matched to the number one bolt hole on the coupling. All runout points will reference the same location. 8 data points are to be recorded at each location.
d) Coupling – check for flatness. NDT rabbet fit
e) Oil deflector lands - Clean and visually inspect. Record diameter
f) Packing lands – NDT as part of steam path. Visually inspect for rubs
g) Journals – clean inspect for roundness and taper. Visually inspect for wear
h) Thrust runner inspection - clean inspect for flatness and parallelism. Record runner spacing. Visually inspect for wear
i) Map balance weights (if applicable)
j) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion
k) Blades exchange:
    i. Rows 1-5 HP
    ii. Rows 1-3 IP
l) Burnish vibration probe areas.
m) Visual and NDE inspection of the control rotor.
n) Boresonic Inspection
o) Low Speed Balancing

<u>Stationary (Work</u> On site):

a) Grit blast crossover line flanges and welds.
b) Inspect the crossover bolting. Identify crossover bolting that is damaged or otherwise unusable for re-assembly.
c) Nozzle block bores are to be measured at 3 elevation

<u>(Work on Vendor's Workshop):</u>

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair

d) Minor repair in 7 stages
e) Major repair in 8 stages – GE Shop
f) Replace strips – 7 stages
g) HP Nozzle – in-Shop repair – Atlanta
h) Inspection on site
i) Transportation to Vendor's Facilities
j) Major repair
k) ransportation to Prepa's Facilities

5) HP/IP Turbine Internal Alignment

a) Clean and inspect front standard
b) Ensure correct clearance of the emergency governor button to trip lever.
c) Inspect turbine anchor bolts and through bolts for proper torque.
d) Inspect welds, bellows and tie rods (bellows inspection will require a boroscope)
e) Clean the crossover flanges and mating flanges.
f) Complete tightwire or laser alignment check of internal components HP/IP.
g) Turbine Assembly
h) Internal boroscope close out inspections for FME.
i) Install LH components
j) Install rotor
k) Measure and record all clearances on buckets and packing segments
l) Install upper components
m) Stretch HP inner casing bolts and record final length
n) Install outer casing
o) Stretch outer casing bolts and record final length
p) Lower casing on to running keys and record final radial and axial position
q) Record the as-left crossover flange gaps
r) The as left crossover gaps will have no more than 0.080" of asymmetry
s) Remove the crossover bellows bracing

LP Pressure Turbine

Disassembly

a) Record radial and axial position of LP rotor to outer casing.
b) Record radial position of LP packing gland
c) Unbolt the last stage UH flow cones and secure to the hood and remove LP Hood
d) Record radial and axial positions on all stationary and rotating blades and gland segments
e) Rig and remove turbine rotor
f) Immediately cover exposed ends of shaft with gasket material and plastic sheet
g) Remove lower half of diaphragms

h) Remove packing from all locations. Ensure components are labeled correctly for assembly.
i) Record internal reference positions

LP Turbine Cleaning and Inspection

Rotor (In Vendor's Workshop)

a) Sandblast steam path components
b) Magnetic particle check rotor and diaphragms.
c) Map balance weights (if applicable)
d) Record runouts
e) Coupling – check for flatness. NDT rabbet fit
f) Oil deflector lands - Clean and visually inspect. Record diameter
g) Packing lands – NDT as part of steam path. Visually inspect for rubs
h) Journals – clean inspect for roundness and taper. Visually inspect for wear
i) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion and erosion shield condition
j) Burnish vibration probe areas.
k) Replace spill strips and packing segments as required by steam path audit
l) Replace L-0 and L-1 Blades (2 flows)
m) Boresonic Inspection
n) Low Speed balancing

Stationary (Vendor's Workshop)

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Perform minor repair on site
e) Replace strips – 6 stages
f) Perform major repair in shop

Valves (On Site)

Main Stop Valve

a) Disconnect actuator
b) Remove jackbolts and pull down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Check bushing clearance and alignment with try bar
h) Perform back seat contact check

i) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
j) Inspect stem seal and backseat
k) Replace metallic gasket for valve stem bushing assembly
l) Record free length of springs and compare to design data
m) Assemble stem, pressure seal head and disk
n) Contact check valve disk to seat
o) Tighten jackbolts on pull down ring
p) Measure total stroke of valve
q) Install steam strainer
r) Assemble valve head
s) Install actuator
t) Record closed end over travel
u) Remove crosshead, stem and valve
v) Clean and measure lockhead and guide for proper clearance
w) Remove stem from crosshead/lockhead
x) Inspect stem threads
y) nspect crosshead threads
z) Dye penetrant check of cross head to lock head fits
aa) Check stem run-out
bb) Clean and record stem and bushing diameters
cc) Check bushing with “try” bar.
dd) Clean seat and body area NDE inspections for cracking
ee) Replace body to stand gasket
ff) Measure and record body to stand fit
gg) Inspect cams for flat spots (roller damage)
hh) Inspect all cam shaft bearings
ii) Inspect all rack and pinion bearings
jj) Inspect the lever/fulcrum pins and bearings
kk) Inspect valve disk for stellite cracks and general condition
ll) Reassemble valve
mm) Blue contact check of disk to seat
nn) Assemble cam shaft
oo) Assemble rack and pinion
pp) Adjust valve crack and intercept points
qq) Clean and inspect snout rings
rr) NDT of diffusers

<u>Intercept Stop Valve Left & Right</u>

a) Disconnect actuator
b) Remove jack bolts and pull-down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings

g) Evaluate bushing clearance and alignment with try bar
h) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
i) Perform back seat contact check
j) Replace metallic gasket for valve stem bushing assembly
k) Record free length of springs and compare to design data
l) Assemble disks and stem
m) Contact check valve disk to seat
n) ighten jack bolts on pull down ring
o) o Measure total stroke of valve
p) Install steam strainer
q) Install valve cover
r) Install actuator
s) Record closed end over travel

Intercept Control Valve Left and Right

a) Record as-found lengths of linkages
b) Disconnect actuator from linkage
c) Remover outer flange
d) Disassemble valve and remove stem/head assembly
e) Disassemble bypass valve
f) Record stem run-out
g) Clean and measure diameters of stem and bushings
h) Evaluate bushing clearance and alignment with try bar
i) Complete NDT on valve disk, valve seat, stem bushing assembly and valve stem
j) Perform back seat contact check
k) Contact check valve disk to seat
l) Replace flange gasket
m) Assemble valve
n) Measure total stroke of valve
o) Install actuator
p) Record closed end over trave
q) Connect actuator linkage

Reheater Bypass Stop Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem bushing assembly
c) Disassemble coupling
d) Remove valve head and stem
e) Disassemble valve head
f) Clean and measure bypass valve
g) Record stem run-out
h) Clean and measure diameters of stem and bushings

i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check valve head to seat
l) Assemble valve
m) Measure total stroke of valve
n) Contact check flange
o) Install flange
p) Install actuator
q) Record closed end over travel.

Reheater Bypass Control Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem
c) bushing assembly
d) Disassemble coupling
e) Disassemble valve disk and stem
f) Disassemble valve disk
g) Clean and measure bypass valve
h) Record stem run-out
i) Clean and measure diameters of stem and bushings
j) Inspect stem seal
k) Record free length of spring and compare to design data
l) Contact check valve disk to seat
m) Assemble valve
n) Measure total stroke of valve
o) Contact check flange
p) Install flange
q) Install actuator
r) Record closed end over travel.

Blowdown Valve

a) Remove actuator
b) Remove valve
c) Remove shaft
d) Disassemble valve disk, shaft and piston rings
e) Clean and inspect
f) Grit blast components and complete NDT on valve disk, valve seat and main valve guide bushing
g) Record stem run-out
h) Clean and measure diameters of stem and bushings
i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check bypass valve to seat
l) Contact check valve head to seat

m) Replace flange gasket
n) Assemble valve
o) Tighten flange bolts
p) Measure total stroke of valve
q) Install actuator
r) Record closed end over travel.

Vacuum Breaker

a) Disassemble, clean, inspect and assemble the motorized valve.

Non-Return Valves

For each of the listed valves, complete the following scope (as applicable):

a) Remove actuator
b) Remove cover flange
c) Remove stem
d) Remove flapper
e) Measure diameters of bushings and shaft
f) Complete run-out on shaft
g) Replace shaft seals
h) Grit blast flapper
i) NDT flapper and seat
j) Assemble stem and shaft
k) Contact check flapper to seat
l) Replace cover flange seal
m) Inspect actuator, replace seals
n) Install actuator
o) Install cover flange
p) Adjust counterweight per OEM specifications
q) Confirm valve freedom of movement and functionality

Valves to be inspected:

a) 6” row 13 uncontrolled extraction
b) 10” row 15 uncontrolled extraction
c) 10” row 17 uncontrolled extraction
d) 16” row 18 uncontrolled extraction
e) 6” cold reheat (no actuator)

Cold Commissioning of Valves

Main and Intercept Stop Valves

a) HP control fluid tank temperature.
b) HP control and safety fluid pressure

c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure.

Intercept Control Valves

a) HP control fluid tank temperature
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure
f) Control Linearity Position Pressure Curve

LP Turbine Internal Alignment

a) Install lower components
b) Complete tightwire or laser alignment check of internal components

LP Turbine Assembly

a) Perform internal borescope close out inspections
b) Install lower diaphragms
c) Install rotor
d) Measure and record all clearances on buckets and packing segments
e) Install upper components
f) Install UH inner casing
g) Install outer casing
h) Install the last stage flow cones

Auxiliary Components

The contractor will disassemble/clean/inspect/assemble the following auxiliary components:

a) drain and fill lube oil tank
b) Auxiliary Components (PREPA)
c) The contractor will disassemble/clean/inspect/assemble the following auxiliary components:
d) drain and fill lube oil tank
e) Auxiliary oil pump (1)
f) Emergency oil pump (1)
g) Lube oil vapor extractors (2)
h) Lube oil pressure regulator (1)
i) AMOT temperature control valve (1)
j) Return oil screen (1)
k) Lube oil coolers (hydro blast by others) (2)

l) Lube oil cooler transfer valve
m) Lube oil level indicator
n) Main oil pump suction strainer
o) Jacking oil pump suction strainers

Contractor shall check for leakages, function check and commission lube oil system, recording all pertinent measurement according to quality procedures and test certificates.

a) Bearing header pressure regulator.
b) Pressure and temperature switches and/or transmitters.
c) Lube oil emergency automatic start up system (The performance of a complete
d) emergency response test, of the type specified by the OEM is highly
e) recommended.)
f) Lube oil cooling temperature/cooling water control system.
g) Remotely (motor operated) and/or (manual) operated valves.
h) Pressure gauges and temperature indicators.
i) Thrust and journal bearing oil inlet and discharge thermocouples (located in the unit).
j) Thrust and journal bearing metal thermocouples.

<u>Lube Oil Recirculation – Preparation</u>

a) Prepare and check that flushing accessories (pipe, adapters, bypasses, spool piece, banks, etc.) at bearings 1-5, main oil pump and gaskets are clean in good condition.
b) Remove main oil pump and install a bypass between inlet and outlet.
c) Remove temperature control valve, pressure control valve relieves valve and fit spool.
d) Remove and clean bearing oil feed lines, inspect and check for the correct orifice size.
e) Remove feed lines to turning gear
f) Install temporary flushing pipes and adapters, verify the correct installation to avoid leaks
g) Install temporary filter elements (20-micron filters bags) to the open ends of the temporary pipes and directs the pipes to the bearing pedestal drains.
h) Prior start AC pump ensure the oil temperature in tank is above 50°C as in work condition, use a temporary heater if necessary do not allow temperature in tank to rise above 75°C

<u>Lube Oil Recirculation – Cleaning</u>

a) Flush the system using the auxiliary AC oil pump
b) Periodically check the solid contents and cleaning of filter bags.
Stop the flush in the lesser of: (i) the cleanliness of bags is acceptable or (ii) 7 days of flushing already performed. Any additional flushing day would be charged as extra.

c) Remove bags and temporary flushing pipes and adapters
d) Return the lube oil system to operating configuration, take precautions to ensure that no dirt enters the system during this operation
e) Remove all temporary flushing accessories
f) Refill lube oil tank

Alignment check of HIP/LP and LP GEN Couplings (Centering, Parallelism and Run-out).

a) Perform alignment corrections according to Contractor recommendations as required.
b) Record of axial and radial position of rotor to outer casing and axial and radial
c) position of casing to bearing pedestal
d) Coupling of HIP/LP and LP/Generator Rotors
e) Install axial plate of LP/Generator Coupling.
f) Install axial plate of HIP/LP Coupling
g) Check of coupling bolts prior installation
h) Install and tighten coupling bots using hydraulic device
i) Install pedestal 1, 2, 3, 4 & 5 cover
j) Install upper half oil catcher and record the clearance of oil catcher
k) Assembly of HIP/LP and LP/Gen coupling guard

Cold Commissioning

TURBINE HMI AND INSTRUMENTATION

a) Identification and conformance of system equipment
b) Verification of instrumentation Calibration
c) Visual checks
d) Operational test sequences
e) System Alarms
f) Supervisory system verification

LUBE OIL SYSTEM VERIFICATION

a) Test with lubricating oil system in final state.
b) Verify turning gear operation

GLAND SEAL AND DRAIN SYSTEM

a) Gland Sealing system verification
b) Turbine Drain system verification

Hot Commissioning

START UP RUN-UP AND LOAD RISING (Check Valve sequence and Hysteresis).

a) Turbine run-up
b) Emergency trip button test
c) ETD Test
d) Primary Overspeed test simulated
e) Emergency Overspeed test
f) Turbine at nominal speed
g) Turbine run down
h) Reverse power test protection
i) Turbine at load Raising
j) Gland Sealing system verification
k) Turbine Drain system verification
l) Turbine Monitoring System verification

VIBRATION SURVEY DURING START UP / LOAD RISING OF THE UNIT.

a) Data Collecting during unit start up
b) Vibration Analysis and recommendation to Owner
c) Balance rotor as required to operate within manufactures recommendations

Quality Assurance

a) Inspection & Test plan will be prepared by Contractor.
b) Technical report will be prepared upon completion of work.

Generator Rehabilitation (Major Inspection)

Scope of On-Site Service - General Works

Mechanical Works:

a) Degas H2 during LOTO; before disassembly. Check H2 usage customer data for potential leakage
b) Dis- and reconnect generator electrically (Customer Scope)
c) Disassembly, inspection and reassembly of bearings
d) Alignment check, coupled run-out (CRO) check
e) Dis- and reassembly of oil pipelines
f) Dis- and reassembly of hydrogen coolers and cooler pipelines
g) Dis- and reassembly of NDE and DE oil deflector and seal assembly
h) Dis- and reassembly of NDE and DE end shields
i) Preparation of field rotor removal and assembly equipment
j) Rotor thread out
k) Check of baffle ring carrier; DP testing of fixed and moving blades
l) Rotor thread in
m) Dis- and reassembly of lower frame extension
n) Disassembly of fan nozzle ring
o) Air leakage check after reassembly, before filling generator with H2

p) Installation of scaffolding and work platforms (unless provided by Buyer)

Visual Inspection and Cleaning

a) Cleaning and inspection of disassembled components Visual Inspection of disassembled parts, all accessible areas (Fans, Filtration System, Mist Precipitator, Rotor Earthen,Seals, Vent pipe, Oil supply lines, Jacking Oil System, Air Inlets, Bearings, Thrust Bearing (where applicable), Cooler (where applicable), Line/neutral cubicles, Heater, Frame, Stator End Winding)
b) Bearing shaft alignment, insulation and clearance
c) Colector rings, brush holders and exciter inspection
d) Rotor borescope Inspection (Cooling paths, Insulation, Balancing Weights, Poles, Bearing journals, End Winding)

Generator Stator Major Inspection - Stator Visual Inspection

e) All visible components within the end winding compartment
a) Perform Borescope inspection on accessible areas at:
b) Magnetic core ends at bottom bars exits.
c) Magnetic core ventilation ducts.
d) Stator end windings. (Look for dirt, dust, and grease deposits. Visible loose ties, corona marks, cracks, blocks displacement, etc.).
e) Check/map the stator wedges (wedge tightening control).
f) Perform a strong winding cleaning, with the objective remove foreign materials, lose or displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined during the inspection, it will depend on how the winding will be, followed by drying process using hot blowers and insulation temperature control.
g) High Voltage Bushings.
h) Surface condition and wear, cracks, burning, oil contamination, deterioration
i) Inspect Coolers or suitability of service.
j) Inspect bearings for suitability of service.

Stator Test

a) RTD Element Resistance: gas and winding RTD's; checks for calibration and poor connections
b) Winding Copper Resistance: stator winding; checks for poor connections and breaks
c) Insulation Resistance (Megger): NDE bearing; contamination and/or deterioration of insulation
d) Insulation Resistance (Megger): Hydrogen seal casing; contamination and/or deterioration of insulation
e) Insulation Resistance (Megger) and Polarization Index (PI): stator winding contamination and/or deterioration of insulation

f) DC Leakage Current: stator winding; contamination and/or deterioration of insulation (reduced voltage level value to be agreed with the customer before executing)
g) DC Hipot: stator winding; ground wall insulation integrity (reduced voltage level value to be agreed with the customer before executing)
h) Wedge Tightness Map: stator wedges; detect wedge tightness deterioration
i) End winding Tightness Check: torque measurement.
j) Corona test in dark cabin (AC voltage)
k) Tan Delta; Stator Winding: check for stator insulation degradation.

Generator Rotor Major Inspections - Rotor Visual Inspection

a) All visible components within the end winding compartment
    - Perform a strong winding cleaning, with the objective remove foreign materials, lose or
    - displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning
    - process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined
    - during the inspection, it will depend on how the winding will be, followed by drying
    - process using hot blowers and insulation temperature control
    - Disassembly fans blades
    - Clean/polish retaining rings
    - On retaining rings, look for overheating marks or discoloration on accessible
    - surface.
    - Perform hand cleaning and vacuum on accessible areas.
    - Perform Boroscope inspection in the rotor (on accessible areas like: ducts, coils,
    - under the retaining rings, etc.)
    - Check/map the rotor wedges
    - Check balancing weights
    - Check/map the rotor wedges (wedge tightening control)

Slip ring System

a) Surface condition and wear, cracks, burning, oil contamination, deterioration
b) Slip rings polishing ("manually").
c) Check of channels
d) Mechanical cleaning of slip rings
e) Roughness check
f) Dimensional control

Journals

a) Check for suitability of service

Rotor run out

a) Perform the run-out check under rollers device, due to was not performed the procedure of periodic running of the generator rotor in the last 6 years on standstill.

Rotor Test

a) Rotor Winding: Winding Copper Resistance; checks for poor connection and breaks
b) Rotor Winding: Insulation Resistance (Megger); contamination and/or deterioration of insulation
c) Rotor Inter-Turn Insulation: Shorted Turn Test; turn shorts (RSO and AC Impedance testing) .

Visual Inspection and Non-Destructive Essays (NDE's) on Generator Components

a) Perform visual inspection on accessible areas at:
b) Accessible areas on outer surface of Retaining Rings.
c) Generator rotor axial fan blades.
d) Journal bearing segments.
e) Generator rotor and extension shaft bearing journals.
f) Generator rotor slip rings.
g) Generator rotor coupling face.
h) Oil and H2 seals segments.
i) Coupling bolts and assembly hardware

Perform Non-Destructive Essays (NDE's) with Die Check on:

a) Generator rotor coupling face.
b) Journal bearing segments.
c) Rotor fan Blades.
d) Retaining rings (external side).
e) Oil and H2 seals segments.
f) Coupling bolts and assembly hardware.
g) Perform Non-Destructive Essays (NDE's) with Ultrasound on:
h) Generator rotor coupling face.
i) Journal bearing segments.
j) Adherence test.
k) Rotor fan Blades.
l) Retaining rings (external side).

Bearings - (Bearing pedestal without bearings. Bearing scope is included in the turbine scope)

a) Check for oil leaks
b) Dis- and reassembly of instrumentation

c) Check of bearing temperature instrumentation
d) Opening of bearing covers
e) Inspection of bearing insulation (pipe flange and bearing)
f) Bearing insulation resistance test
g) Closing of bearing covers
h) Visual inspection of bearing Babbitt for serviceability

Couplings

a) Opening of couplings
b) Coupling guard clearance check and removal.
c) Coupling CRO check, decoupling and alignment check
d) Coupling bolts ultrasonic and bolt hardness test.
e) Radial and axial alignment of shaft train
f) Closing couplings
g) Coupling insulation check

Exciter (Brushes and Brush Holders)

a) Dis- and reassemble the brush holders, brushes, cableClean and inspect of complete exciter and components (visual check for abnormalities, dust and dirt, charring, etc.)
b) Check the performance of new brushes
c) Check of brushes alignment
d) Check of connections torque

Seal Oil system

a) AC Seal Oil Pump - Visual inspection, cleaning and checking of coupling & pads
b) Emergency Seal Oil Pumps -Visual inspection, cleaning and checking of coupling & pads
c) Inspect clearance of labyrinth rings, seal strips & Lift oil components.

Seal Oil Coolers

a) Check and Inspect condition of coolers, cooling water inlet and outlet pipes. Mounting of all coolers, valves at drain and vent pipes

Hydrogen Gas System

a) Functional test of all valves, pressure reducers.
b) Leakage test of Hydrogen – System
c) Check filters

Hydrogen Dryer

a) Replacement of adsorbent material and cover gaskets
b) Inspection of dryers and functional test

Coolers

a) Inspection of Coolers
b) Back flushing of Cooler
c) Inspection of Cooling water inlet and outlet pipes
d) Inspection of Temperature and pressure measuring devices
e) Testing of Valves at drain and vent pipes

Outer Case

a) Repair and painting of the generator outer casing.

Generator Start up

Verification of the operational data of the generator during startup of the unit.

a) Verification along with the Customer that all generator systems were properly normalized.
b) During the startup of the unit under 100% loaded register the following operating parameters of the electric generator:
    - Electrical parameters.

End of Scope of Work

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Unit 7 Turbine Rehabilitation

2/3/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	02/03/2022	

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Unit 7 Turbine Rehabilitation San Juan Power Plant
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Power Plant Unit 7 Turbine Rehabilitation	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

It is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the disassembly, inspection and reassemble of the HP-IP, LPB and Turbine Steam Valves of San Juan Power Plant Unit 7 in accordance the Terms and Conditions as requested by PREPA.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for San Juan Power Plant Unit 7 Turbine Rehabilitation will consist of the following:

Activities covered by the scope of services shall include:

1. Disassembly and reassembly of pedestals and bearings 1,2,3.
2. HP outer casing and steam inlet piping heat thermal removal and reinstalling.
3. Disassembly and reassembly of HIP turbine upper outer casing, inner casings, diaphragm carrier, diaphragms, rotor, gland seals and crossover.
4. Disassembly and reassembly of LP turbine; outer casing, diaphragms, rotor, gland seals. Cross Over and Inner casing are currently out.
5. HIP and LP pedestal anchoring inspection and maintenance.
6. HIP and LP catenary survey verification.
7. HIP and LP rotor repair in GE Workshop
8. Inspection and NDT's of disassembled HIP and LP steam turbine components and pedestals 1, 2 and 3.
9. Alignment of the HIP/LP rotors.
10. HIP and LP Turbine Assembly
11. Cold and hot commissioning

Bearings and Couplings

1) Couplings A/B

a) Loosen and remove coupling windage covers (coupling B only).
b) Loosen and remove coupling bolts
c) Separate couplings enough to record alignment
d) Record parallel alignment on both couplings
e) Clean and measure coupling bolts, compare to original dimensions o Inspect coupling nut locking plates for damage, replace as necessary
f) Clean coupling face and all threaded holes
g) Record final parallel alignment and runout
h) Record offset alignment on coupling B
i) Ensure bolts are stretched to the correct length and nuts secured correctly
j) Complete sling check coupling A (T-1 removed)
k) Inspect coupling A radius for steam erosion from packing case leakage
l) Supply shims for coupling alignment moves and perform the coupling alignment if required.

2) Bearings 1-3

a. The following minimum scope of work will be completed on each of the radial/axial bearings.
b. Record as found/final oil seal clearance
c. Record rotor position as found/final
d. Record bearing inside diameter and journal outside diameter
e. Perform NDT on babbitted surfaces
f. Photograph wear pattern
g. Inspect all components for mechanical looseness (fretting/damaged shims, etc.)
h. Fit bearing pads to the turbine standards for correct contact. A photo will be taken of the contact pattern of each bearing.
i. Supply shims for bearing alignment moves. If a bearing is required to be moved over .010" the blue contact checks MUST be performed again to verify the required contact.
j. Install bearings
k. Measure twist/tilt. Correct as required
l. Ensure bearings are square to joint at final installation
m. Perform a bearing pinch check
n. Measure thrust float of the assembled thrust bearing
o. Perform as-found/as-left thrust check
p. Record radial alignment position of the thrust runners to the thrust bearing housing
q. Remove and install the thermocouples
r. Record thrust oil seal clearances
s. Ultrasonically inspect lands
t. Perform flatness check of copper side of thrust plate on precision surface plate
u. Perform 15 pt. taper check of lands
v. Perform stack check of thrust bearing components
w. Check bearing to ball fit contact. 80% minimum contact.
x. Perform a pinch check
y. Machine thrust shims for specified clearance and rotor position

3) HP/IP Turbine

<u>Initial Disassembly</u>

a) Record radial and axial position of HP/IP rotor to outer casing. Record radial and axial position of casing to bearing pedestals.
b) Perform shell arm loading checks
c) Transfer the shell running keys to the building keys maintain elevation as close as practical, ensure a safety key is installed at no more than 0.060" clearance.
d) Record as-found crossover flange gap at the HP/IP crossover flange after the bolts are loosened and prior to removal of the pipe and prior to the installation of the crossover braces. Notify owner of any differential greater than 0.080".

e) Record the as-left crossover flange gaps.
f) The as left crossover gaps will have no more than 0.080" of asymmetry.
g) Record tight as found casing gap.
h) Loosen casing bolts (induction heat required).
i) Record loose as-found casing gap
j) Remove gib keys
k) Raise upper casing with jack bolts, rig and remove
l) Remove outer casing bolts and nuts, organize for grit blasting
m) Record internal reference positions
n) Raise upper inner casings high enough with jack bolts, rig and remove
o) Remove UH packing
p) Removed UH diaphragms
q) Record radial and axial positions on all stationary and rotating components.

4) HP/IP Turbine Cleaning and Inspection

Rotor (Take it to a Workshop to perform the following tasks:

a) Sandblast steam path
b) Magnetic particles check rotating and stationary buckets
c) Perform run outs. All runouts will be matched to the number one bolt hole on the coupling. All runout points will reference the same location. 8 data points are to be recorded at each location.
d) Coupling – check for flatness. NDT rabbet fit
e) Oil deflector lands - Clean and visually inspect. Record diameter
f) Packing lands – NDT as part of steam path. Visually inspect for rubs
g) Journals – clean inspect for roundness and taper. Visually inspect for wear
h) Thrust runner inspection - clean inspect for flatness and parallelism. Record runner spacing. Visually inspect for wear
i) Map balance weights (if applicable)
j) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion
k) Blades exchange:
    i. Rows 1-5 HP
    ii. Rows 1-3 IP
l) Burnish vibration probe areas.
m) Visual and NDE inspection of the control rotor.
n) Boresonic Inspection
o) Low Speed Balancing

Stationary (Work On site):

a) Grit blast crossover line flanges and welds.
b) Inspect the crossover bolting. Identify crossover bolting that is damaged or otherwise unusable for re-assembly.
c) Nozzle block bores are to be measured at 3 elevation

(Work on Vendor's Workshop):

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Minor repair in 7 stages
e) Major repair in 8 stages – GE Shop
f) Replace strips – 7 stages
g) HP Nozzle – in-Shop repair – Atlanta
h) Inspection on site
i) Transportation to Vendor's Facilities
j) Major repair
k) Transportation to Prepa's Facilities

5) HP/IP Turbine Internal Alignment

a) Clean and inspect front standard
b) Ensure correct clearance of the emergency governor button to trip lever.
c) Inspect turbine anchor bolts and through bolts for proper torque.
d) Inspect welds, bellows, and tie rods (bellows inspection will require a borescope)
e) Clean the crossover flanges and mating flanges.
f) Complete tightwire or laser alignment check of internal components HP/IP.
g) Turbine Assembly
h) Internal borescope close out inspections for FME.
i) Install LH components
j) Install rotor
k) Measure and record all clearances on buckets and packing segments
l) Install upper components
m) Stretch HP inner casing bolts and record final length
n) Install outer casing
o) Stretch outer casing bolts and record final length
p) Lower casing on to running keys and record final radial and axial position
q) Record the as-left crossover flange gaps
r) The as left crossover gaps will have no more than 0.080" of asymmetry
s) Remove the crossover bellows bracing

LP Pressure Turbine

Disassembly

a) Record radial and axial position of LP rotor to outer casing.
b) Record radial position of LP packing gland
c) Unbolt the last stage UH flow cones and secure to the hood and remove LP Hood

d) Record radial and axial positions on all stationary and rotating blades and gland segments
e) Rig and remove turbine rotor
f) Immediately cover exposed ends of shaft with gasket material and plastic sheet
g) Remove lower half of diaphragms
h) Remove packing from all locations. Ensure components are labeled correctly for assembly.
i) Record internal reference positions

LP Turbine Cleaning and Inspection

Rotor (In Vendor's Workshop)

a) Sandblast steam path components
b) Magnetic particle check rotor and diaphragms.
c) Map balance weights (if applicable)
d) Record runouts
e) Coupling – check for flatness. NDT rabbet fit
f) Oil deflector lands - Clean and visually inspect. Record diameter
g) Packing lands – NDT as part of steam path. Visually inspect for rubs
h) Journals – clean inspect for roundness and taper. Visually inspect for wear
i) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion and erosion shield condition
j) Burnish vibration probe areas.
k) Replace spill strips and packing segments as required by steam path audit
l) Replace L-0 and L-1 Blades (2 flows)
m) Boresonic Inspection
n) Low Speed balancing

Stationary (Vendor's Workshop)

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Perform minor repair on site
e) Replace strips – 6 stages
f) Perform major repair in shop

Valves (On Site)

Main Stop Valve

a) Disconnect actuator
b) Remove jackbolts and pull down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk

e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Check bushing clearance and alignment with try bar
h) Perform back seat contact check
i) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
j) Inspect stem seal and backseat
k) Replace metallic gasket for valve stem bushing assembly
l) Record free length of springs and compare to design data
m) Assemble stem, pressure seal head and disk
n) Contact check valve disk to seat
o) Tighten jackbolts on pull down ring
p) Measure total stroke of valve
q) Install steam strainer
r) Assemble valve head
s) Install actuator
t) Record closed end over travel
u) Remove crosshead, stem and valve
v) Clean and measure lockhead and guide for proper clearance
w) Remove stem from crosshead/lockhead
x) Inspect stem threads
y) nspect crosshead threads
z) Dye penetrant check of cross head to lock head fits
aa) Check stem run-out
bb) Clean and record stem and bushing diameters
cc) Check bushing with “try” bar.
dd) Clean seat and body area NDE inspections for cracking
ee) Replace body to stand gasket
ff) Measure and record body to stand fit
gg) Inspect cams for flat spots (roller damage)
hh) Inspect all cam shaft bearings
ii) Inspect all rack and pinion bearings
jj) Inspect the lever/fulcrum pins and bearings
kk) Inspect valve disk for stellite cracks and general condition
ll) Reassemble valve
mm) Blue contact check of disk to seat
nn) Assemble cam shaft
oo) Assemble rack and pinion
pp) Adjust valve crack and intercept points
qq) Clean and inspect snout rings
rr) NDT of diffusers

<u>Intercept Stop Valve Left & Right</u>

a) Disconnect actuator
b) Remove jack bolts and pull-down ring

c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Evaluate bushing clearance and alignment with try bar
h) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
i) Perform back seat contact check
j) Replace metallic gasket for valve stem bushing assembly
k) Record free length of springs and compare to design data
l) Assemble disks and stem
m) Contact check valve disk to seat
n) ighten jack bolts on pull down ring
o) o Measure total stroke of valve
p) Install steam strainer
q) Install valve cover
r) Install actuator
s) Record closed end over travel

Intercept Control Valve Left and Right

a) Record as-found lengths of linkages
b) Disconnect actuator from linkage
c) Remover outer flange
d) Disassemble valve and remove stem/head assembly
e) Disassemble bypass valve
f) Record stem run-out
g) Clean and measure diameters of stem and bushings
h) Evaluate bushing clearance and alignment with try bar
i) Complete NDT on valve disk, valve seat, stem bushing assembly and valve stem
j) Perform back seat contact check
k) Contact check valve disk to seat
l) Replace flange gasket
m) Assemble valve
n) Measure total stroke of valve
o) Install actuator
p) Record closed end over trave
q) Connect actuator linkage

Reheater Bypass Stop Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem bushing assembly
c) Disassemble coupling
d) Remove valve head and stem

e) Disassemble valve head
f) Clean and measure bypass valve
g) Record stem run-out
h) Clean and measure diameters of stem and bushings
i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check valve head to seat
l) Assemble valve
m) Measure total stroke of valve
n) Contact check flange
o) Install flange
p) Install actuator
q) Record closed end over travel.

Reheater Bypass Control Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem
c) bushing assembly
d) Disassemble coupling
e) Disassemble valve disk and stem
f) Disassemble valve disk
g) Clean and measure bypass valve
h) Record stem run-out
i) Clean and measure diameters of stem and bushings
j) Inspect stem seal
k) Record free length of spring and compare to design data
l) Contact check valve disk to seat
m) Assemble valve
n) Measure total stroke of valve
o) Contact check flange
p) Install flange
q) Install actuator
r) Record closed end over travel.

Blowdown Valve

a) Remove actuator
b) Remove valve
c) Remove shaft
d) Disassemble valve disk, shaft and piston rings
e) Clean and inspect
f) Grit blast components and complete NDT on valve disk, valve seat and main valve guide bushing
g) Record stem run-out
h) Clean and measure diameters of stem and bushings

i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check bypass valve to seat
l) Contact check valve head to seat
m) Replace flange gasket
n) Assemble valve
o) Tighten flange bolts
p) Measure total stroke of valve
q) Install actuator
r) Record closed end over travel.

Vacuum Breaker

a) Disassemble, clean, inspect and assemble the motorized valve.

Non-Return Valves

For each of the listed valves, complete the following scope (as applicable):

a) Remove actuator
b) Remove cover flange
c) Remove stem
d) Remove flapper
e) Measure diameters of bushings and shaft
f) Complete run-out on shaft
g) Replace shaft seals
h) Grit blast flapper
i) NDT flapper and seat
j) Assemble stem and shaft
k) Contact check flapper to seat
l) Replace cover flange seal
m) Inspect actuator, replace seals
n) Install actuator
o) Install cover flange
p) Adjust counterweight per OEM specifications
q) Confirm valve freedom of movement and functionality

Valves to be inspected:

a) 6” row 13 uncontrolled extraction
b) 10” row 15 uncontrolled extraction
c) 10” row 17 uncontrolled extraction
d) 16” row 18 uncontrolled extraction
e) 6” cold reheat (no actuator)

Cold Commissioning of Valves

Main and Intercept Stop Valves

a) HP control fluid tank temperature.
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure.

Intercept Control Valves

a) HP control fluid tank temperature
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure
f) Control Linearity Position Pressure Curve

LP Turbine Internal Alignment

a) Install lower components
b) Complete tightwire or laser alignment check of internal components

LP Turbine Assembly

a) Perform internal borescope close out inspections
b) Install lower diaphragms
c) Install rotor
d) Measure and record all clearances on buckets and packing segments
e) Install upper components
f) Install UH inner casing
g) Install outer casing
h) Install the last stage flow cones

Auxiliary Components

The contractor will disassemble/clean/inspect/assemble the following auxiliary components:

a) drain and fill lube oil tank
b) Auxiliary Components (PREPA)
c) The contractor will disassemble/clean/inspect/assemble the following auxiliary components:
d) drain and fill lube oil tank
e) Auxiliary oil pump (1)
f) Emergency oil pump (1)
g) Lube oil vapor extractors (2)

h) Lube oil pressure regulator (1)
i) AMOT temperature control valve (1)
j) Return oil screen (1)
k) Lube oil coolers (hydro blast by others) (2)
l) Lube oil cooler transfer valve
m) Lube oil level indicator
n) Main oil pump suction strainer
o) Jacking oil pump suction strainers

Contractor shall check for leakages, function check and commission lube oil system, recording all pertinent measurement according to quality procedures and test certificates.

a) Bearing header pressure regulator.
b) Pressure and temperature switches and/or transmitters.
c) Lube oil emergency automatic start up system (The performance of a complete
d) emergency response test, of the type specified by the OEM is highly
e) recommended.)
f) Lube oil cooling temperature/cooling water control system.
g) Remotely (motor operated) and/or (manual) operated valves.
h) Pressure gauges and temperature indicators.
i) Thrust and journal bearing oil inlet and discharge thermocouples (located in the unit).
j) Thrust and journal bearing metal thermocouples.

Lube Oil Recirculation – Preparation

a) Prepare and check that flushing accessories (pipe, adapters, bypasses, spool piece, banks, etc.) at bearings 1-5, main oil pump and gaskets are clean in good condition.
b) Remove main oil pump and install a bypass between inlet and outlet.
c) Remove temperature control valve, pressure control valve relieves valve and fit spool.
d) Remove and clean bearing oil feed lines, inspect and check for the correct orifice size.
e) Remove feed lines to turning gear
f) Install temporary flushing pipes and adapters, verify the correct installation to avoid leaks
g) Install temporary filter elements (20-micron filters bags) to the open ends of the temporary pipes and directs the pipes to the bearing pedestal drains.
h) Prior start AC pump ensure the oil temperature in tank is above 50°C as in work condition, use a temporary heater if necessary do not allow temperature in tank to rise above 75°C

Lube Oil Recirculation – Cleaning

a) Flush the system using the auxiliary AC oil pump

b) Periodically check the solid contents and cleaning of filter bags.
   Stop the flush in the lesser of: (i) the cleanliness of bags is acceptable or (ii) 7 days of flushing already performed. Any additional flushing day would be charged as extra.
c) Remove bags and temporary flushing pipes and adapters
d) Return the lube oil system to operating configuration, take precautions to ensure that no dirt enters the system during this operation
e) Remove all temporary flushing accessories
f) Refill lube oil tank

Alignment check of HIP/LP and LP GEN Couplings (Centering, Parallelism and Run-out).

a) Perform alignment corrections according to Contractor recommendations as required.
b) Record of axial and radial position of rotor to outer casing and axial and radial
c) position of casing to bearing pedestal
d) Coupling of HIP/LP and LP/Generator Rotors
e) Install axial plate of LP/Generator Coupling.
f) Install axial plate of HIP/LP Coupling
g) Check of coupling bolts prior installation
h) Install and tighten coupling bots using hydraulic device
i) Install pedestal 1, 2, 3, 4 & 5 cover
j) Install upper half oil catcher and record the clearance of oil catcher
k) Assembly of HIP/LP and LP/Gen coupling guard

Cold Commissioning

TURBINE HMI AND INSTRUMENTATION

a) Identification and conformance of system equipment
b) Verification of instrumentation Calibration
c) Visual checks
d) Operational test sequences
e) System Alarms
f) Supervisory system verification

LUBE OIL SYSTEM VERIFICATION

a) Test with lubricating oil system in final state.
b) Verify turning gear operation

GLAND SEAL AND DRAIN SYSTEM

a) Gland Sealing system verification
b) Turbine Drain system verification

Hot Commissioning

START UP RUN-UP AND LOAD RISING (Check Valve sequence and Hysteresis).

a) Turbine run-up
b) Emergency trip button test
c) ETD Test
d) Primary Overspeed test simulated
e) Emergency Overspeed test
f) Turbine at nominal speed
g) Turbine run down
h) Reverse power test protection
i) Turbine at load Raising
j) Gland Sealing system verification
k) Turbine Drain system verification
l) Turbine Monitoring System verification

VIBRATION SURVEY DURING START UP / LOAD RISING OF THE UNIT.

a) Data Collecting during unit start up
b) Vibration Analysis and recommendation to Owner
c) Balance rotor as required to operate within manufactures recommendations

Quality Assurance

a) Inspection & Test plan will be prepared by Contractor.
b) Technical report will be prepared upon completion of work.

Generator Rehabilitation (Major Inspection)

Scope of On-Site Service - General Works

Mechanical Works:

a) Degas H2 during LOTO; before disassembly. Check H2 usage customer data for potential leakage
b) Dis- and reconnect generator electrically (Customer Scope)
c) Disassembly, inspection, and reassembly of bearings
d) Alignment check, coupled run-out (CRO) check
e) Dis- and reassembly of oil pipelines
f) Dis- and reassembly of hydrogen coolers and cooler pipelines
g) Dis- and reassembly of NDE and DE oil deflector and seal assembly
h) Dis- and reassembly of NDE and DE end shields
i) Preparation of field rotor removal and assembly equipment
j) Rotor thread out
k) Check of baffle ring carrier; DP testing of fixed and moving blades

l) Rotor thread in
m) Dis- and reassembly of lower frame extension
n) Disassembly of fan nozzle ring
o) Air leakage check after reassembly, before filling generator with H2
p) Installation of scaffolding and work platforms (unless provided by Buyer)

Visual Inspection and Cleaning

a) Cleaning and inspection of disassembled components Visual Inspection of disassembled parts, all accessible areas (Fans, Filtration System, Mist Precipitator, Rotor Earthen,Seals, Vent pipe, Oil supply lines, Jacking Oil System, Air Inlets, Bearings, Thrust Bearing (where applicable), Cooler (where applicable), Line/neutral cubicles, Heater, Frame, Stator End Winding)
b) Bearing shaft alignment, insulation and clearance
c) Colector rings, brush holders and exciter inspection
d) Rotor borescope Inspection (Cooling paths, Insulation, Balancing Weights, Poles, Bearing journals, End Winding)

Generator Stator Major Inspection - Stator Visual Inspection

e) All visible components within the end winding compartment
a) Perform Borescope inspection on accessible areas at:
b) Magnetic core ends at bottom bars exits.
c) Magnetic core ventilation ducts.
d) Stator end windings. (Look for dirt, dust, and grease deposits. Visible loose ties, corona marks, cracks, blocks displacement, etc.).
e) Check/map the stator wedges (wedge tightening control).
f) Perform a strong winding cleaning, with the objective remove foreign materials, lose or displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined during the inspection, it will depend on how the winding will be, followed by drying process using hot blowers and insulation temperature control.
g) High Voltage Bushings.
h) Surface condition and wear, cracks, burning, oil contamination, deterioration
i) Inspect Coolers or suitability of service.
j) Inspect bearings for suitability of service.

Stator Test

a) RTD Element Resistance: gas and winding RTD's; checks for calibration and poor connections
b) Winding Copper Resistance: stator winding; checks for poor connections and breaks
c) Insulation Resistance (Megger): NDE bearing; contamination and/or deterioration of insulation

d) Insulation Resistance (Megger): Hydrogen seal casing; contamination and/or deterioration of insulation
e) Insulation Resistance (Megger) and Polarization Index (PI): stator winding contamination and/or deterioration of insulation
f) DC Leakage Current: stator winding; contamination and/or deterioration of insulation (reduced voltage level value to be agreed with the customer before executing)
g) DC Hipot: stator winding; ground wall insulation integrity (reduced voltage level value to be agreed with the customer before executing)
h) Wedge Tightness Map: stator wedges; detect wedge tightness deterioration
i) End winding Tightness Check: torque measurement.
j) Corona test in dark cabin (AC voltage)
k) Tan Delta; Stator Winding: check for stator insulation degradation.

Generator Rotor Major Inspections - Rotor Visual Inspection

a) All visible components within the end winding compartment
- Perform a strong winding cleaning, with the objective remove foreign materials, lose or
- displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning
- process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined
- during the inspection, it will depend on how the winding will be, followed by drying
- process using hot blowers and insulation temperature control
- Disassembly fans blades
- Clean/polish retaining rings
- On retaining rings, look for overheating marks or discoloration on accessible
- surface.
- Perform hand cleaning and vacuum on accessible areas.
- Perform Boroscope inspection in the rotor (on accessible areas like: ducts, coils,
- under the retaining rings, etc.)
- Check/map the rotor wedges
- Check balancing weights
- Check/map the rotor wedges (wedge tightening control)

Slip ring System

a) Surface condition and wear, cracks, burning, oil contamination, deterioration
b) Slip rings polishing ("manually").
c) Check of channels
d) Mechanical cleaning of slip rings
e) Roughness check
f) Dimensional control

Journals

a) Check for suitability of service

Rotor run out

a) Perform the run-out check under rollers device, due to was not performed the procedure of periodic running of the generator rotor in the last 6 years on standstill.

Rotor Test

a) Rotor Winding: Winding Copper Resistance; checks for poor connection and breaks
b) Rotor Winding: Insulation Resistance (Megger); contamination and/or deterioration of insulation
c) Rotor Inter-Turn Insulation: Shorted Turn Test; turn shorts (RSO and AC Impedance testing) .

Visual Inspection and Non-Destructive Essays (NDE's) on Generator Components

a) Perform visual inspection on accessible areas at:
b) Accessible areas on outer surface of Retaining Rings.
c) Generator rotor axial fan blades.
d) Journal bearing segments.
e) Generator rotor and extension shaft bearing journals.
f) Generator rotor slip rings.
g) Generator rotor coupling face.
h) Oil and H2 seals segments.
i) Coupling bolts and assembly hardware

Perform Non-Destructive Essays (NDE's) with Die Check on:

a) Generator rotor coupling face.
b) Journal bearing segments.
c) Rotor fan Blades.
d) Retaining rings (external side).
e) Oil and H2 seals segments.
f) Coupling bolts and assembly hardware.
g) Perform Non-Destructive Essays (NDE's) with Ultrasound on:
h) Generator rotor coupling face.
i) Journal bearing segments.
j) Adherence test.
k) Rotor fan Blades.
l) Retaining rings (external side).

Bearings - (Bearing pedestal without bearings. Bearing scope is included in the turbine scope)

a) Check for oil leaks
b) Dis- and reassembly of instrumentation
c) Check of bearing temperature instrumentation
d) Opening of bearing covers
e) Inspection of bearing insulation (pipe flange and bearing)
f) Bearing insulation resistance test
g) Closing of bearing covers
h) Visual inspection of bearing Babbitt for serviceability

Couplings

a) Opening of couplings
b) Coupling guard clearance check and removal.
c) Coupling CRO check, decoupling and alignment check
d) Coupling bolts ultrasonic and bolt hardness test.
e) Radial and axial alignment of shaft train
f) Closing couplings
g) Coupling insulation check

Exciter (Brushes and Brush Holders)

a) Dis- and reassemble the brush holders, brushes, cableClean and inspect of complete exciter and components (visual check for abnormalities, dust and dirt, charring, etc.)
b) Check the performance of new brushes
c) Check of brushes alignment
d) Check of connections torque

Seal Oil system

a) AC Seal Oil Pump - Visual inspection, cleaning and checking of coupling & pads
b) Emergency Seal Oil Pumps -Visual inspection, cleaning and checking of coupling & pads
c) Inspect clearance of labyrinth rings, seal strips & Lift oil components.

Seal Oil Coolers

a) Check and Inspect condition of coolers, cooling water inlet and outlet pipes. Mounting of all coolers, valves at drain and vent pipes

Hydrogen Gas System

a) Functional test of all valves, pressure reducers.

b) Leakage test of Hydrogen – System
c) Check filters

Hydrogen Dryer

a) Replacement of adsorbent material and cover gaskets
b) Inspection of dryers and functional test

Coolers

a) Inspection of Coolers
b) Back flushing of Cooler
c) Inspection of Cooling water inlet and outlet pipes
d) Inspection of Temperature and pressure measuring devices
e) Testing of Valves at drain and vent pipes

Outer Case

a) Repair and painting of the generator outer casing.

Generator Start up

Verification of the operational data of the generator during startup of the unit.

a) Verification along with the Customer that all generator systems were properly normalized.
b) During the startup of the unit under 100% loaded register the following operating parameters of the electric generator:
   - Electrical parameters.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
   a. Other improvements, not required by codes and standards
   b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
Rehabilitation	$10,000,000.00
Total Project Estimated Cost	**$10,000,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name	Date
Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

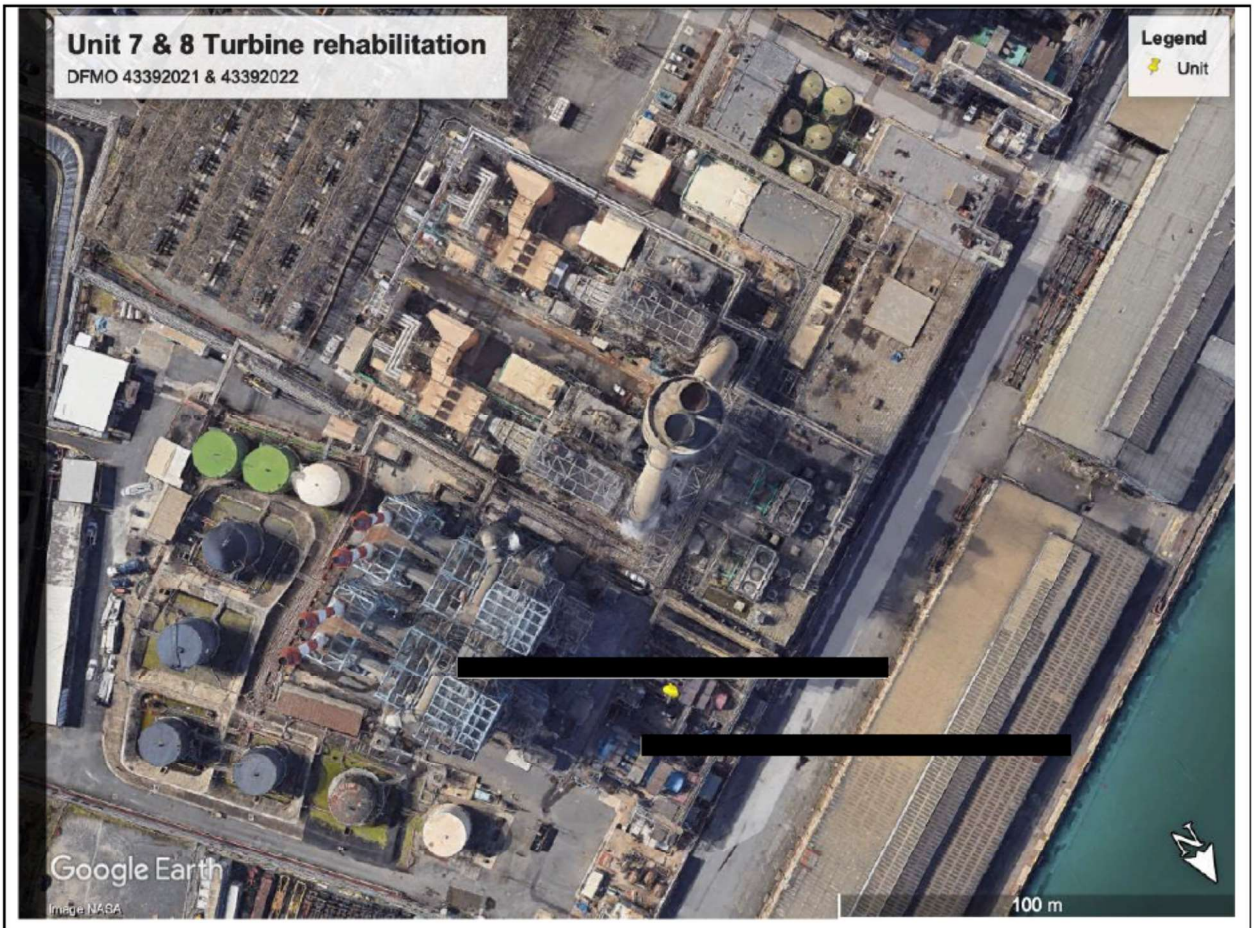
10.1. Project Detailed Cost Estimates

- Please see attached Scope of Work.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Scope of Work – HP/IP/LP Replacement Work San Juan 7

The Contractor is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the disassembly, inspection and reassemble of the HP-IP, LPB and Turbine Steam Valves of San Juan Power Plant Unit 7 in accordance the Terms and Conditions as requested by PREPA.

Activities covered by the scope of services shall include:

1) Disassembly and reassembly of pedestals and bearings 1,2,3.
2) HP outer casing and steam inlet piping heat thermal removal and reinstalling.
3) Disassembly and reassembly of HIP turbine upper outer casing, inner casings, diaphragm carrier, diaphragms, rotor, gland seals and crossover.
4) Disassembly and reassembly of LP turbine; outer casing, diaphragms, rotor, gland seals. Cross Over and Inner casing are currently out.
5) HIP and LP pedestal anchoring inspection and maintenance.
6) HIP and LP catenary survey verification.
7) HIP and LP rotor repair in GE Workshop
8) Inspection and NDT's of disassembled HIP and LP steam turbine components and pedestals 1, 2 and 3.
9) Alignment of the HIP/LP rotors.
10) HIP and LP Turbine Assembly
11) Cold and hot commissioning

Bearings and Couplings

1) Couplings A/B

    a) Loosen and remove coupling windage covers (coupling B only).
    b) Loosen and remove coupling bolts
    c) Separate couplings enough to record alignment
    d) Record parallel alignment on both couplings
    e) Clean and measure coupling bolts, compare to original dimensions o Inspect coupling nut locking plates for damage, replace as necessary
    f) Clean coupling face and all threaded holes
    g) Record final parallel alignment and runout
    h) Record offset alignment on coupling B
    i) Ensure bolts are stretched to the correct length and nuts secured correctly
    j) Complete sling check coupling A (T-1 removed)
    k) Inspect coupling A radius for steam erosion from packing case leakage
    l) Supply shims for coupling alignment moves and perform the coupling alignment if required.

2) Bearings 1-3

a) The following minimum scope of work will be completed on each of the radial/axial bearings.
b) Record as-found/final oil seal clearance
c) Record rotor position as-found/final
d) Record bearing inside diameter and journal outside diameter
e) Perform NDT on babbitted surfaces
f) Photograph wear pattern
g) Inspect all components for mechanical looseness (fretting/damaged shims, etc.)
h) Fit bearing pads to the turbine standards for correct contact. A photo will be taken of the contact pattern of each bearing.
i) Supply shims for bearing alignment moves. If a bearing is required to be moved over .010" the blue contact checks MUST be performed again to verify the required contact.
j) Install bearings
k) Measure twist/tilt. Correct as required
l) Ensure bearings are square to joint at final installation
m) Perform a bearing pinch check
n) Measure thrust float of the assembled thrust bearing
o) Perform as-found/as-left thrust check
p) Record radial alignment position of the thrust runners to the thrust bearing housing
q) Remove and install the thermocouples
r) Record thrust oil seal clearances
s) Ultrasonically inspect lands
t) Perform flatness check of copper side of thrust plate on precision surface plate
u) Perform 15 pt. taper check of lands
v) Perform stack check of thrust bearing components
w) Check bearing to ball fit contact. 80% minimum contact.
x) Perform a pinch check
y) Machine thrust shims for specified clearance and rotor position

3) HP/IP Turbine

<u>Initial Disassembly</u>

a) Record radial and axial position of HP/IP rotor to outer casing. Record radial and axial position of casing to bearing pedestals.
b) Perform shell arm loading checks
c) Transfer the shell running keys to the building keys maintain elevation as close as practical, ensure a safety key is installed at no more than 0.060" clearance.
d) Record as-found crossover flange gap at the HP/IP crossover flange after the bolts are loosened and prior to removal of the pipe and prior to the installation of the crossover braces. Notify owner of any differential greater than 0.080".
e) Record the as-left crossover flange gaps.
f) The as left crossover gaps will have no more than 0.080" of asymmetry.
g) Record tight as found casing gap.
h) Loosen casing bolts (induction heat required).
i) Record loose as-found casing gap

j) Remove gib keys
k) Raise upper casing with jack bolts, rig and remove
l) Remove outer casing bolts and nuts, organize for grit blasting
m) Record internal reference positions
n) Raise upper inner casings high enough with jack bolts, rig and remove
o) Remove UH packing
p) Removed UH diaphragms
q) Record radial and axial positions on all stationary and rotating components.

4) HP/IP Turbine Cleaning and Inspection

<u>Rotor (Take it to a Workshop to perform the following tasks</u>:

a) Sandblast steam path
b) Magnetic particle check rotating and stationary buckets
c) Perform run outs. All runouts will be matched to the number one bolt hole on the coupling. All runout points will reference the same location. 8 data points are to be recorded at each location.
d) Coupling – check for flatness. NDT rabbet fit
e) Oil deflector lands - Clean and visually inspect. Record diameter
f) Packing lands – NDT as part of steam path. Visually inspect for rubs
g) Journals – clean inspect for roundness and taper. Visually inspect for wear
h) Thrust runner inspection - clean inspect for flatness and parallelism. Record runner spacing. Visually inspect for wear
i) Map balance weights (if applicable)
j) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion
k) Blades exchange:
    i. Rows 1-5 HP
    ii. Rows 1-3 IP
l) Burnish vibration probe areas.
m) Visual and NDE inspection of the control rotor.
n) Boresonic Inspection
o) Low Speed Balancing

<u>Stationary (Work</u> On site):

a) Grit blast crossover line flanges and welds.
b) Inspect the crossover bolting. Identify crossover bolting that is damaged or otherwise unusable for re-assembly.
c) Nozzle block bores are to be measured at 3 elevation

<u>(Work on Vendor's Workshop):</u>

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair

d) Minor repair in 7 stages
e) Major repair in 8 stages – GE Shop
f) Replace strips – 7 stages
g) HP Nozzle – in-Shop repair – Atlanta
h) Inspection on site
i) Transportation to Vendor's Facilities
j) Major repair
k) ransportation to Prepa's Facilities

5) HP/IP Turbine Internal Alignment

a) Clean and inspect front standard
b) Ensure correct clearance of the emergency governor button to trip lever.
c) Inspect turbine anchor bolts and through bolts for proper torque.
d) Inspect welds, bellows and tie rods (bellows inspection will require a boroscope)
e) Clean the crossover flanges and mating flanges.
f) Complete tightwire or laser alignment check of internal components HP/IP.
g) Turbine Assembly
h) Internal boroscope close out inspections for FME.
i) Install LH components
j) Install rotor
k) Measure and record all clearances on buckets and packing segments
l) Install upper components
m) Stretch HP inner casing bolts and record final length
n) Install outer casing
o) Stretch outer casing bolts and record final length
p) Lower casing on to running keys and record final radial and axial position
q) Record the as-left crossover flange gaps
r) The as left crossover gaps will have no more than 0.080" of asymmetry
s) Remove the crossover bellows bracing

LP Pressure Turbine

Disassembly

a) Record radial and axial position of LP rotor to outer casing.
b) Record radial position of LP packing gland
c) Unbolt the last stage UH flow cones and secure to the hood and remove LP Hood
d) Record radial and axial positions on all stationary and rotating blades and gland segments
e) Rig and remove turbine rotor
f) Immediately cover exposed ends of shaft with gasket material and plastic sheet
g) Remove lower half of diaphragms

h) Remove packing from all locations. Ensure components are labeled correctly for assembly.
i) Record internal reference positions

LP Turbine Cleaning and Inspection

Rotor (In Vendor's Workshop)

a) Sandblast steam path components
b) Magnetic particle check rotor and diaphragms.
c) Map balance weights (if applicable)
d) Record runouts
e) Coupling – check for flatness. NDT rabbet fit
f) Oil deflector lands - Clean and visually inspect. Record diameter
g) Packing lands – NDT as part of steam path. Visually inspect for rubs
h) Journals – clean inspect for roundness and taper. Visually inspect for wear
i) Inspect rotor and buckets - Cover and notch lifting, foreign object damage, erosion/corrosion and erosion shield condition
j) Burnish vibration probe areas.
k) Replace spill strips and packing segments as required by steam path audit
l) Replace L-0 and L-1 Blades (2 flows)
m) Boresonic Inspection
n) Low Speed balancing

Stationary (Vendor's Workshop)

a) Blast Cleaning and NDE inspection
b) Dimensioning area
c) Inspections and select each one will go to GE Shop to major repair
d) Perform minor repair on site
e) Replace strips – 6 stages
f) Perform major repair in shop

Valves (On Site)

Main Stop Valve

a) Disconnect actuator
b) Remove jackbolts and pull down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings
g) Check bushing clearance and alignment with try bar
h) Perform back seat contact check

i) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
j) Inspect stem seal and backseat
k) Replace metallic gasket for valve stem bushing assembly
l) Record free length of springs and compare to design data
m) Assemble stem, pressure seal head and disk
n) Contact check valve disk to seat
o) Tighten jackbolts on pull down ring
p) Measure total stroke of valve
q) Install steam strainer
r) Assemble valve head
s) Install actuator
t) Record closed end over travel
u) Remove crosshead, stem and valve
v) Clean and measure lockhead and guide for proper clearance
w) Remove stem from crosshead/lockhead
x) Inspect stem threads
y) nspect crosshead threads
z) Dye penetrant check of cross head to lock head fits
aa) Check stem run-out
bb) Clean and record stem and bushing diameters
cc) Check bushing with “try” bar.
dd) Clean seat and body area NDE inspections for cracking
ee) Replace body to stand gasket
ff) Measure and record body to stand fit
gg) Inspect cams for flat spots (roller damage)
hh) Inspect all cam shaft bearings
ii) Inspect all rack and pinion bearings
jj) Inspect the lever/fulcrum pins and bearings
kk) Inspect valve disk for stellite cracks and general condition
ll) Reassemble valve
mm) Blue contact check of disk to seat
nn) Assemble cam shaft
oo) Assemble rack and pinion
pp) Adjust valve crack and intercept points
qq) Clean and inspect snout rings
rr) NDT of diffusers

<u>Intercept Stop Valve Left & Right</u>

a) Disconnect actuator
b) Remove jack bolts and pull-down ring
c) Remove valve head/steam/guide assembly (control side disassembled)
d) Disassemble stem and disk
e) Record stem run-out
f) Clean and measure diameters of stem and bushings

g) Evaluate bushing clearance and alignment with try bar
h) Complete NDT on strainer, valve disk, valve seat and valve stem bushing assembly
i) Perform back seat contact check
j) Replace metallic gasket for valve stem bushing assembly
k) Record free length of springs and compare to design data
l) Assemble disks and stem
m) Contact check valve disk to seat
n) ighten jack bolts on pull down ring
o) o Measure total stroke of valve
p) Install steam strainer
q) Install valve cover
r) Install actuator
s) Record closed end over travel

Intercept Control Valve Left and Right

a) Record as-found lengths of linkages
b) Disconnect actuator from linkage
c) Remover outer flange
d) Disassemble valve and remove stem/head assembly
e) Disassemble bypass valve
f) Record stem run-out
g) Clean and measure diameters of stem and bushings
h) Evaluate bushing clearance and alignment with try bar
i) Complete NDT on valve disk, valve seat, stem bushing assembly and valve stem
j) Perform back seat contact check
k) Contact check valve disk to seat
l) Replace flange gasket
m) Assemble valve
n) Measure total stroke of valve
o) Install actuator
p) Record closed end over trave
q) Connect actuator linkage

Reheater Bypass Stop Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem bushing assembly
c) Disassemble coupling
d) Remove valve head and stem
e) Disassemble valve head
f) Clean and measure bypass valve
g) Record stem run-out
h) Clean and measure diameters of stem and bushings

i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check valve head to seat
l) Assemble valve
m) Measure total stroke of valve
n) Contact check flange
o) Install flange
p) Install actuator
q) Record closed end over travel.

Reheater Bypass Control Valve Left & Right

a) Remove flange
b) Grit blast components and complete NDT on valve disk, valve seat and valve stem
c) bushing assembly
d) Disassemble coupling
e) Disassemble valve disk and stem
f) Disassemble valve disk
g) Clean and measure bypass valve
h) Record stem run-out
i) Clean and measure diameters of stem and bushings
j) Inspect stem seal
k) Record free length of spring and compare to design data
l) Contact check valve disk to seat
m) Assemble valve
n) Measure total stroke of valve
o) Contact check flange
p) Install flange
q) Install actuator
r) Record closed end over travel.

Blowdown Valve

a) Remove actuator
b) Remove valve
c) Remove shaft
d) Disassemble valve disk, shaft and piston rings
e) Clean and inspect
f) Grit blast components and complete NDT on valve disk, valve seat and main valve guide bushing
g) Record stem run-out
h) Clean and measure diameters of stem and bushings
i) Inspect stem seal
j) Record free length of spring and compare to design data
k) Contact check bypass valve to seat
l) Contact check valve head to seat

m) Replace flange gasket
n) Assemble valve
o) Tighten flange bolts
p) Measure total stroke of valve
q) Install actuator
r) Record closed end over travel.

Vacuum Breaker

a) Disassemble, clean, inspect and assemble the motorized valve.

Non-Return Valves

For each of the listed valves, complete the following scope (as applicable):

a) Remove actuator
b) Remove cover flange
c) Remove stem
d) Remove flapper
e) Measure diameters of bushings and shaft
f) Complete run-out on shaft
g) Replace shaft seals
h) Grit blast flapper
i) NDT flapper and seat
j) Assemble stem and shaft
k) Contact check flapper to seat
l) Replace cover flange seal
m) Inspect actuator, replace seals
n) Install actuator
o) Install cover flange
p) Adjust counterweight per OEM specifications
q) Confirm valve freedom of movement and functionality

Valves to be inspected:

a) 6” row 13 uncontrolled extraction
b) 10” row 15 uncontrolled extraction
c) 10” row 17 uncontrolled extraction
d) 16” row 18 uncontrolled extraction
e) 6” cold reheat (no actuator)

Cold Commissioning of Valves

Main and Intercept Stop Valves

a) HP control fluid tank temperature.
b) HP control and safety fluid pressure

c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure.

Intercept Control Valves

a) HP control fluid tank temperature
b) HP control and safety fluid pressure
c) Valve Stroke
d) Opening and closing time
e) Valve gear Supply /Discharge Pressure
f) Control Linearity Position Pressure Curve

LP Turbine Internal Alignment

a) Install lower components
b) Complete tightwire or laser alignment check of internal components

LP Turbine Assembly

a) Perform internal borescope close out inspections
b) Install lower diaphragms
c) Install rotor
d) Measure and record all clearances on buckets and packing segments
e) Install upper components
f) Install UH inner casing
g) Install outer casing
h) Install the last stage flow cones

Auxiliary Components

The contractor will disassemble/clean/inspect/assemble the following auxiliary components:

a) drain and fill lube oil tank
b) Auxiliary Components (PREPA)
c) The contractor will disassemble/clean/inspect/assemble the following auxiliary components:
d) drain and fill lube oil tank
e) Auxiliary oil pump (1)
f) Emergency oil pump (1)
g) Lube oil vapor extractors (2)
h) Lube oil pressure regulator (1)
i) AMOT temperature control valve (1)
j) Return oil screen (1)
k) Lube oil coolers (hydro blast by others) (2)

l) Lube oil cooler transfer valve
m) Lube oil level indicator
n) Main oil pump suction strainer
o) Jacking oil pump suction strainers

Contractor shall check for leakages, function check and commission lube oil system, recording all pertinent measurement according to quality procedures and test certificates.

a) Bearing header pressure regulator.
b) Pressure and temperature switches and/or transmitters.
c) Lube oil emergency automatic start up system (The performance of a complete
d) emergency response test, of the type specified by the OEM is highly
e) recommended.)
f) Lube oil cooling temperature/cooling water control system.
g) Remotely (motor operated) and/or (manual) operated valves.
h) Pressure gauges and temperature indicators.
i) Thrust and journal bearing oil inlet and discharge thermocouples (located in the unit).
j) Thrust and journal bearing metal thermocouples.

<u>Lube Oil Recirculation – Preparation</u>

a) Prepare and check that flushing accessories (pipe, adapters, bypasses, spool piece, banks, etc.) at bearings 1-5, main oil pump and gaskets are clean in good condition.
b) Remove main oil pump and install a bypass between inlet and outlet.
c) Remove temperature control valve, pressure control valve relieves valve and fit spool.
d) Remove and clean bearing oil feed lines, inspect and check for the correct orifice size.
e) Remove feed lines to turning gear
f) Install temporary flushing pipes and adapters, verify the correct installation to avoid leaks
g) Install temporary filter elements (20-micron filters bags) to the open ends of the temporary pipes and directs the pipes to the bearing pedestal drains.
h) Prior start AC pump ensure the oil temperature in tank is above 50°C as in work condition, use a temporary heater if necessary do not allow temperature in tank to rise above 75°C

<u>Lube Oil Recirculation – Cleaning</u>

a) Flush the system using the auxiliary AC oil pump
b) Periodically check the solid contents and cleaning of filter bags.
Stop the flush in the lesser of: (i) the cleanliness of bags is acceptable or (ii) 7 days of flushing already performed. Any additional flushing day would be charged as extra.

c) Remove bags and temporary flushing pipes and adapters
d) Return the lube oil system to operating configuration, take precautions to ensure that no dirt enters the system during this operation
e) Remove all temporary flushing accessories
f) Refill lube oil tank

Alignment check of HIP/LP and LP GEN Couplings (Centering, Parallelism and Run-out).

a) Perform alignment corrections according to Contractor recommendations as required.
b) Record of axial and radial position of rotor to outer casing and axial and radial
c) position of casing to bearing pedestal
d) Coupling of HIP/LP and LP/Generator Rotors
e) Install axial plate of LP/Generator Coupling.
f) Install axial plate of HIP/LP Coupling
g) Check of coupling bolts prior installation
h) Install and tighten coupling bots using hydraulic device
i) Install pedestal 1, 2, 3, 4 & 5 cover
j) Install upper half oil catcher and record the clearance of oil catcher
k) Assembly of HIP/LP and LP/Gen coupling guard

Cold Commissioning

TURBINE HMI AND INSTRUMENTATION

a) Identification and conformance of system equipment
b) Verification of instrumentation Calibration
c) Visual checks
d) Operational test sequences
e) System Alarms
f) Supervisory system verification

LUBE OIL SYSTEM VERIFICATION

a) Test with lubricating oil system in final state.
b) Verify turning gear operation

GLAND SEAL AND DRAIN SYSTEM

a) Gland Sealing system verification
b) Turbine Drain system verification

Hot Commissioning

START UP RUN-UP AND LOAD RISING (Check Valve sequence and Hysteresis).

a) Turbine run-up
b) Emergency trip button test
c) ETD Test
d) Primary Overspeed test simulated
e) Emergency Overspeed test
f) Turbine at nominal speed
g) Turbine run down
h) Reverse power test protection
i) Turbine at load Raising
j) Gland Sealing system verification
k) Turbine Drain system verification
l) Turbine Monitoring System verification

VIBRATION SURVEY DURING START UP / LOAD RISING OF THE UNIT.

a) Data Collecting during unit start up
b) Vibration Analysis and recommendation to Owner
c) Balance rotor as required to operate within manufactures recommendations

Quality Assurance

a) Inspection & Test plan will be prepared by Contractor.
b) Technical report will be prepared upon completion of work.

Generator Rehabilitation (Major Inspection)

Scope of On-Site Service - General Works

Mechanical Works:

a) Degas H2 during LOTO; before disassembly. Check H2 usage customer data for potential leakage
b) Dis- and reconnect generator electrically (Customer Scope)
c) Disassembly, inspection, and reassembly of bearings
d) Alignment check, coupled run-out (CRO) check
e) Dis- and reassembly of oil pipelines
f) Dis- and reassembly of hydrogen coolers and cooler pipelines
g) Dis- and reassembly of NDE and DE oil deflector and seal assembly
h) Dis- and reassembly of NDE and DE end shields
i) Preparation of field rotor removal and assembly equipment
j) Rotor thread out
k) Check of baffle ring carrier; DP testing of fixed and moving blades
l) Rotor thread in
m) Dis- and reassembly of lower frame extension
n) Disassembly of fan nozzle ring
o) Air leakage check after reassembly, before filling generator with H2

p) Installation of scaffolding and work platforms (unless provided by Buyer)

Visual Inspection and Cleaning

a) Cleaning and inspection of disassembled components Visual Inspection of disassembled parts, all accessible areas (Fans, Filtration System, Mist Precipitator, Rotor Earthen,Seals, Vent pipe, Oil supply lines, Jacking Oil System, Air Inlets, Bearings, Thrust Bearing (where applicable), Cooler (where applicable), Line/neutral cubicles, Heater, Frame, Stator End Winding)
b) Bearing shaft alignment, insulation and clearance
c) Colector rings, brush holders and exciter inspection
d) Rotor borescope Inspection (Cooling paths, Insulation, Balancing Weights, Poles, Bearing journals, End Winding)

Generator Stator Major Inspection - Stator Visual Inspection

e) All visible components within the end winding compartment
a) Perform Borescope inspection on accessible areas at:
b) Magnetic core ends at bottom bars exits.
c) Magnetic core ventilation ducts.
d) Stator end windings. (Look for dirt, dust, and grease deposits. Visible loose ties, corona marks, cracks, blocks displacement, etc.).
e) Check/map the stator wedges (wedge tightening control).
f) Perform a strong winding cleaning, with the objective remove foreign materials, lose or displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined during the inspection, it will depend on how the winding will be, followed by drying process using hot blowers and insulation temperature control.
g) High Voltage Bushings.
h) Surface condition and wear, cracks, burning, oil contamination, deterioration
i) Inspect Coolers or suitability of service.
j) Inspect bearings for suitability of service.

Stator Test

a) RTD Element Resistance: gas and winding RTD's; checks for calibration and poor connections
b) Winding Copper Resistance: stator winding; checks for poor connections and breaks
c) Insulation Resistance (Megger): NDE bearing; contamination and/or deterioration of insulation
d) Insulation Resistance (Megger): Hydrogen seal casing; contamination and/or deterioration of insulation
e) Insulation Resistance (Megger) and Polarization Index (PI): stator winding contamination and/or deterioration of insulation

f) DC Leakage Current: stator winding; contamination and/or deterioration of insulation (reduced voltage level value to be agreed with the customer before executing)
g) DC Hipot: stator winding; ground wall insulation integrity (reduced voltage level value to be agreed with the customer before executing)
h) Wedge Tightness Map: stator wedges; detect wedge tightness deterioration
i) End winding Tightness Check: torque measurement.
j) Corona test in dark cabin (AC voltage)
k) Tan Delta; Stator Winding: check for stator insulation degradation.

Generator Rotor Major Inspections - Rotor Visual Inspection

a) All visible components within the end winding compartment
    - Perform a strong winding cleaning, with the objective remove foreign materials, lose or
    - displaced parts, damage, wear, dusting, corrosion, or deterioration. The cleaning
    - process (dielectric solvent, CO2 blasting, neutral soap and water, etc.) to be defined
    - during the inspection, it will depend on how the winding will be, followed by drying
    - process using hot blowers and insulation temperature control
    - Disassembly fans blades
    - Clean/polish retaining rings
    - On retaining rings, look for overheating marks or discoloration on accessible
    - surface.
    - Perform hand cleaning and vacuum on accessible areas.
    - Perform Boroscope inspection in the rotor (on accessible areas like: ducts, coils,
    - under the retaining rings, etc.)
    - Check/map the rotor wedges
    - Check balancing weights
    - Check/map the rotor wedges (wedge tightening control)

Slip ring System

a) Surface condition and wear, cracks, burning, oil contamination, deterioration
b) Slip rings polishing ("manually").
c) Check of channels
d) Mechanical cleaning of slip rings
e) Roughness check
f) Dimensional control

Journals

a) Check for suitability of service

Rotor run out

a) Perform the run-out check under rollers device, due to was not performed the procedure of periodic running of the generator rotor in the last 6 years on standstill.

Rotor Test

a) Rotor Winding: Winding Copper Resistance; checks for poor connection and breaks
b) Rotor Winding: Insulation Resistance (Megger); contamination and/or deterioration of insulation
c) Rotor Inter-Turn Insulation: Shorted Turn Test; turn shorts (RSO and AC Impedance testing) .

Visual Inspection and Non-Destructive Essays (NDE's) on Generator Components

a) Perform visual inspection on accessible areas at:
b) Accessible areas on outer surface of Retaining Rings.
c) Generator rotor axial fan blades.
d) Journal bearing segments.
e) Generator rotor and extension shaft bearing journals.
f) Generator rotor slip rings.
g) Generator rotor coupling face.
h) Oil and H2 seals segments.
i) Coupling bolts and assembly hardware

Perform Non-Destructive Essays (NDE's) with Die Check on:

a) Generator rotor coupling face.
b) Journal bearing segments.
c) Rotor fan Blades.
d) Retaining rings (external side).
e) Oil and H2 seals segments.
f) Coupling bolts and assembly hardware.
g) Perform Non-Destructive Essays (NDE's) with Ultrasound on:
h) Generator rotor coupling face.
i) Journal bearing segments.
j) Adherence test.
k) Rotor fan Blades.
l) Retaining rings (external side).

Bearings - (Bearing pedestal without bearings. Bearing scope is included in the turbine scope)

a) Check for oil leaks
b) Dis- and reassembly of instrumentation

c) Check of bearing temperature instrumentation
d) Opening of bearing covers
e) Inspection of bearing insulation (pipe flange and bearing)
f) Bearing insulation resistance test
g) Closing of bearing covers
h) Visual inspection of bearing Babbitt for serviceability

Couplings

a) Opening of couplings
b) Coupling guard clearance check and removal.
c) Coupling CRO check, decoupling and alignment check
d) Coupling bolts ultrasonic and bolt hardness test.
e) Radial and axial alignment of shaft train
f) Closing couplings
g) Coupling insulation check

Exciter (Brushes and Brush Holders)

a) Dis- and reassemble the brush holders, brushes, cableClean and inspect of complete exciter and components (visual check for abnormalities, dust and dirt, charring, etc.)
b) Check the performance of new brushes
c) Check of brushes alignment
d) Check of connections torque

Seal Oil system

a) AC Seal Oil Pump - Visual inspection, cleaning and checking of coupling & pads
b) Emergency Seal Oil Pumps -Visual inspection, cleaning and checking of coupling & pads
c) Inspect clearance of labyrinth rings, seal strips & Lift oil components.

Seal Oil Coolers

a) Check and Inspect condition of coolers, cooling water inlet and outlet pipes. Mounting of all coolers, valves at drain and vent pipes

Hydrogen Gas System

a) Functional test of all valves, pressure reducers.
b) Leakage test of Hydrogen – System
c) Check filters

Hydrogen Dryer

a) Replacement of adsorbent material and cover gaskets
b) Inspection of dryers and functional test

Coolers

a) Inspection of Coolers
b) Back flushing of Cooler
c) Inspection of Cooling water inlet and outlet pipes
d) Inspection of Temperature and pressure measuring devices
e) Testing of Valves at drain and vent pipes

Outer Case

a) Repair and painting of the generator outer casing.

Generator Start up

Verification of the operational data of the generator during startup of the unit.

a) Verification along with the Customer that all generator systems were properly normalized.
b) During the startup of the unit under 100% loaded register the following operating parameters of the electric generator:
    - Electrical parameters.

End of Scope of Work

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Unit 7 - Major Outage - Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work

2/2/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	San Juan Power Plant, Unit 7 - Major Outage - Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work
PREPA Project Number	1027

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Power Plant, Unit 7	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Unit 7 of San Juan Power Plant needs Boiler sections replacement and repairs & auxiliary equipment inspection work. Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required to complete the works detailed below.

Section 3. Scope of Work

3.1. Scope of Work Description

The Scope of Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the Unit 7 Boiler Sections Replacement & Repairs & Auxiliary Equipment Inspection Work.

Perform all necessary works) including but not limited to the replacement of the following components:

a) Fabrication and delivery of one (1) rear/arch waterwall panels from elevation 87'-0" to 109'-0".
b) Replacement of a section of rear/arch waterwall panels. from elevation 87'-0" to 109'-0".
c) Rehabilitation of the Air-Preheaters.

Quality Assurance

a) The Contractor is responsible of the radiographic examination (RT) and the magnetic particles (PT) as requested by PREPA, required in twenty percent (20%) of the total performed welds and that shall be examined throughout their entire length by the X-ray or gamma-ray method in accordance with the ASME Code, Article 2 of Section V. The test weld will be chosen by PREPA. If in this twenty percent (20%) more than three percent (3%) of welds are rejected, radiographic examination is required to fifty percent (50%) of total welds. If in this fifty percent (50%) more than five percent (5%) of welds are rejected, radiographic examination is required in one hundred percent (100%) of total welds, except for the areas described on the Article 2.1.I of this document. This shall be included on Contractor scope. PREPA requires that the activity described in this item shall be performed by a third party subcontractor that does not have conflict of interest with the Contractor. Also all daily field reports shall be submitted to PREPA's authorized personnel. Hours for making the radiographic test shall be coordinated with PREPA Safety and Operations Personnel and will be out of standard labor hours, copy of the field report shall be submitted immediately after taken. The Contractor shall provide all the required equipment to perform the preheating and post weld heat treatment as specified by the latest edition ASME Code and the NBIC.

b) To perform works inside the boiler or in a confined space, the Contractor shall comply with all the requirements under regulation 29 CFR 1910.146 and 29 CFR 1910.269(e) for confined space and enclosed space entry. Prior to commencement, any work shall be approved by PREPA (Plant Industrial Hygiene and Safety). The Contractor shall provide a complete working plan, training evidence, and required medical exams for those workers that are going to perform any activity under confide or closed space environment as required by regulation 29 CFR 1910.146.

c) Supply all necessary equipment to perform the Preheat Treatment and Post Weld Heat Treatment procedure to the tubes welds and any other welds necessary to perform the scope of work. A qualified technician shall be present during the Preheat and Stress Relieving procedure

Scope of Work – Project Execution Tasks

a) Remove insulation, casing and casing anchors to perform the scope of work. Also, install insulation, with finishing cement and mesh, casing anchors and aluminum casing in all the areas describes in the scope of work. PREPA will supply calcium silicate insulation, mesh, nails, finishing cement and any other insulation material needed to perform the work. The Contractor will supply aluminum casing and casing anchors. Any asbestos insulation removal shall be performed by PREPA.

b) Supply all labor, personnel, materials tools and equipment for the installation, certification and removal of scaffolding required to complete the scope of work.

c) Fabrication and delivery of One (1) rear and arch wall panels unit #7 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

- All tubes will be 2-1/2" OD x 0.203" MW SA210A1 material. Tubes spaced on 3" centers.
- All membrane bar materials will be 1'4" thick carbon steel material and stop 1" from each end. The outside tubes on each panel will be bare, no half width membrane.
- The membrane bar will be cut 6" long with ¼" Dia. Drilled hole at the end of the slot at both ends to aid fit-up of the tube pressure welds.
- The panels shall include the cable openings in the same locations.
- Fin bar ¼" thickness x 1/2" wide, carbon steel material will be shipped loose to be used during the site assembly.
- Tube field weld ends will be cut and beveled to length.
- All fabrication will be in accordance with the ASME Boiler and Pressure Vessel Code Section I (Power Boilers) latest edition and shop standards.

d) Remove and install ninety-five (95) 2" OD Remove and install twenty-three (23) 2" OD, rear and arch wall panels unit #7 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels.

e) Remove and install all the structural parts (windbox, angles, plates, buck stays, protections, etc.) of the boiler necessaries to complete the waterwall installation.

f) Perform all required cuts, bevels and welds to fit and replace the waterwall panels describe in the scope of work. This includes cuts, bevels and welds from tube to tube, membranes to tubes, tubes to attachments and any other weld necessary to perform the waterwall panels replacement.

g) Supply all aluminum laggings and anchors. The Contractor shall supply any steel plates, angle, channels, I-beams and any steel material needed to perform the work.

h) High pressure air-ball test shall be performed by the Contractor in coordination with PREPA representative to all waterwall tubes panels before installation, to determine if is free from obstructions or debris, and to make sure it is clean.

i) Replacement of the Air-Preheater baskets and seals.

j) Inspection and repair, if necessary, of the following equipment of the boiler:

- High pressure and low-pressure water heaters.
- Circulating water pumps
- Boiler feed water pumps
- Fuel Pumps
- Water and fuel valves
- Instrumentation equipment for operation of the water and fuel systems.

Codes and Standards Required to Complete the Scope of Work

a) All work performed under this technical specification shall be done in a safe and workmanlike manner and in strict accordance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved; and including but not limited to the applicable codes, standards and procedures of the following organizations:

- Puerto Rico OSHA – Rule # 17
- Occupational Safety and Health Administration (OSHA)
- American Society of mechanical Engineers (ASME)
- National Board Inspection Code (NBIC)
- American Petroleum Institute (API)
- American Society for Nondestructive Testing (ASNT)
- National Fire Protection Association (NFPA)
- U S Environmental Protection Agency (EPA)
- Puerto Rico Environmental Quality Board (EQB)
- National Association of Corrosion Engineers (NACE)
- American Standard Testing Material (ASTM)
- American Welding Society (AWS)
- College of Engineers and Land surveyors of Puerto Rico (CIAPR)
- Department of Transportation of Puerto Rico (DOT)
- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($)
Fabrication, delivery, replacement of Boiler waterwalls and Rehabilitation of the Air Preheaters	$8,000,000.00
Total Project Estimated Cost	**$8,000,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

_____ _____

Program Manager's Printed Name Date

_____ _____

Title Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name _____ Date _____

Title _____ Signature _____

Section 10. Attachments

10.1. Project Detailed Cost Estimates

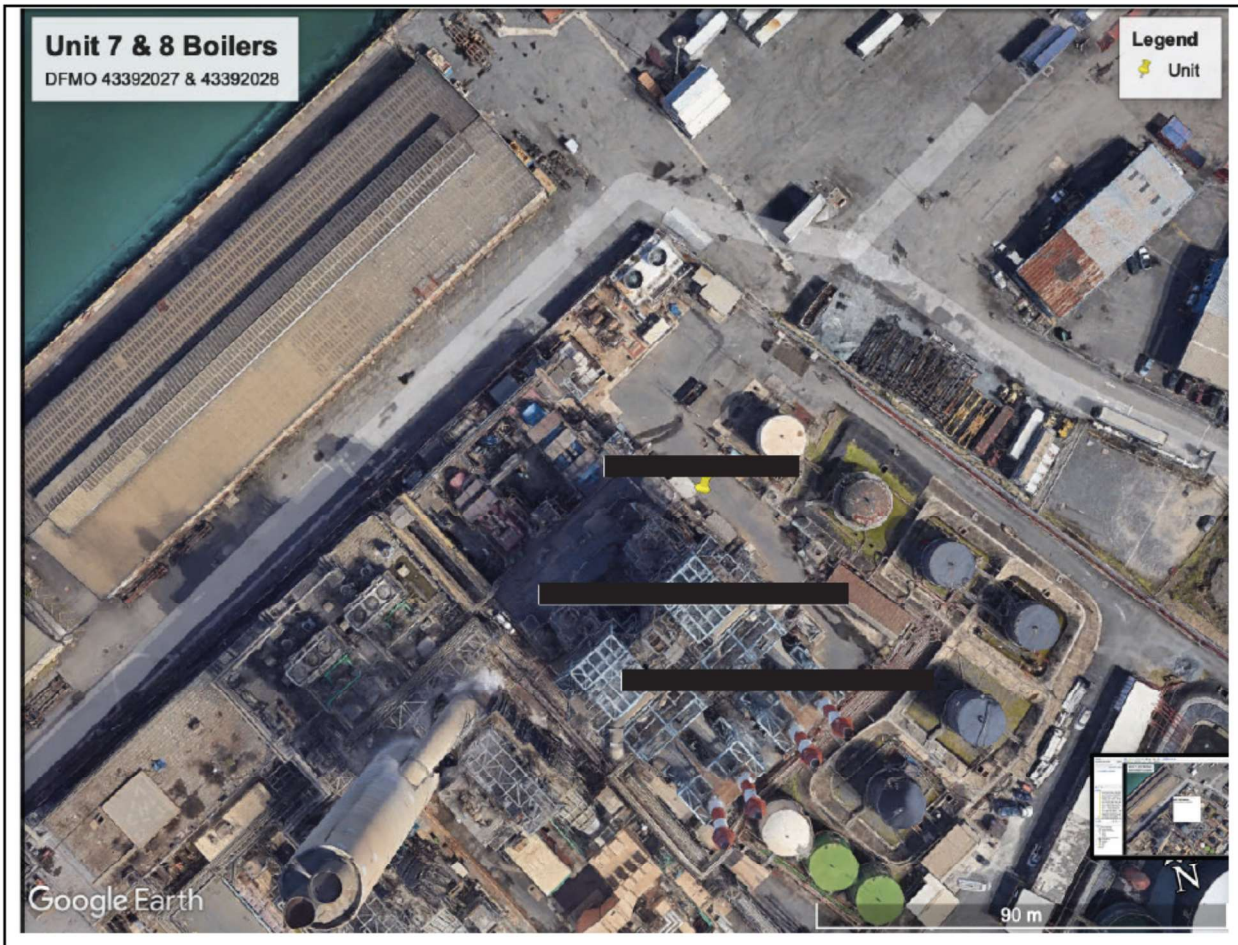
Please see attached the following:

- Detailed Scope of Work provide by PREPA Plant Engineers

10.2. Engineering Studies and Designs

N/A

10.3 Location Maps and Site Pictures



10.4 Other: (Please Describe)

N/A

GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

PROJECT NUMBER: 1027

San Juan Power Plant Unit 7 Major Outage
Boiler Sections Replacement & Repairs & Auxiliary
Equipment Inspection Work

The Scope of Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the Unit 7 Boiler Sections Replacement & Repairs & Auxiliary Equipment Inspection Work.

Perform all necessary works) including but not limited to the replacement of the following components:

a) Fabrication and delivery of one (1) rear/arch waterwall panels from elevation 87'-0" to 109'-0".
b) Replacement of a section of rear/arch waterwall panels. from elevation 87'-0" to 109'-0".
c) Rehabilitation of the Air-Preheaters.

Quality Assurance

a) The Contractor is responsible of the radiographic examination (RT) and the magnetic particles (PT) as requested by PREPA, required in twenty percent (20%) of the total performed welds and that shall be examined throughout their entire length by the X-ray or gamma-ray method in accordance with the ASME Code, Article 2 of Section V. The test weld will be chosen by PREPA. If in this twenty percent (20%) more than three percent (3%) of welds are rejected, radiographic examination is required to fifty percent (50%) of total welds. If in this fifty percent (50%) more than five percent (5%) of welds are rejected, radiographic examination is required in one hundred percent (100%) of total welds, except for the areas described on the Article 2.1.I of this document. This shall be included on Contractor scope. PREPA requires that the activity described in this item shall be performed by a third party subcontractor that does not have conflict of interest with the Contractor.

b) Also all daily field reports shall be submitted to PREPA's authorized personnel. Hours for making the radiographic test shall be coordinated with PREPA Safety and Operations Personnel and will be out of standard labor hours, copy of the field report shall be submitted immediately after taken. The Contractor shall provide all the required equipment to perform the preheating and post weld heat treatment as specified by the latest edition ASME Code and the NBIC.

c) To perform works inside the boiler or in a confined space, the Contractor shall comply with all the requirements under regulation 29 CFR 1910.146 and 29 CFR 1910.269(e) for confined space and enclosed space entry. Prior to commencement, any work shall be approved by PREPA (Plant Industrial Hygiene and Safety). The Contractor shall provide a complete working plan, training evidence, and required medical exams for those workers that are going to perform any activity under confide or closed space environment as required by regulation 29 CFR 1910.146.

d) Supply all necessary equipment to perform the Preheat Treatment and Post Weld Heat Treatment procedure to the tubes welds and any other welds necessary to perform the scope of work. A qualified technician shall be present during the Preheat and Stress Relieving procedure

Scope of Work – Project Execution Tasks

a) Remove insulation, casing and casing anchors to perform the scope of work. Also, install insulation, with finishing cement and mesh, casing anchors and aluminum casing in all the areas describes in the scope of work. PREPA will supply calcium silicate insulation, mesh, nails, finishing cement and any other insulation material needed to perform the work. The Contractor will supply aluminum casing and casing anchors. Any asbestos insulation removal shall be performed by PREPA.

b) Supply all labor, personnel, materials tools and equipment for the installation, certification and removal of scaffolding required to complete the scope of work.

c) Fabrication and delivery of One (1) rear and arch wall panels unit #7 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

- All tubes will be 2-1/2" OD x 0.203" MW SA210A1 material. Tubes spaced on 3" centers.

- All membrane bar materials will be 1'4" thick carbon steel material and stop 1" from each end. The outside tubes on each panel will be bare, no half width membrane.

- The membrane bar will be cut 6" long with ¼" Dia. Drilled hole at the end of the slot at both ends to aid fit-up of the tube pressure welds.

- The panels shall include the cable openings in the same locations.
- Fin bar ¼" thickness x 1/2" wide, carbon steel material will be shipped loose to be used during the site assembly.
- Tube field weld ends will be cut and beveled to length.
- All fabrication will be in accordance with the ASME Boiler and Pressure Vessel Code Section I (Power Boilers) latest edition and shop standards.

d) Remove and install ninety-five (95) 2" OD Remove and install twenty-three (23) 2" OD, rear and arch wall panels unit #7 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels.

e) Remove and install all the structural parts (windbox, angles, plates, buck stays, protections, etc.) of the boiler necessaries to complete the waterwall installation.

f) Perform all required cuts, bevels and welds to fit and replace the waterwall panels describe in the scope of work. This includes cuts, bevels and welds from tube to tube, membranes to tubes, tubes to attachments and any other weld necessary to perform the waterwall panels replacement.

g) Supply all aluminum laggings and anchors. The Contractor shall supply any steel plates, angle, channels, I-beams and any steel material needed to perform the work.

h) High pressure air-ball test shall be performed by the Contractor in coordination with PREPA representative to all waterwall tubes panels before installation, to determine if is free from obstructions or debris, and to make sure it is clean.

i) Replacement of the Air-Preheater baskets and seals.

j) Inspection and repair, if necessary, of the following equipment of the boiler:

- High pressure and low-pressure water heaters.
- Circulating water pumps
- Boiler feed water pumps
- Fuel Pumps
- Water and fuel valves
- Instrumentation equipment for operation of the water and fuel systems.

Codes and Standards Required to Complete the Scope of Work

a) All work performed under this technical specification shall be done in a safe and workmanlike manner and in strict accordance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved; and including but not limited to the applicable codes, standards and procedures of the following organizations:

- Puerto Rico OSHA – Rule # 17
- Occupational Safety and Health Administration (OSHA)
- American Society of mechanical Engineers (ASME)
- National Board Inspection Code (NBIC)
- American Petroleum Institute (API)
- American Society for Nondestructive Testing (ASNT)
- National Fire Protection Association (NFPA)
- U S Environmental Protection Agency (EPA)
- Puerto Rico Environmental Quality Board (EQB)
- National Association of Corrosion Engineers (NACE)
- American Standard Testing Material (ASTM)
- American Welding Society (AWS)
- College of Engineers and Land surveyors of Puerto Rico (CIAPR)
- Department of Transportation of Puerto Rico (DOT)
- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Unit 8 - Major Outage - Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work

2/2/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	San Juan Power Plant, Unit 7 - Major Outage - Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work
PREPA Project Number	1027

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
San Juan Power Plant, Unit 8	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Unit 8 of San Juan Power Plant needs Boiler sections replacement and repairs & auxiliary equipment inspection work. Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required to complete the works detailed below.

Section 3. Scope of Work

3.1. Scope of Work Description

The Scope of Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the Unit 8 Boiler Sections Replacement & Repairs & Auxiliary Equipment Inspection Work.

Perform all necessary works) including but not limited to the replacement of the following components:

a. Fabrication and delivery of one (1) set left sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" The left sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

b. Fabrication and delivery of one (1) set right sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" opp. hand The right sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

c. Fabrication and delivery of one (1) set front wall panels unit #8 from elevation 30'-3" to elevation 95'-0" The front wall will be (93) tubes wide assembled in three (3) sections of (32), (30) and (31) tubes wide. The panels will have a field weld location at elevation 67'-0".

d. Fabrication and delivery of one (1 rear and arch wall panels unit #8 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

e. Replacement of a section of rear/arch waterwall panels. from elevation 87'-0" to 109'-0".

f. Replacement of right and left waterwall panels. from elevation 15'-6" to 93'-6".

g. Rehabilitation of the Air-Preheaters.

Quality Assurance

a. The Contractor is responsible of the radiographic examination (RT) and the magnetic particles (PT) as requested by PREPA, required in twenty percent (20%) of the total performed welds and that shall be examined throughout their entire length by the X-ray or gamma-ray method in accordance with the ASME Code, Article 2 of Section V. The test weld will be chosen by PREPA. If in this twenty percent (20%) more than three percent (3%) of welds are rejected, radiographic examination is required to fifty percent (50%) of total welds. If in this fifty percent (50%) more than five percent (5%) of welds are rejected, radiographic examination is required in one hundred percent (100%) of total welds, except for the areas described on the Article 2.1.l of this document. This shall be included on Contractor scope. PREPA requires that the activity described in this item shall be performed by a third party subcontractor that does not have conflict of interest with the Contractor. Also all daily field reports shall be submitted to PREPA's authorized personnel. Hours for making the radiographic test shall be coordinated with PREPA Safety and Operations Personnel and will be out of standard labor hours, copy of the field report shall be submitted immediately after taken. The Contractor shall provide all the required equipment to perform the preheating and post weld heat treatment as specified by the latest edition ASME Code and the NBIC.

b. To perform works inside the boiler or in a confined space, the Contractor shall comply with all the requirements under regulation 29 CFR 1910.146 and 29 CFR 1910.269(e) for confined space and enclosed space entry. Prior to commencement, any work shall be approved by PREPA (Plant Industrial Hygiene and Safety). The Contractor shall provide a complete working plan, training evidence, and required medical exams for those workers that are going to perform any activity under confide or closed space environment as required by regulation 29 CFR 1910.146.

c. Supply all necessary equipment to perform the Preheat Treatment and Post Weld Heat Treatment procedure to the tubes welds and any other welds necessary to perform the scope of work. A qualified technician shall be present during the Preheat and Stress Relieving procedure

Scope of Work – Project Execution Tasks

a. Remove insulation, casing and casing anchors to perform the scope of work. Also, install insulation, with finishing cement and mesh, casing anchors and aluminum casing in all the areas describes in the scope of work. PREPA will supply calcium silicate insulation, mesh, nails, finishing cement and any other insulation material needed to perform the work. The Contractor will supply aluminum casing and casing anchors. Any asbestos insulation removal shall be performed by PREPA.

b. Supply all labor, personnel, materials tools and equipment for the installation, certification and removal of scaffolding required to complete the scope of work.

a. Fabrication and delivery of one (1) set left sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" The left sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

b. Fabrication and delivery of one (1) set right sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" opp. hand The right sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

c. Fabrication and delivery of one (1) set front wall panels unit #8 from elevation 30'-3" to elevation 95'-0" The front wall will be (93) tubes wide assembled in three (3) sections of (32), (30) and (31) tubes wide. The panels will have a field weld location at elevation 67'-0".

d. Fabrication and delivery of one (1) rear and arch wall panels unit #8 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

- All tubes will be 2-1/2" OD x 0.203" MW SA210A1 material. Tubes spaced on 3" centers.
- All membrane bar materials will be 1'4" thick carbon steel material and stop 1" from each end. The outside tubes on each panel will be bare, no half width membrane.
- The membrane bar will be cut 6" long with ¼" Dia. Drilled hole at the end of the slot at both ends to aid fit-up of the tube pressure welds.
- The panels shall include the cable openings in the same locations.
- Fin bar ¼" thickness x 1/2" wide, carbon steel material will be shipped loose to be used during the site assembly.
- Tube field weld ends will be cut and beveled to length.
- All fabrication will be in accordance with the ASME Boiler and Pressure Vessel Code Section I (Power Boilers) latest edition and shop standards.

c. Remove and install eighty-nine (89), 2" OD tubes from elevation 15'-6" & 18'-6" to elevation 93'-6".

d. Remove and install eighty-nine (89), 2" OD tubes from elevation 15'-6" & 18'-6" to elevation 93'-6".

e. Remove and install ninety-three (93), 2" OD tubes from elevation 15'-6" & 18'-6" to elevation 93'-6".

f. Remove and install ninety-five (95), 2" OD at the rear and arch wall panels unit #8 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels.

g. Remove and install all the structural parts (windbox, angles, plates, buck stays, protections, etc.) of the boiler necessaries to complete the waterwall installation.

h. Perform all required cuts, bevels and welds to fit and replace the waterwall panels describe in the scope of work. This includes cuts, bevels and welds from tube to tube, membranes to tubes, tubes to attachments and any other weld necessary to perform the waterwall panels replacement.

i. Supply all aluminum laggings and anchors. The Contractor shall supply any steel plates, angle, channels, I-beams and any steel material needed to perform the work.

j. High pressure air-ball test shall be performed by the Contractor in coordination with PREPA representative to all waterwall tubes panels before installation, to determine if is free from obstructions or debris, and to make sure it is clean.

k. Replacement of the Air-Preheater baskets and seals.

l. Inspection and repair, if necessary, of the following equipment of the boiler:

- High pressure and low-pressure water heaters.
- Circulating water pumps
- Boiler feed water pumps
- Fuel Pumps
- Water and fuel valves
- Instrumentation equipment for operation of the water and fuel systems.

Codes and Standards Required to Complete the Scope of Work

a. All work performed under this technical specification shall be done in a safe and workmanlike manner and in strict accordance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved; and including but not limited to the applicable codes, standards and procedures of the following organizations:

- Puerto Rico OSHA – Rule # 17
- Occupational Safety and Health Administration (OSHA)
- American Society of mechanical Engineers (ASME)
- National Board Inspection Code (NBIC)
- American Petroleum Institute (API)
- American Society for Nondestructive Testing (ASNT)
- National Fire Protection Association (NFPA)
- U S Environmental Protection Agency (EPA)
- Puerto Rico Environmental Quality Board (EQB)
- National Association of Corrosion Engineers (NACE)
- American Standard Testing Material (ASTM)
- American Welding Society (AWS)
- College of Engineers and Land surveyors of Puerto Rico (CIAPR)
- Department of Transportation of Puerto Rico (DOT)
- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($)
Fabrication, delivery, replacement of Boiler waterwalls and Rehabilitation of the Air Preheaters	$8,000,000.00
Total Project Estimated Cost	**$8,000,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

_____ _____

Program Manager's Printed Name Date

_____ _____

Title Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name _____ Date _____

Title _____ Signature _____

Section 10. Attachments

10.1. Project Detailed Cost Estimates

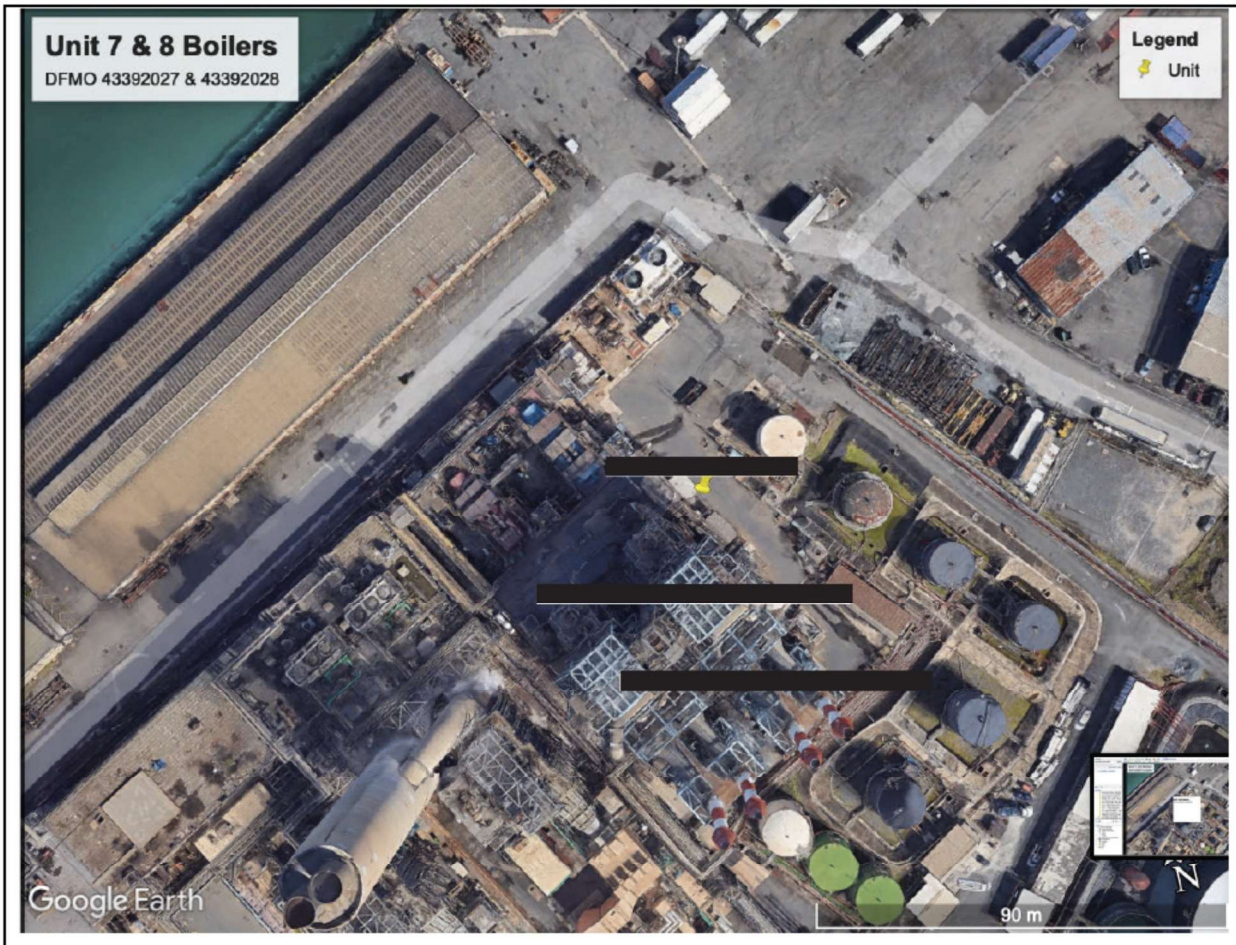
Please see attached the following:

- Detailed Scope of Work provide by PREPA Plant Engineers

10.2. Engineering Studies and Designs

N/A

10.3 Location Maps and Site Pictures



10.4 Other: (Please Describe)

N/A

GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

PROJECT NUMBER: 1028

Unit 8 - Major Outage - Boiler Sections Replacement and Repairs & Auxiliary Equipment Repairs

The Scope of Work requires to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, for the Unit 8 Boiler Sections Replacement & Repairs & Auxiliary Equipment Inspection Work.

Perform all necessary works) including but not limited to the replacement of the following components:

a. Fabrication and delivery of one (1) set left sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" The left sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

b. Fabrication and delivery of one (1) set right sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" opp. hand The right sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

c. Fabrication and delivery of one (1) set front wall panels unit #8 from elevation 30'-3" to elevation 95'-0" The front wall will be (93) tubes wide assembled in three (3) sections of (32), (30) and (31) tubes wide. The panels will have a field weld location at elevation 67'-0".

d. Fabrication and delivery of one (1 rear and arch wall panels unit #8 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

e. Replacement of a section of rear/arch waterwall panels. from elevation 87'-0" to 109'-0".

f. Replacement of right and left waterwall panels. from elevation 15'-6" to 93'-6".

g. Rehabilitation of the Air-Preheaters.

Quality Assurance

a. The Contractor is responsible of the radiographic examination (RT) and the magnetic particles (PT) as requested by PREPA, required in twenty percent (20%) of the total performed welds and that shall be examined throughout their entire length by the X-ray or gamma-ray method in accordance with the ASME Code, Article 2 of Section V. The test weld will be chosen by PREPA. If in this twenty percent (20%) more than three percent (3%) of welds are rejected, radiographic examination is required to fifty percent (50%) of total welds. If in this fifty percent (50%) more than five percent (5%) of welds are rejected, radiographic examination is required in one hundred percent (100%) of total welds, except for the areas described on the Article 2.1.I of this document. This shall be included on Contractor scope. PREPA requires that the activity described in this item shall be performed by a third party subcontractor that does not have conflict of interest with the Contractor. Also all daily field reports shall be submitted to PREPA's authorized personnel. Hours for making the radiographic test shall be coordinated with PREPA Safety and Operations Personnel and will be out of standard labor hours, copy of the field report shall be submitted immediately after taken. The Contractor shall provide all the required equipment to perform the preheating and post weld heat treatment as specified by the latest edition ASME Code and the NBIC.

b. To perform works inside the boiler or in a confined space, the Contractor shall comply with all the requirements under regulation 29 CFR 1910.146 and 29 CFR 1910.269(e) for confined space and enclosed space entry. Prior to commencement, any work shall be approved by PREPA (Plant Industrial Hygiene and Safety). The Contractor shall provide a complete working plan, training evidence, and required medical exams for those workers that are going to perform any activity under confide or closed space environment as required by regulation 29 CFR 1910.146.

c. Supply all necessary equipment to perform the Preheat Treatment and Post Weld Heat Treatment procedure to the tubes welds and any other welds necessary to perform the scope of work. A qualified technician shall be present during the Preheat and Stress Relieving procedure

Scope of Work – Project Execution Tasks

a. Remove insulation, casing and casing anchors to perform the scope of work. Also, install insulation, with finishing cement and mesh, casing anchors and aluminum casing in all the areas describes in the scope of work. PREPA will supply calcium silicate insulation, mesh, nails, finishing cement and any other insulation material needed to perform the work. The Contractor will supply aluminum casing and casing anchors. Any asbestos insulation removal shall be performed by PREPA.

b. Supply all labor, personnel, materials tools and equipment for the installation, certification and removal of scaffolding required to complete the scope of work.

a. Fabrication and delivery of one (1) set left sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" The left sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

b. Fabrication and delivery of one (1) set right sidewall panels unit #8 from elevation 15'-6" & 18'-6" to elevation 93'-6" opp. hand The right sidewall will be (89) tubes wide centers assembled in three (3) sections of (28), (33) and (28) tubes wide. The panels will have a field weld location at elevation 54'-6" which will make the center panels 39'-0" long. This is the maximum to fit inside a 40ft. container. Tubes will stop 2" from the face of the lower headers.

c. Fabrication and delivery of one (1) set front wall panels unit #8 from elevation 30'-3" to elevation 95'-0" The front wall will be (93) tubes wide assembled in three (3) sections of (32), (30) and (31) tubes wide. The panels will have a field weld location at elevation 67'-0".

d. Fabrication and delivery of one (1) rear and arch wall panels unit #8 from elevation 87'-0" to elevation 109'-0" on the rear panels and elevation 87'-0 to elevation 96'-0" on the arch wall panels. The rear and arch wall panels will be (95) tubes wide assembled in three (3) sections of (33), (31) and (31) tubes wide.

- All tubes will be 2-1/2” OD x 0.203” MW SA210A1 material. Tubes spaced on 3” centers.

- All membrane bar materials will be 1’4” thick carbon steel material and stop 1” from each end. The outside tubes on each panel will be bare, no half width membrane.

- The membrane bar will be cut 6” long with ¼” Dia. Drilled hole at the end of the slot at both ends to aid fit-up of the tube pressure welds.

- The panels shall include the cable openings in the same locations.

- Fin bar ¼” thickness x 1/2” wide, carbon steel material will be shipped loose to be used during the site assembly.

- Tube field weld ends will be cut and beveled to length.

- All fabrication will be in accordance with the ASME Boiler and Pressure Vessel Code Section I (Power Boilers) latest edition and shop standards.

c. Remove and install eighty-nine (89), 2” OD tubes from elevation 15’-6” & 18’-6” to elevation 93’-6”.

d. Remove and install eighty-nine (89), 2” OD tubes from elevation 15’-6” & 18’-6” to elevation 93’-6”.

e. Remove and install ninety-three (93), 2” OD tubes from elevation 15’-6” & 18’-6” to elevation 93’-6”.

f. Remove and install ninety-five (95), 2” OD at the rear and arch wall panels unit #8 from elevation 87’-0” to elevation 109’-0” on the rear panels and elevation 87’-0 to elevation 96’-0” on the arch wall panels.

g. Remove and install all the structural parts (windbox, angles, plates, buck stays, protections, etc.) of the boiler necessaries to complete the waterwall installation.

h. Perform all required cuts, bevels and welds to fit and replace the waterwall panels describe in the scope of work. This includes cuts, bevels and welds from tube to tube, membranes to tubes, tubes to attachments and any other weld necessary to perform the waterwall panels replacement.

i. Supply all aluminum laggings and anchors. The Contractor shall supply any steel plates, angle, channels, I-beams and any steel material needed to perform the work.

j. High pressure air-ball test shall be performed by the Contractor in coordination with PREPA representative to all waterwall tubes panels before installation, to determine if is free from obstructions or debris, and to make sure it is clean.

k. Replacement of the Air-Preheater baskets and seals.

l. Inspection and repair, if necessary, of the following equipment of the boiler:

- High pressure and low-pressure water heaters.
- Circulating water pumps
- Boiler feed water pumps
- Fuel Pumps
- Water and fuel valves
- Instrumentation equipment for operation of the water and fuel systems.

Codes and Standards Required to Complete the Scope of Work

a. All work performed under this technical specification shall be done in a safe and workmanlike manner and in strict accordance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved; and including but not limited to the applicable codes, standards and procedures of the following organizations:

- Puerto Rico OSHA – Rule # 17
- Occupational Safety and Health Administration (OSHA)
- American Society of mechanical Engineers (ASME)
- National Board Inspection Code (NBIC)
- American Petroleum Institute (API)
- American Society for Nondestructive Testing (ASNT)
- National Fire Protection Association (NFPA)
- U S Environmental Protection Agency (EPA)
- Puerto Rico Environmental Quality Board (EQB)
- National Association of Corrosion Engineers (NACE)
- American Standard Testing Material (ASTM)
- American Welding Society (AWS)
- College of Engineers and Land surveyors of Puerto Rico (CIAPR)
- Department of Transportation of Puerto Rico (DOT)
- American National Standards Institute (ANSI)
- International Organization for Standardization (ISO)

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Replacement of Air Preheater's Baskets Unit 5

2/2/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	2/2/2022	

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Replacement of Air Preheater's Baskets Unit 5
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant Replacement of Air Preheater's Baskets Unit 5	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for Costa Sur Power Plant Replacement of Air Preheater's Baskets Unit 5 will consist of the following:

The scope of work for this project includes the removal of the damaged baskets of the air preheater of unit 5 of South Coast and install the baskets described in the project 50. The installation includes the repair of the drum casing, replacement of the seals (circumferential, radial, and axial seals), adjustment of the sector plates.

The contractor shall provide all the necessary equipment (cranes, welding machines, pulleys, scaffolds, etc.), manpower including supervision and labor and consumable materials (welding rods, bolts, etc.) to make the replacement. PREPA shall provide the dumpsters and transportation to dispose the baskets to be removed in the industrial landfill.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
Replacement	$700,000.00
Total Project Estimated Cost	**$700,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

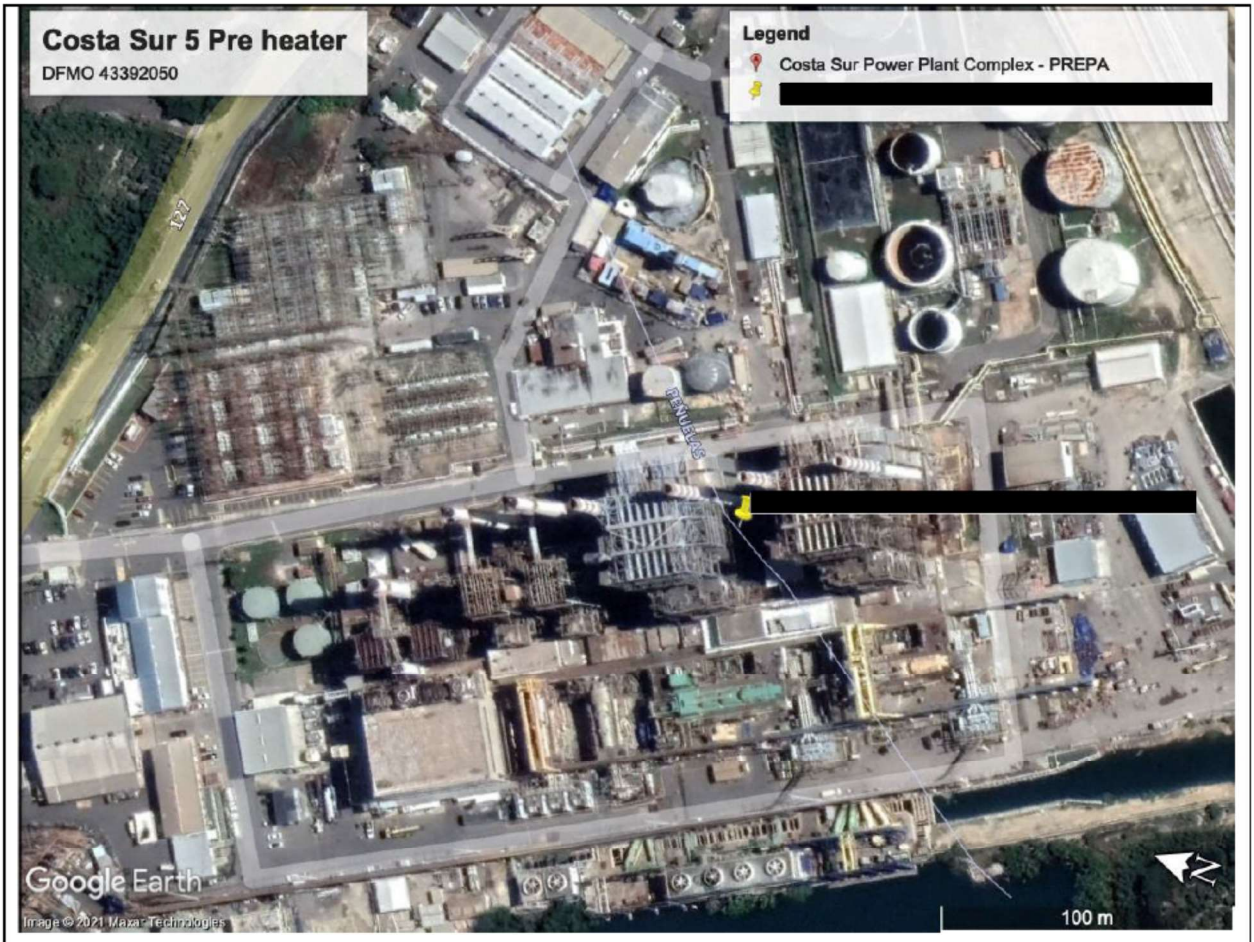
10.1. Project Detailed Cost Estimates

- Please see attached Scope of Work and Technical Specifications.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

GOVERNMENT OF PUERTO RICO
PUERTO RICO ELECTRIC POWER AUTHORITY

Project number: 51
Project name: Replacement of air preheater's baskets unit 5
Estimated cost: $700,000

Scope of work

The scope of work for this project includes the removal of the damaged baskets of the air preheater of unit 5 of South Coast and install the baskets described in the project 50. The installation includes the repair of the drum casing, replacement of the seals (circumferential, radial and axial seals), adjustment of the sector plates. The contractor shall provide all the necessary equipment (cranes, welding machines, pulleys, scaffolds, etc.), manpower including supervision and labor and consumable materials (welding rods, bolts, etc.) to make the replacement. PREPA shall provide the dumpsters and transportation to dispose the baskets to be removed in the industrial landfill.

101-89710 Ultima Compra 2009 2 set, ultimo despacho 2010 2 sets,

BASKET, SET, **AIR PREHEATER, HOT END HEAT TRANSFER** SURFACE SHALL BE OF THE FNC (FLAT, NOTCHED, CROSSED) DESIGN, 42INCHES IN DEPTH.BASE METAL SHALL BE NO.22 USG LOW ALLOY CORROSION RESISTANT MATERIAL (U.S. STEEL'S CORTEN OR EQUIVALENT).BASKET FRAMES SHALL BE FABRICATED FROM NO.7 US GAUGE LOW ALLOY CORROSION RESISTANT MATERIAL ((U.S. STEEL'S CORTEN OR EQUIVALENT).AT TIME OF SHIPMENT TOGETHER WITH THE MATERIAL,VENDOR MUST SEND A NOTARIZED CERTIFIED TEST REPORTWITH MUST INCLUDE:A) DESCRIPTION OF MATERIAL AND SPECIFICATIONB) MILL CERTIFICATEC) CHEMICAL ANALYSIS CERTIFICATED) MECHANICAL PROPERTIES AND TESTBASKETS SHOULD BE PROPERLY PACKED ANDWRAPPED WITH PLASTIC MATERIAL ANDSTEEL BANDS, WEATHER RESISTINGALL BASKETS SHOULD BE IDENTIFIED ANDPROPERLY MARKED WITH BASKET TYPEIN ORDER TO FACILITATE PREPA AN EASY IDENTIFICATION OF THEMAND SHOULD BE DELIVERED IN PALLETS IN OPEN PLATFORMS

101-89728 - Ultima compra 2009 2 set, ultimo despacho 2010 2 sets,

BASKET, SET, **AIR PREHEATER, COLD END ENAMEL** COATED HEAT TRANSFER SURFACE SHALL BE OF NF6 CONFIGURATION, 24 INCHES IN DEPTH.BASE METAL SHALL BE ENEMELING IRON CONFORMING TO ASTM SPECIFICATION A424. A) NOTCHED SHEET SHALL BE NO. 22 US GAUGE. B) FLAT SHEET SHALL BE NO. 20 US GAUGE. C) A CONTINUOS COATING OF PORCELAIN ENAMEL SHALL BE APPLIED TO EACH INDIVIDUAL ELEMENT SHEET FOLLOWING ADEQUATE CLEANING TO ASSURE ADHESION. D) FINAL THICKNESS OF ENAMEL COATING SHALL BE 5 MILS. (+.0015 IN./-.0005 IN.)BASKET FRAMES SHALL BE FABRICATED FROM 1/4 IN. THICK LOW ALLOY CORROSION RESISTANT MATERIAL ((U.S. STEEL'S CORTEN OR EQUIVALENT).AT TIME OF SHIPMENT TOGETHER WITH THE MATERIAL,VENDOR MUST SEND A NOTARIZED CERTIFIED TEST REPORTWITH MUST INCLUDE:A) DESCRIPTION OF MATERIAL AND SPECIFICATIONB) MILL CERTIFICATEC) CHEMICAL ANALYSIS CERTIFICATED) MECHANICAL PROPERTIES AND TESTBASKETS SHOULD BE PROPERLY PACKED ANDWRAPPED WITH PLASTIC MATERIAL ANDSTEEL BANDS, WEATHER RESISTINGALL BASKETS SHOULD BE IDENTIFIED ANDPROPERLY MARKED

WITH BASKET TYPEIN ORDER TO FACILITATE PREPAAN EASY IDENTIFICATION OF THEMAND SHOULD BE DELIVERED IN PALLETS IN OPEN PLATFORMS

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES
Submittal to COR3 and FEMA

Costa Sur Power Plant

CS 5 Major Inspection Unit 5 - HP IP LP Turbine Rotor Replacement

11/29/2021

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	CS 5 Major Inspection Unit 5 - HP IP LP Turbine Rotor Replacement
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Unit 5 Turbine	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

A steam path audit is a physical inspection of the turbine steampath, conducted while the rotor is on the half-shell. The purpose is to identify and quantify performance problems due to the deterioration of steampath components. Engineers and maintenance personnel use the results of audits to identify the most cost-effective repairs and to justify repair recommendations.

PREPA received a proposal #211569R2 from vendor Mechanical Dynamics & Analysis LLC as part of the procurement for inspection planned during outage of October 2022 on Unit 5 of the Costa Sur Power Plant.

This project is necessary and relevant because during the steampath audit or inspection the return to service performance of the machine can be predicted, also following repairs.

Data taken during a steampath audit can also help to:

- Measure the efficiency effects of deposits
- Assess recoverable leakage losses following repairs
- Determine losses due to surface roughness changes
- Provide quantifiable data for the review repair recommendations

- Evaluate the effects of solid particle erosion
- Calculate losses associated with foreign object damage
- Integrate decisions with alignment recommendations
- Provide historical records for future outages

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of this project is mainly to inspect and refurbish the spare turbine rotors and their stationary parts (diaphragms), previously removed from unit 6 in 2020 after 10 years of use, in order to install them in the turbine of unit 5 during the programmed outage on October 2022.

The project will cover HP/IP rotor, LPA rotor and the LPB rotor that was damaged on August 22, 2021. The rotor's inspections will be performed in the United States and a recommendation report will be submitted for PREPA's staff evaluation. After the evaluation of the recommendations and the proper procurement procedure, a refurbish process of about 4 months will be initiated. The refurbishing process will include a high-speed balance of the three rotors. The rotors and diaphragms will be shipped to the plant and properly stored at the facility.

The installation costs are not part of the scope of this project.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
MD&A Parts	$773,150
Return Shipping Estimate	$213,525
Buckets and Hardware (18 stages)	$2,069,851
HPIP Repairs - Rotor & Diaphragm (based on Inspection & Recomm.)	$1,530,196
LPA Repairs - Rotor & Diaphragm (based on Inspection & Recomm.)	$573,985
LPB Repairs - Rotor & Diaphragm (based on Inspection & Recomm.)	$741,515
Total Project Estimated Cost	**$5,902,222**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

_____ _____

Program Manager's Printed Name Date

Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

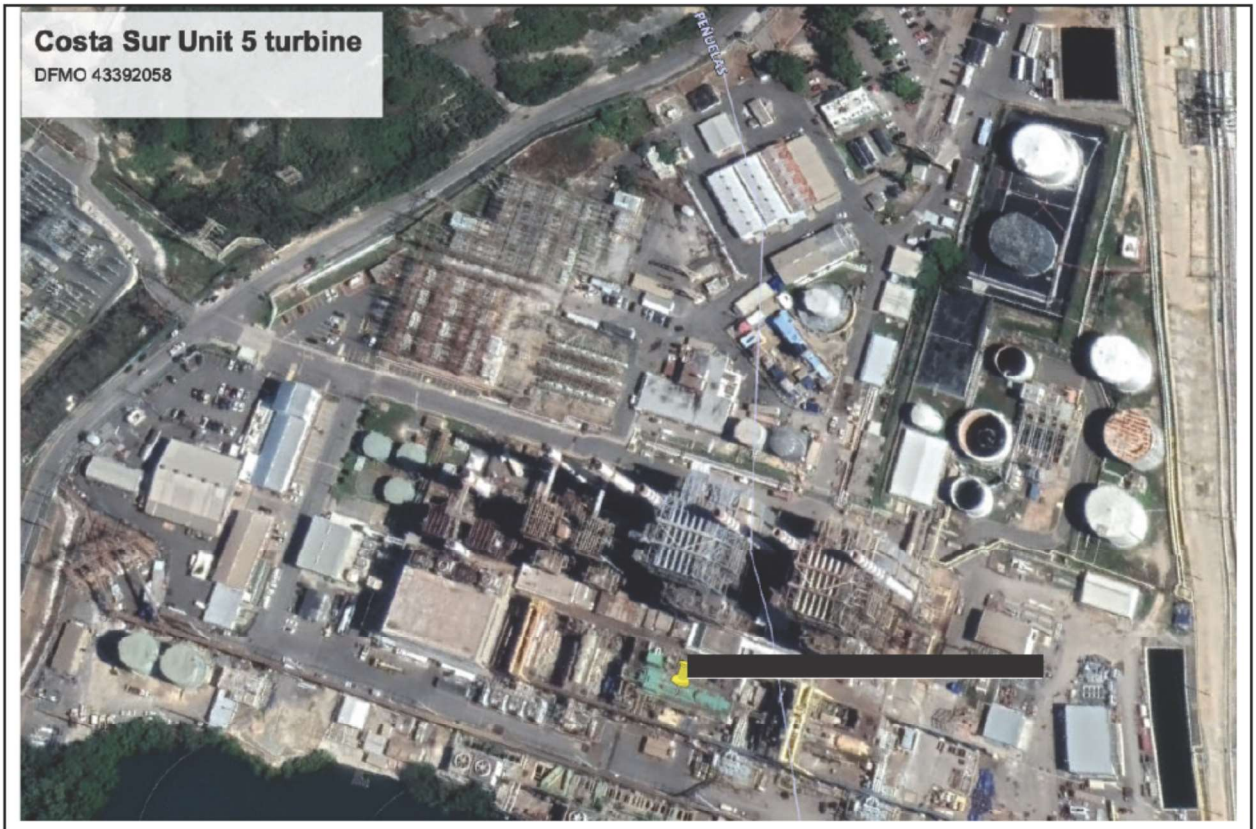
Please see attached the following:

- Memo_ Proyectos_2022_Angel_Perez_Rev_IJR
- PROPOSAL 211569R2 Prepa South Coast 5 Spare Steampath Repairs

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

1/26/2022

PREPA

SOUTH COAST, UNIT 5 SPARE

HPIP, LPA AND LPB STEAMPATH REPAIRS

PROPOSAL 211569R2

MECHANICAL DYNAMICS & ANALYSIS LLC
19 BRITISH AMERICAN BLVD. • LATHAM • NEW YORK • 12110
PHONE: (518) 399-3616 • FAX: (518) 399-3929
www.MDAturbines.com

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www.MDAturbines.com

1/26/2022

PROPOSAL 211569R2

Ing. Jaime A. Umpierre Montalvo
PREPA - South Coast
Road 127, Km 15.7
Guayanilla, PR 00656

E-mail: JAIME.UMPIERRE@prepa.com

Tel: 787.521.4833

Re: **PREPA - South Coast 5 Spare**
HPIP, LPA and LPB Steampath Repairs

Dear Ing. Jaime A. Umpierre Montalvo:

Mechanical Dynamics & Analysis is pleased to offer the attached Proposal for performing the above referenced work.

MD&A's proposal is organized as follows:

Scope Pricing
Supplemental Terms and Conditions
MD&A Rate Schedule(s) and T&C's
Technical Clarifications

MD&A appreciates having this potential opportunity to serve PREPA at its South Coast Station.

Sincerely,

Honey Mae Lee
Steampath Proposal Manager

c: J. Theokitisto, MD&A Proposals & Contracts Manager
D. Gregory, MD&A VP of Turbine-Generator Repairs
J. Wheeler, MD&A Repairs Steampath Shop Manager
D. Gould, MD&A Repair Machining Services Manager

PRICING & SCOPES

Summary	
Description	Price
MDA Parts	$773,150
Return Shipping estimate	$213,525
Buckets and hardware	$2,069,851
HPIP Repairs	$1,530,196
LPA Repairs	$573,985
LPB Repairs	$741,515
Grand Total	**$5,902,222**

Summary Details:

PARTS	
Description	Firm Price
Supply and Installation, complete Set of Packing, Spill Strips and Springs HPIP, LPA and LPB. See quote 262140 for details	$603,150
Snout Rings (4 sets nozzle box, 4 sets inner shell).	$76,500
Misc Diaphragm and Nozzle Hardware: Support blocks, clearance key, elevation key, horizontal joint bolts, Screws	$90,000
MDA Parts Shipping Estimate at cost + 17%	$3,500
MDA Parts Sub total	$773,150
Buckets and installation hardware	
Stage 1 buckets (with coating) and hardware	$186,869
Stage 2 buckets and hardware	$131,888
Stage 3 buckets and hardware	$147,563
Stage 4 buckets and hardware	$108,808
Stage 5 buckets and hardware	$106,273
Stage 6 buckets and hardware	$119,703
Stage 7 buckets and hardware	$107,138
Stage 8 buckets (with SPE Coating) and hardware	$169,348
Stage 9 buckets and hardware	$143,970
Stage 13 buckets and hardware	$150,100
Stage 17 buckets and hardware (TE)	$198,710
Stage 17 buckets and hardware (GE)	$198,710
Stage 18 buckets and hardware	$300,775
Buckets Sub total (up to 12 weeks delivery)	$2,069,851
Return Shipping estimate at Cost + 17% based on 3 heavy haulers for the rotors and 5 truckloads of diaphragms	$213,525

HPIP SECTION		
Item	Works Scope According to MD&A Insp. & Recommendations Report	Breakdown Cost (USD)
HPIP ROTOR		
T1 and T2 Journals	Machine T1 and T2 Journals	$35,860.00
Couplings	Take down high spots from galling in coupling holes Peen and machine GE coupling	$17,930.00
Stage 1	Replace Stage 1 Buckets	$93,055.00
Stage 2	Replace Stage 2 Buckets	$44,420.00
Stage 3	Replace Stage 3 Buckets	$44,420.00
Stage 4	Replace Stage 4 Buckets	$44,420.00
Stage 5	Replace Stage 5 Buckets	$44,420.00
Stage 6	Replace Stage 6 Buckets	$44,420.00
Stage 7	Replace Stage 7 Buckets	$44,420.00
Stage 8	Replace Stage 8 Buckets	$44,420.00
Stage 9	Replace Stage 9 Buckets	$44,420.00
Stage 10 to 12	HVOF Coat covers with chromium carbide (details/break out pricing per below)	$45,500.00
	Price for 1st Row Cover ($20,500)	
	Price for each additional Row ($12,500)	
Stage 10 to 12	Blend and Polish FOD (3 rows)	$11,520.00
HPIP Rotor	Perform Boresonic Inspection	$45,000.00
HPIP Rotor	Perform High Speed Balance	$90,000.00
	Sub Total	$694,225.00
HPIP DIAPRAGMS		
Nozzle	Major repair partitions with Inco 82 Weld repair seal groove and machine Remove broken alignment key bolts (qty 4) and replace 2 missing alignment keys in LH Remove broken shim screws in UH for bolt counterbores	$73,935.00

Nozzle Snout	Remove existing seal ring sets from upper & lower nozzle box halves Blast clean & NDE nozzle box halves – i.e. seal ring bores NDE nozzle box halves – seal ring bores / report findings Take as found dimensional data on the seal ring bores (before honing); record Prep bores by honing to be straight, round, etc. Take as left dimensional data on the seal ring bores (after honing); record Would need the corresponding snout pipe stellited OD dimensions for each seal ring bore location to be provided from site (to be provided by others); the corresponding snout pipe stellited areas should have been NDE'd (by others) and found free of defects - a copy of the NDE Report is requested to be provided prior to the machining of the new seal ring hardware here in the shop Machine seal ring components in prep for their installation; record as left dimensions Install seal ring components / seal weld / PT / photo document Provide all as left data sheets, etc.	$47,965.00
Stage 2	Major repair partitions with Inco 82Weld repair heavy erosion on outer sidewallWeld repair appendage and spill hooks and machineWeld repair root radial seal and machineRemove 1 broken screw	$56,536.00
Stage 5	Major repair 25% of partitions and bench back and straighten remaining Weld repair root radial seal and machine Drill out 1 broken HJ bolt in LH and 4 clearance key screws	$31,300.00
Stage 6	Major repair 30% of partitions and bench back and straighten remaining Weld repair root radial seal and machine Drill out 1 broken HJ bolt in LH and 4 clearance key screws	$32,935.00
Stage 7	Corner repair 20 partitions and bench back and straighten remaining Weld repair root radial seal and machine Drill out 1 broken HJ bolt in LH and 4 clearance key screws	$32,935.00
Stage 8	Major repair partitions Weld repair outer sidewall Weld repair appendage and spill strip hooks and machine Weld repair root radial seal and machine Remove 1 clearance key screw, 1 spill strip retaining key screw, and 2 axial packing retaining key screws	$122,636.00

Stage 9	Up to 30 corners and up to 20 majors Weld repair appendage and spill strip hooks and machine Weld repair root radial seal and machine	$48,010.00
Stage10	Up to 40 corner repairs – straighten and bench back remaining Remove 2 broken HJ bolts and one spill strip keeper screw Weld repair root radial seal and machine	$24,060.00
Stage 11	Coupon repair partitions Remove 2 broken HJ bolts and 1 clearance key screw Verify slot widths	$77,620.00
Stage 12	Coupon repair partitions Remove 2 broken HJ bolts and 1 spill retaining key screw	$86,275.00
Stage 7 and 8	Window Weld Repair Horizontal Joint. Recommended for stage 7 and 8	$27,330.00
Stage 8 and 9	HVOF Coat Diaphragm Partitions. Recommended for Stage 8 and 9	$15,000.00
Stage 3 and 4	Best effort weld repair of structural weld and partition repairs per recommendation	$159,434.00
	Sub Total	$835,971.00
	GRAND TOTAL	$1,530,196.00

LPA SECTION		
Item	Works Scope According to MD&A Insp. & Recommendations Report	Breakdown Cost (USD)
LPA ROTOR		
T3 and T4 Journals	Machine T3 and T4 Journals	$35,860.00
Thrust Runner	Skim cut and polish active and inactive thrust faces. Strap lap inboard and outboard journals	$17,930.00
Couplings	Take down high spots from galling in coupling holes Peen and machine TE coupling	$17,930.00
Stage 13 to 18	Blend, polish, remove high spots (12 rows)	$48,480.00
Stage 17 and 18	HVOF Coat covers with chromium carbide (assumes additional rows, 4 total at 12,500 each)	$50,000.00
LPA Rotor	Perform High Speed Balance	$90,000.00
	Sub Total	$260,200.00
LPA DIAPRAGMS		
DF Stage 13	Bench back and straighten trailing edges Remove high spots from FOD Remove 3 broken screws from packing retaining keys Install seal face insert and leave with extra stock	$49,635.00
Stage 14	Bench back and straighten trailing edges Remove high spots from FOD Remove 2 broken screws from 14TA UH spill strip retaining key Weld repair and machine root radial seal on stage 14 TA and 14 GA diaphragms	$60,700.00
Stage 15	Major repair up to 5 partitions/half Bench back and straighten remaining trailing edges Remove high spots from minor FOD Remove broken screw from 15 TA UH spill strip retaining key Remove dowel from 15 GA LH and install new in UH Weld repair and machine root radial seal on stage 15 TA and 15 GA diaphragms	$73,810.00
Stage 16	Bench back and straighten trailing edges Remove high spots from FOD Weld and machine horizontal joint on stage 16 GE to correct out of round up to .103”	$37,840.00
Stage 17	Bench back and straighten trailing edges Remove high spots from FOD Weld repair 1 partitions on 17 TA	$21,490.00
Stage 18	Remove 1 broken screw from stage 18 TA and 2 from stage 18 GA spill strip retaining keys Bench back and straighten trailing edges Remove high spots from FOD	$21,490.00

Stage 19	Bench back and straighten trailing edges Remove high spots from FOD	$21,490.00
Stage 13	Window Weld Repair Horizontal Joint.	$27,330.00
	Sub Total	$313,785.00
	GRAND TOTAL	$573,985.00

LPB SECTION		
Item	Works Scope According to MD&A Insp. & Recommendations Report	Breakdown Cost (USD)
LPB ROTOR		
T5 and T6 Journals	Machine T5 and T6 Journals	$35,860.00
Couplings	Take down high spots from galling in coupling holes Peen and machine GE coupling	$17,930.00
Stage 13 GE) to 16 (TE and GE) and Stage 19 TE/GE	Blend, polish, remove high spots (10 stages total)	$40,400.00
Stage 13 TE	Replace Stage 13 TE Buckets	$49,490.00
Stage 17 TE and GE	Replace Stage 17 TE and GE buckets. L1 wheel indication repair not included/TBD	$110,980.00
Stage 18 TE	Replace 18 TE Buckets	$49,490.00
Stage 16 TE/GE and 18 GE	HVOF Coat covers with chromium carbide (assumes additional rows, 3 total at 12,500 each)	$37,500.00
LPB Rotor	Perform High Speed Balance	$90,000.00
	Sub Total	$431,650.00
LPB DIAPRAGMS		
DF Stage 13	Major repair up to 10 partitions Corner repair up to 20 partitions Bench back, straighten remaining partitions Install seal face insert and leave with extra stock	$64,380.00
Stage 14	Bump back and straighten trailing edges and remove highs from FOD Replace broken clearance key screw in 14 GE LH	$29,655.00
Stage 15	Bump back and straighten trailing edges and remove highs from FOD	$29,655.00
Stage 16	Major repair up to 5 partitions total Corner repair up to 10 partitions total Bump back and straighten trailing edges and remove highs from FOD	$32,935.00
Stage 17	Perform corner/thumbnail repair on 50% of partitions Bump back and straighten trailing edges and remove highs from FOD Repair appendage Machine off existing, broken appendage Manufacture and mechanically install new appendage ring Final machine appendage and spill strip groove Stage 17 GE Diaphragm Bump back and straighten trailing edges and remove highs from FOD Perform up to 10 corner repairs	$94,610.00

Stage 18	Stage 18 TE Perform 15 corner/thumbnail repairs per half Fill in large FOD, bump back and straighten trailing edges, and remove highs from FOD Stage 18 GE Fill in large FOD, bump back and straighten trailing edges, and remove highs from FOD	$31,300.00
Stage 19	Work completed. Diaphragms are onsite	$0.00
Stage 13	Window Weld Repair Horizontal Joint.	$27,330.00
	Sub Total	$309,865.00
	GRAND TOTAL	$741,515.00

A Division of Mechanical Dynamics & Analysis LLC

MD&A Parts Division
767 Pierce Road
Suite #2
Clifton Park, NY 12065
UNITED STATES

Phone: (518) 885-3199
Fax: (518) 885-3072
E-mail: parts@mdaturbines.com

Quote Number: 262140
Quote Date: 22-Dec-2021

Privileged and Confidential

QUOTE

Quote To:

Puerto Rico Electric Power Authority: South Coast
Road 127, Km 15.7
Guayanilla PR 00656

Phone: 787-521-5205 **Fax:**
Email:

Date: 22-Dec-2021
Expires: 21-Jan-2022
Reference:
Sales Person: Jeff Simkins
jsimkins@mdaturbines.com
Terms & Cond.: See attached.
Warranty: See attached.
Payment Terms: Due Upon Receipt

Thank you for your inquiry.
Please note that all lead times are quoted in *calendar* days (ARO).
Freight and delivery not included in quoted price (unless otherwise stated).
Please provide shipping instructions at time of PO.

PREPA SOUTH COAST

All rings will be manufactured with zero butt gap, integral teeth and concentric round bores, unless otherwise specified by customer or part number. Manufacturing of inserted teeth, offset bores, or elliptical bores would be extra. All bronze rings will be manufactured from CDA 973 Modified and all steel rings will be manufactured from 400 series stainless steel, unless otherwise specified by customer.

US Dollars

Line	Part Number	Description	Lead Time (days)	Qty	Unit Price	Net Price
1	LOT PRICE	HPIP DIAPHRAGM GUARDIAN PACKING RINGS & VORTEX SHEDDER SPILLS	35	1	133,190.00	133,190.00

Estimated turnaround: 28-35 days.

Includes pricing for (15) rows of Advanced Guardian Packing Rings for the HPIP turbine section:
(15) rows for the HPIP Diaphragm Stages (2-12)

Includes pricing for (11) rows of Advanced Vortex Shedder Spill Strips and (6) rows of conventional spill strips for the HPIP turbine section:
(17) rows for Stages 2-12

Includes packing rings, spills and springs. Any additional hardware would be extra.
Premeasure and installation by MD&A are mandatory with Guardian Packing & Vortex Shedder Spills.

Line	Part Number	Description	Lead Time (days)	Qty	Unit Price	Net Price
2	LOT PRICE	LPA DIAPHRAGM CONVENTIONAL PACKING RINGS & VORTEX SHEDDER SPILLS	35	1	159,120.00	159,120.00

Estimated turnaround: 28-35 days.

Includes pricing for (15) rows of Conventional Packing Rings for the LPA turbine section:
(15) rows for the LPA Diaphragm Stages 13-19 (TE/GE)

Includes pricing for (12) rows of Advanced Vortex Shedder Spill Strips for the LPA turbine section:
(12) rows for LPA Diaphragm Stages 13-18 (TE/GE)

Includes packing rings, spills, and springs. Any additional hardware would be extra.
Premeasure and installation by MD&A are mandatory with Vortex Shedder Spills.

A Division of Mechanical Dynamics & Analysis LLC

MD&A Parts Division
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Suite #2
Clifton Park, NY 12065
UNITED STATES

Phone: (518) 885-3199
Fax: (518) 885-3072
E-mail: parts@mdaturbines.com

Quote Number: 262140
Quote Date: 22-Dec-2021

Privileged and Confidential

3	LOT PRICE	LPB DIAPHRAGM CONVENTIONAL PACKING RINGS & VORTEX SHEDDER SPILLS	35	1	159,920.00	159,920.00

Estimated turnaround: 28-35 days.

Includes pricing for (15) rows of Conventional Packing Rings for the LPB turbine section:
(15) rows for the LPB Diaphragm Stages 13-19 (TE/GE)

Includes pricing for (12) rows of Advanced Vortex Shedder Spill Strips for the LPB turbine section:
(12) rows for LPB Diaphragm Stages 13-18 (TE/GE)

Includes packing rings, spills, and springs. Any additional hardware would be extra.
Premeasure and installation by MD&A are mandatory with Vortex Shedder Spills.

4	FIRM PRICE	PREMEASURE		1	6,730.00	6,730.00

MD&A On-site Seal Services will provide One Lead and One seal technician to take disassembly seal measurements needed to verify component design and take critical component distortion measurements required to improve fit of replacement seals. The premeasure activity will help reduce the amount of custom fitting of packing during final assembly. Premeasure work will take place immediately following the removal of all packing.

Following seal removal by others, MD&A recommends bolting the UH and LH seal holders together, to most accurately determine if custom machining will be required to optimize replacement seals during manufacture, due to out of roundness. Component assembly to be performed by customer, with bolted roundness measurements made by MD&A On-site Seal Services. Recommendations and any associated extra costs would be reviewed with customer prior to manufacturing.

Any Stand-by, extras, etc. due to no fault of MD&A will be invoiced per MD&A rate sheet in effect for year work is performed.

If applicable, the ability to implement Vortex Shedders to existing spill strip design will also be evaluated.

5	FIRM PRICE	PACKING & SPILL STRIP INSTALLATION - HPIP, LPA & LPB DIAPHRAGM PACKING & SPILLS		1	102,790.00	102,790.00

MD&A On-site Seal Services offers a custom fit seal installation, including the trimming of end gap (butt) clearances, as well as exact radial and axial adjustments, based on unit alignment and component distortion, to optimize closing clearances. MD&A's team of highly trained technicians will measure and adjust each individual packing ring on-site, using a portable machine shop, to achieve the proper fit. Failure to make final radial and axial adjustments can lead to rubs during startup and operation, reducing the effectiveness of the newly installed seals.

Installation of (45) rows of diaphragm packing rings & (41) rows of spill strips for HPIP, LPA & LPB sections.

Price Includes:
*One lead and one seal technician and associated per diem.
*Portable machine shop rental and expendables.
*Includes unpacking, inspection and deburring packing fits, installation of new packing rings including measurements and required machining to set packing butt clearances.
*Packing radial clearance measurements will be taken and provided to customer once rotor is installed.
*Any custom fitting and adjustment of radial or axial clearances will be considered extra work and will be performed on a ring by ring basis as needed, and billed per MD&A published rates at time of service.

Any stand-by, extras, etc. due to no fault of MD&A will be invoiced per MD&A rate sheet in effect for the year work is performed.

6	T&M	MOBILIZATION ESTIMATE	1	1	41,400.00	41,400.00

Mobilization Time & Material Estimate

Price estimate includes:

*All travel time, expenses and per diem for seal technicians to complete premeasurement and installation activities.
*Freight in/out for container - Round trip shipment of the Portable Machine shop.

Any Stand-by, extras, etc. due to no fault of MD&A, will be invoiced per M&DA rate sheet in effect for year work is performed.

Freight and delivery not included in quoted price (unless otherwise stated).
Please provide shipping instructions at time of PO.

Misc. Charge Total:	$0.00
Goods Total:	$603,150.00
Grand Total:	**$603,150.00**

SUPPLEMENTAL TERMS AND CONDITIONS

1. **Terms and Conditions** – MD&A's proposal is based on the attached document titled "MD&A Terms and Conditions, Services and Parts (Dated 09/11/17)".

2. **Payment**
   a. We propose the following Payment Schedule:
      i. 15% invoice upon award/issuance of PO
      ii. 20% invoiced upon completion of HP rotor repairs
      iii. 20% invoiced upon completion of LPA rotor repairs
      iv. 20% invoiced upon completion of LPB rotor repairs
      v. 20% invoiced upon completion of diaphragm repairs
      vi. 5 % invoiced upon delivery of components to site

   b. All invoices net thirty (30).
   c. Our price does not include import / export customs taxes, duties, or the cost of any required work permits or visas. If these are required, they would be billed to the customer at cost plus administrative mark up.
   d. All pricing is in current, 2022 US Dollars. Pricing quoted would apply for the work to be performed in 2022. All Payments shall be made in US dollars.

3. **Extra Work**
   a. MD&A will be reimbursed for extra scope work, with Customer's prior approval per the attached Rate Schedule(s).
   b. Extra work can be performed on either a time and material basis or on a lump sum firm price basis, as requested. MD&A shall not be required to comply with any requested change order until Customer and MD&A have reached written agreement on appropriate adjustments in price, schedule and scope of work.
   c. MD&A employees are capable of performing safe work in power plants. They are trained and are in compliance with the most current OSHA safety standards. Additional Customer required safety training that has not been specified can be performed on a T&M basis.

4. This proposal may be impacted by unforeseen circumstances arising out of the **Coronavirus Pandemic** that require extra costs such as mandatory quarantine for personnel or other. MD&A will do its best to notify the Customer of such circumstances as soon as they become aware, however the Customer shall be responsible for any extra costs related to quarantine as may be required to accommodate COVID-19 restrictions & protocols.

5. **Validity** - Proposal is valid for ninety (90) days. Extensions may be requested by the Customer.

6. **Schedule**: Quoted workscope will be completed within 24 weeks from receipt of PO.

2022 RATE SCHEDULE

U.S. and CANADA *(01/01/22 THRU 12/31/22)*

	Hourly Rates *(Note 2)* S.T.	O.T.
Engineering Rates		
Field Engineer, Technical Field Advisor, Generator Specialist	$ 255.00	$ 382.50
Project Management, Steampath Engineering Supervision	$ 278.00	$ 417.00
Engineering Consultant, Specialty Field Engineer	$ 347.00	$ 520.50
Controls, Excitation, Balancing, Alignment, Shell/Casing Repair		
Principal Engineer, Combustion Tuning Engineer	$ 395.00	$ 592.50
Labor Rates		
Steampath Specialist, Lead Seal Technician, CAD Designer, Reverse Engineering Technician	$ 198.75	$ 298.00
Steampath Work Leader	$ 149.00	$ 223.50
Steampath Technician	$ 137.00	$ 205.50
Blader, Machinist, Welder, Seal Technician		
Gas Turbine Bucket/Blade Specialist	$ 205.00	$ 307.50
Gas Turbine Repair Technician	$ 158.00	$ 237.00
Generator Technician, I&C Technician	$ 192.00	$ 288.00
Safety Professional	$ 94.50	$ 134.50
Craft Labor, Administrative/Clerical	Available upon request	

Equipment, Parts, Services		**Daily**	**Weekly**
Turbine Tool Container	*(Note 3)*	$1,265.00	$7,590.00
Purchased/Subcontracted Parts and Services		Cost + 17%	
Steampath Consumables	*(Note 4)*	$ 14.00/person/hour	
Travel and Living Expenses			
Per Diem	*(Note 5)*	$ 295.00/person	
Per Diem (Safety Professional)	*(Note 5)*	$ 250.00/person	
Travel Expenses	*(Note 6)*	Cost + 10%	
Personal Vehicle (to and from worksite)		IRS Standard Rate + 10%	

NOTES:

1. *Rates are based on a minimum of ten (10) hours per day, six (6) days per week per person, unless noted differently in the proposal. Any required stand-by time will be billed at S.T. rates and limited to ten (10) hours per day, six (6) days per week per person.*
2. *O.T. is defined as work over eight (8) hours on weekdays and all hours worked on Saturdays, Sundays, and Holidays.*
3. *Pricing does not include shipping and freight, which will be invoiced at cost plus 17%.*
4. *Rate excludes weld filler materials in some high deposition applications and all silver solder.*
5. *Firm price per diem rate includes local transportation, lodging, meals, laundry, communications and incidentals and will be invoiced on a 7 day per week basis. Price shown is based on rural to medium suburban areas. Large metropolitan locations (such as NYC, Chicago, Los Angeles, etc.) or locations where seasonal/special event rates apply will be quoted upon request.*
6. *Travel hours will be invoiced on a straight time basis for actual hours traveled.*

TERMS:

1. *Payment terms – Net 30 days.*
2. *1½% per month finance charge applied to late payments.*
3. *All prices in U.S. Dollars.*
4. *Subject to MD&A TERMS AND CONDITIONS, SALE OF SERVICES AND PARTS (dated 9/11/17).*

2022 MD&A Tool/Equipment Rental Schedule

is available upon request.

MD&A LLC, 19 British American Blvd., Latham, NY 12110
Tel: 518-399-3616, Fax: 518-399-3929
WWW.MDATURBINES.COM

2022 TOOL/EQUIPMENT RENTAL SCHEDULE

U.S. and Canada
(01/01/22 THRU 12/31/22)

Equipment Rentals *(Note1)*	**Daily**	**Weekly**
Turbine Tool Container	$ 1,265.00	$ 7,590.00
Generator Repair Equipment and Tool Rental		
Induction Heating Set	N/A	$ 6,800.00
Generator Tool Trailer	N/A	$ 2,950.00
Power Rollers	N/A	$ 1,650.00
Field Removal System *(Note 3)*	N/A	$ 8,620.00
Stator Cooling Water Vacuum–Pressure Test Skid	$ 685.00	$ 4,110.00
Voltage Regulator Test Set	$ 105.00	$ 630.00
AC Hi-Pot	$ 570.00	$ 3,420.00
Test Box	$ 310.00	$ 1,850.00
Stator ElCid Test Equipment	$ 915.00	$ 5,490.00
Specialty Generator Equipment	Available upon request	
Turbine Repair Equipment and Tool Rental		
Portable Lathe (over 60 tons)	$ 660.00	$ 3,950.00
Portable Lathe (60 tons or less)	$ 467.00	$ 2,800.00
Portable Machine Shops	$ 500.00	$ 3,000.00
Line Boring Bars (1 ½" to 4" diameter)	$ 475.00	$ 2,850.00
Line Boring Bars (over 4" diameter)	$ 575.00	$ 3,450.00
Vertical Turning Lathe/Boring Machine	$ 265.00	$ 1,590.00
Flange Facing Machine	$ 315.00	$ 1,890.00
Metal Disintegration Machine (MDM) *(Note2)*	$ 990.00	$ 5,940.00
Stud Removal Machine	$ 385.00	$ 2,310.00
Lamina Hydraulic Drill and Power Pack	$ 525.00	$ 3,150.00
Cylinder Boring Machine	$ 285.00	$ 1,710.00
Portable Honing Machine	$ 135.00	$ 800.00
CNC Milling Machine	$ 260.00	$ 1,560.00
Three Axis Master Milling Machine	$ 275.00	$ 1,650.00
Knee Milling Machine, 24"	$ 310.00	$ 1,860.00
Bucket/Blade Milling Machine	$ 142.00	$ 850.00
Punch Press	$ 142.00	$ 850.00
Cover/Shroud Roller	$ 142.00	$ 850.00
Welding Machine	$ 150.00	$ 900.00
Laser Joint Flatness Measurement Instrumentation *(Note 3)*	$ 365.00	$ 2,190.00
Welding Package (manual welding machine, cables, stingers)	$ 165.00	$ 990.00
Automatic MIG Orbital Welding System (no consumables included)	$ 465.00	$ 2,790.00
Automatic TIG Orbital Welding System (no consumables included)	$ 1,500.00	$ 9,000.00
ASME Certified Weld Procedures (labor supervisor required)	$2,800.00/procedure/use	
Heat Treating Equipment (6-ways, heating pads, thermocouples, etc.)	$ 325.00	$ 1,950.00
Turbobalancer	$ 308.00	$ 1,848.00
ADRE 408	$ 500.00	$ 3,000.00
Combustion Tuning Kit	$ 500.00	$ 3,000.00
Rotor Shipping Skids and Containers	Available upon request	
Other Tooling and Equipment	Available upon request	

NOTES:

1. *Pricing does not include shipping and freight. Shipping and freight will be invoiced at cost plus 17%.*
2. *Rate does not include consumables. All consumables will be charged at cost plus 17%.*
3. *Requires the use of an MD&A Specialty Field Engineer (not included in rental rate).*

TERMS:

1. *Payment terms – Net 30 days.*
2. *1½% per month finance charge applied to late payments.*
3. *All prices in U.S. Dollars.*
4. *Subject to MD&A TERMS AND CONDITIONS, SALE OF SERVICES AND PARTS (dated 9/11/17).*

2022 MD&A Rate Schedule

is available upon request.

MD&A LLC, 19 British American Blvd., Latham, NY 12110
Tel: 518-399-3616, Fax: 518-399-3929
WWW.MDATURBINES.COM

MD&A TERMS AND CONDITIONS
SERVICES AND PARTS

NOTICE: Sale of any services and/or parts ordered by Customer is expressly conditioned on Customer's assent to the additional or different terms contained herein, including MD&A's quotation. Any additional or different terms proposed by Customer are expressly objected to and will not be binding upon MD&A unless specifically assented to in writing by MD&A. Any order for, or any statement of intent to purchase services/parts, or any direction to perform work and MD&A's performance, shall constitute assent to MD&A's terms and conditions. MD&A's quotation is valid for 90 days, unless withdrawn prior to receipt of Customer's acceptance.

1. WARRANTY.

a. Services and Parts. Services performed on Customer's equipment by MD&A and any parts supplied by MD&A are warranted to conform to the Contract specifications and to be free from defects in workmanship, material and title for a period of twelve months following the equipment's return to service, or eighteen months following completion of work or delivery of the part, whichever occurs first. If any services or parts fail to meet the foregoing warranty, at MD&A's option, MD&A shall correct such failure, (a) by reperforming any portion of the nonconforming services or repairing or replacing any nonconforming or defective parts; or (b) by making available Ex Works MD&A's facility (Incoterms 2010), any necessary repaired or replacement parts. Where a nonconforming or defective part cannot be corrected by MD&A's reasonable efforts, the parties will negotiate an equitable adjustment in price. All costs and risks of access to the equipment, disassembly, and reassembly associated with the corrective action shall be borne by Customer, if not included in the original work scope. The supply of repaired or replacement parts, or reperformed services shall not extend the duration of the warranty period.

b. Rentals. With respect to rental services, MD&A warrants only that rental equipment when delivered is in good operating condition. If the equipment rented hereunder is not in good operating condition due to no fault of Customer and Customer notifies MD&A promptly, MD&A shall thereupon (at its option) either repair the equipment or rent replacement equipment, subject to availability.

c. Exclusive. The preceding paragraphs set forth the exclusive remedies for claims (except as to title) based on failure to conform to the Contract specifications or defects in workmanship, material, parts or services, or professional errors or omissions which may be asserted under any theory including, for example, breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise. Upon the expiration of the warranty period, all such liability shall terminate and Customer shall have a reasonable time, within ten (10) days after the warranty period, to give written notice of any nonconformance or defects that appear during the warranty period. Except as set forth in Article 6, the foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY.

d. Limits. MD&A's obligations under this Article 1 shall not apply to any part or portion thereof, which (a) is nonconforming or defective due to normal wear and tear including that due to environment or operation, or (b) has a normal life inherently shorter than the warranty period, or (c) is not properly stored, installed, used or maintained other than pursuant to MD&A's written instructions or approval, or (d) has been subjected to any other kind of misuse or detrimental exposure or has been involved in an accident. In addition, this warranty shall be void if (a) Customer makes any repairs to, or effects any changes in, parts or any portion thereof, which have not been authorized by MD&A in writing, or (b) MD&A is not promptly notified of any failure in writing or has not been given prompt and complete access to the failed parts or equipment including full access to all diagnostic and repair efforts.

The conditions of any acceptance and other tests shall be mutually agreed upon and MD&A shall be notified of, and may be represented at all tests.

e. Latent Defects. In no event shall MD&A be liable for any loss or damage whatsoever arising from its failure to discover or repair latent defects or defects inherent in the design of parts or equipment serviced or caused by the use of parts by Customer against the advice of MD&A.

2. LIMITATIONS OF LIABILITY.

a. In no event, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, shall MD&A's liability to Customer, its subsidiaries and affiliates, successors or assigns, or its insurers for any loss or damage arising out of, connected with, or resulting from the Contract, or from MD&A's performance or breach, or from any parts or services covered by or furnished under the Contract or any extension or expansion thereof (including remedial warranty efforts), exceed the Contract price.

MD&A and Customer expressly agree that under no circumstances, including indemnity obligations, shall MD&A be liable to Customer for any of the following:

i. Loss of profits, whether direct or indirect
ii. Loss of revenues, whether direct or indirect
iii. Cost of purchased power
iv. Cost of replacement power
v. Downtime costs

Customer recognizes that MD&A's insurance will not cover all risks that Customer may be exposed to as a result of this Contract, specifically the exclusions listed directly above (numbered 1-5), for which MD&A excludes all liability. Customer has reviewed MD&A's insurance coverages, as outlined in Article 5, and Customer agrees that it shall take all reasonable efforts to procure insurance to protect against any risks and damages that it may incur which are not insured for by MD&A, and for which MD&A shall not be liable as a result of this Article 2.

Except as to title to any parts furnished, all such liability shall terminate upon the expiration of the warranty period specified in Article 1. Any such claim of liability must be commenced in no event later than one year from the termination of the warranty period in accordance with Article 17. This limitation of liability shall not apply to the indemnity for bodily injury or death as set forth in Article 4.

b. If MD&A furnishes Customer with advice or assistance concerning any part supplied hereunder or any part, system or equipment in which any such part may be installed and which is not required pursuant to this Contract, the furnishing of such advice or assistance will not subject MD&A to any liability, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise.

c. Customer waives all rights of recovery against MD&A and all rights of subrogation, whether Customer's claim is brought under breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, for loss or damage to the property of Customer to the extent such claim is covered by insurance maintained by Customer. For the purposes of Articles 2 and 3, the term "MD&A" includes MD&A and its subcontractors, suppliers, subsidiaries and affiliates, their directors, officers, agents, employees, successors and assigns and authorized representatives.

3. CONSEQUENTIAL DAMAGES. Notwithstanding anything else contained in this Contract, in no event, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, shall MD&A be liable to Customer or its subsidiaries and affiliates, successors or assigns, or its insurers for any special, incidental, exemplary, indirect or consequential damages, including, without limitation, loss of profits or revenues, loss of use of any property, parts or any associated equipment, damage to associated equipment, cost of capital, cost of purchased power, cost of substitute equipment, facilities, parts, services or replacement power, downtime costs or claims of customers of Customer for such damages and Customer will indemnify MD&A against any such claims from Customer's customer.

4. INDEMNITY. MD&A and Customer each agree to defend, indemnify, and hold harmless the other party, including the other party's subcontractors, suppliers, subsidiaries and affiliates, their directors, officers, agents, employees, successors and assigns and authorized representatives, from and against any claim, loss, damage or expense for all bodily injury or death, but only to the extent that such bodily injury or death is caused by the indemnifying party's negligence. In the event that such bodily injury or death is caused by the joint or concurrent negligence of MD&A and Customer, the claim, loss, damage or expense shall be borne by each party in proportion to its own negligence.

5. INSURANCE. MD&A, at its expense, shall procure and maintain in effect without interruption during the term of this Contract, policies of insurance providing the coverages and limits specified, and complying with the other requirements stated below (all amounts below are stated in US dollars):

a. Worker's Compensation in statutory amounts and Employer's Liability with a minimum limit of $1,000,000 each accident, $1,000,000 Disease - each Employee, $1,000,000 Disease Policy Limit.

b. Commercial General Liability on an Occurrence Basis, with the following coverages and limits:

i.	Per Occurrence	$1,000,000
ii.	General Aggregate	$1,000,000
iii.	Products-Completed Operations Aggregate	$1,000,000
iv.	Personal & Advertising Injury Each Occurrence	$1,000,000

c. Automobile Liability covering automobiles of MD&A, including owned, hired and non-owned automobiles, for Bodily Injury and Property Damage with a combined single limit of $1,000,000 each Occurrence.

d. Excess Liability in Umbrella Form with a limit of $4,000,000 each Occurrence, $4,000,000 Aggregate.

6. PATENTS. MD&A warrants that parts furnished hereunder shall be delivered free of any rightful claim of any third party for infringement of any U.S. patent. If notified promptly in writing and given authority, information and assistance, MD&A shall defend, or may settle, at its expense, any suit or proceeding against Customer so far as based on a claimed infringement which would result in a breach of this warranty and MD&A shall pay all damages and costs awarded therein against Customer due to such breach. In case any part is in such suit held to constitute such an infringement and the use for the purpose intended of said part is enjoined, MD&A shall, at its expense and option, either procure for Customer the right to continue using said part, or replace same with a noninfringing part, or modify same so it becomes noninfringing, or remove the part and refund the Contract price. The foregoing states the entire liability of MD&A for patent infringement.

The preceding paragraph shall not apply to any parts specified by Customer or manufactured to Customer's design, or purchased from other sources, or to the use of any parts furnished hereunder in conjunction with any other parts in a combination not furnished by MD&A as part of this Contract. As to any such parts, or use in such combination, MD&A assumes no liability whatsoever for patent infringement and Customer will hold MD&A harmless against any infringement claim arising therefrom.

In the case of rental equipment MD&A may, at any time after it becomes aware of a possible infringement, elect to require that the equipment be returned and excuse Customer from further rental payments. This paragraph contains the entire liability of MD&A for patent infringement by rental equipment.

7. DELIVERY. Completion dates are approximate and are based upon prompt receipt of the equipment and all necessary information from Customer, or ready access to same if work is to be done at Customer's facility. Unless otherwise specified by MD&A, all shipments of parts are Ex Works MD&A's facility (Incoterms 2010), shipping and insurance prepaid by Customer. In the case of rental equipment, shipping dates quoted are based on rental stocks available at the time of quotation and are, therefore, subject to prior rentals.

8. EXCUSABLE DELAYS. MD&A shall not be liable for any delay in delivery or performance, or for any failure to manufacture, deliver, or perform due to (a) any cause beyond its reasonable control; or (b) any act of God, act of Customer, act of civil or military authority, government priority, fire, severe weather condition, earthquake, strike or other labor disturbance, flood, epidemic, war (declared or undeclared, including civil unrest), riot, terrorist act, delay in transportation or car shortage; or (c) act (or omission) of Customer, including failure to promptly: (i) provide MD&A with information and approvals necessary to permit MD&A to proceed with performance immediately and without interruption, (ii) comply with the terms of payment, or (iii) provide MD&A with such evidence as MD&A may request that any export or import license or permit has been issued; or (d) inability on account of any cause beyond the reasonable control of MD&A to obtain necessary materials, components, services or facilities. The date of delivery or of performance shall be extended for a period equal to the time lost by reason of delay, plus such additional time as may be reasonably necessary to overcome the effect of such excusable delay. MD&A shall notify Customer, as soon as practicable, of the revised date of delivery or of performance. If MD&A is delayed by acts or omissions of Customer, or

by the prerequisite work of Customer's other contractors or suppliers, MD&A shall also be entitled to an equitable price adjustment.

9. PAYMENTS AND FINANCIAL CONDITION. Unless otherwise specified by MD&A in its quotation, payments under the Contract shall be either (a) received in MD&A's account, or (b) secured by a letter of credit satisfactory to MD&A, before MD&A has any obligation to begin performance under the Contract. If a letter of credit is utilized, payment(s) shall be made upon presentation of documents (mutually agreed to in advance by the parties) against a confirmed irrevocable letter of credit issued or confirmed by MD&A authorized bank. The letter of credit shall (a) be established by the Customer, at Customer's expense (including confirmation, amendments and maintenance charges), and (b) remain in effect for a period of three months after the last item of the scope of work is scheduled to be performed under the Contract. The letter of credit shall provide for partial payments pro rata on partial performance and partial shipments from MD&A's facility and for the payment of any charges for storage (including storage at MD&A's facility), price adjustments, cancellation or termination, and all other payments due from Customer under the Contract against MD&A's presentation of documents, and will otherwise be acceptable to MD&A. Customer will increase the amount(s) or extend the validity period(s) and make appropriate modifications to any letter of credit within ten (10) days of MD&A's notification that such is necessary to provide for payments to become due. If MD&A consents to delay shipments, payment shall become due on the date when MD&A is prepared to make shipment. Parts held for Customer shall be at the risk and expense of Customer.

If Customer fails to fulfill any condition of its payment obligations, MD&A may suspend performance and delivery. Any cost incurred by MD&A in accordance with such suspension, including storage costs (including storage at MD&A's facility), shall be payable by Customer upon submission of MD&A's invoices.

Any order for services/parts by Customer shall constitute a representation that Customer is solvent. If the financial condition of Customer at any time does not, in the judgment of MD&A, justify continuance of MD&A's obligations hereunder on the terms of payment agreed upon, MD&A may require full or partial payment in advance or shall be entitled to terminate the Contract and receive termination charges. In the event of bankruptcy or insolvency of Customer or in the event any proceeding is brought against Customer, voluntarily or involuntarily, under the bankruptcy or any insolvency laws, MD&A shall be entitled to cancel any order then outstanding at any time during the period allowed for filing claims against Customer and shall receive reimbursement for its proper cancellation charges. MD&A's rights under this Article 9 are in addition to all rights available to it at law or in equity.

MD&A shall have a lien on and may retain possession of equipment repaired, modified, inspected, tested, maintained or serviced under this Contract until its charges for such services are paid. If such charges are not paid within ninety (90) days following completion of the work and invoicing Customer, MD&A may, upon not less than seven (7) days written notice by certified mail to Customer at Customer's last known address, sell the equipment at public or private sale and apply the net proceeds to MD&A's charges.

10. TERMINATION.

a. By Customer. Customer shall be entitled to terminate the Contract in the event MD&A fails to commence reasonable cure within thirty (30) days after notice from Customer specifying a material default. MD&A's liability for material default shall be limited to the direct costs that Customer must pay a third party to correct the default, but in no event shall exceed the Contract price. MD&A shall be entitled to recover reasonable termination charges on any order that is terminated unless MD&A is in prior material breach of these Terms and Conditions. Termination of an order shall not relieve either party of any obligation arising prior to termination.

b. By MD&A. If Customer fails to fulfill any condition of its payment obligations and does not correct such failure in the manner and time satisfactory to MD&A, then MD&A may, terminate the Contract in respect to the portion of the parts not delivered and work not yet performed. Customer shall pay MD&A its reasonable and proper termination charges in the event of such termination, in addition to the amounts owed up to the date of termination.

11. TITLE. Title to parts not yet incorporated into Customer's equipment will pass to Customer upon MD&A's receipt of all payments for the parts/services under this Contract. Title and right of possession of equipment repaired, modified, inspected, tested, or maintained under this Contract shall remain with Customer, subject to any applicable lien rights of MD&A and to its right of sale in the event of nonpayment as provided in Article 9. Title to all rental equipment shall remain with MD&A.

12. TAXES. In addition to any price specified herein, Customer shall pay the gross amount of any present or future sales, use, excise, value-added, withholding, or other similar tax applicable to the price, sale, or delivery of any parts or services furnished hereunder or to their use by MD&A or Customer, or Customer shall furnish MD&A with a tax exemption certificate acceptable to the taxing authorities.

13. SOFTWARE. Unless otherwise agreed in writing, no software rights are granted to Customer under this Contract. In the event that Customer desires to license any software used by MD&A, Customer must contact the owner of such software to negotiate a software license agreement with such owner in order to use such software. MD&A makes no representation that it is the owner or licensee of any software, or that it has any right to sell, or grant any license to Customer to use, any software.

14. PROHIBITION ON NUCLEAR USE.

a. Parts, materials, equipment and services provided hereunder, are not intended for and shall not be used in connection with any nuclear facility or activity. Customer represents and warrants that it shall not use them or permit others to use such materials, equipment or services for any such purpose, and that it will not transfer or permit to be transferred any parts, materials, equipment and services provided hereunder to any third party without having first obtained the agreement of such third party or parties not to use them for any such purpose.

b. Notwithstanding the foregoing, if any parts and materials sold, equipment rented and services provided by MD&A to Customer under the Contract, shall be used at Customer's commercial nuclear power station[s] identified in the Contract and located within the USA (hereinafter, the "Plant[s]"), the following terms and conditions shall apply:

i. Customer shall, without cost to MD&A, obtain and maintain insurance to cover "public liability" arising out of a "nuclear incident" (as those terms are defined in the Atomic Energy Act of 1954, as amended, hereinafter referred to as the "Act") at, or arising out of, the operation of the Plant[s], the policy to be provided by American Nuclear Insurers/Mutual Atomic Energy Liability Underwriters. This insurance shall cover the liability of Customer, MD&A, and any other person or organization that may have legal responsibility for public liability arising out of a nuclear

incident. The limits shall be in the amounts required to meet financial protection requirements by the Act, and applicable regulations of the U. S. Nuclear Regulatory Commission ("NRC").

ii. Customer shall also enter into the governmental indemnity agreement required by the Act, and applicable regulations of the NRC, with coverage and limits as may be required by the NRC.

iii. In the event the nuclear liability protection system in effect on the effective date of the Contract expires or is repealed, changed or modified, Customer shall, without cost to MD&A, obtain and maintain liability protection provided through government indemnity, limitation of liability and/or liability insurance to the extent available and consistent with customary industry practice in the United States. Such substitute liability protection shall not result in a material impairment of the protection afforded MD&A by such nuclear liability protection system and this Article 14.

iv. Customer hereby waives all rights of recourse and subrogation which it may have or acquire against MD&A with respect to liability for nuclear damage.

v. MD&A shall not have any liability to Customer or its insurers for nuclear damage to any property located at the site of or used in connection with the Plant[s] or any other nuclear plant of Customer. To the extent reasonably available, Customer shall, at no cost to MD&A, obtain and maintain insurance against loss or destruction of or damage to Customer's property within the Plant[s] site boundaries arising out of or resulting from a nuclear incident. Such insurance shall have limits of coverage not less than $500 million. Customer shall indemnify MD&A, its suppliers and its directors, officers and employees for any and all liability that they may have to third parties, including Customer's insurers and other financial guarantors, for physical loss or destruction of or damage to the property of third parties that is located within the Plant[s] site boundary and used in the operation of the Plant[s], to the extent that such physical loss, destruction or damage results from or arises out of a nuclear incident or otherwise.

vi. In the event of a nuclear incident at or arising out of the operation of the Plant[s], Customer waives and will require its insurer to waive all rights of recovery against MD&A, its subcontractors and suppliers of any tier, whether in contract, warranty, indemnity, tort (including MD&A's negligence), strict liability or otherwise, for (1) physical damage to or loss or destruction of any Customer property, (2) third-party claims, and (3) any and all costs or expenses incurred by MD&A in investigation, settlement and defense of any claims arising out of such incident, including attorneys' and experts' fees, settlement awards and costs, court costs, disbursements, and internal expenses resulting from such claims.

vii. Customer shall not transfer or use, or permit the transfer or use of, any parts, materials, equipment and services provided under this Contract at any nuclear power plant other than the Plant[s] specified in this Contract. In the event of such transfer or use, MD&A shall have no liability whatsoever for any nuclear or other damage, injury or contamination. In addition to any other legal or equitable rights of MD&A, Customer shall indemnify MD&A against any such liability, and shall reimburse MD&A for any and all costs or expenses incurred by MD&A in investigation, settlement and defense of any claims arising out of such use, including attorneys' and experts' fees, settlement awards and costs, court costs, disbursements, and internal expenses resulting from such claims.

viii. Any decontamination necessary for MD&A's performance (including remedial warranty efforts) shall be performed by Customer without cost to MD&A. Any of MD&A's parts, materials or equipment which become contaminated (including becoming radioactive) at the work site shall, at MD&A's option, be decontaminated or purchased by Customer without cost to MD&A.

ix. For purposes of this Article 14, the following definitions apply:
"liability" means liability of any kind at any time whether in contract, warranty, indemnity, tort (including negligence), strict liability or otherwise;
"nuclear damage" means any loss, damage, or loss of use, which in whole or in part is caused by, arises out of, results from, or is in any way related, directly or indirectly, to the radioactive properties or a combination of radioactive properties with toxic, explosive or other hazardous properties of source, special nuclear or byproduct material, as those materials are defined in the Act, including any loss of life or personal injury (including to Customer's employees), or any loss of, loss of use of, or damage to, property of Customer or others, on or off the site, including the Plant[s].
"site" or "plant site" means the area identified as the Plant location in either (a) the nuclear liability insurance policy or (b) the governmental agreement of indemnity issued pursuant to the Act, whichever is more inclusive.

x. Customer's obligations under this Article 14 shall be effective through the decommissioning of the Plant[s] and any other nuclear plant or plants to which they apply.

15. COMPLIANCE WITH LAWS. All transactions hereunder shall at all times be subject to and conditioned upon compliance with all applicable export control laws and regulations of the U.S. Government and any amendments thereof. Customer agrees that it shall not, except as said laws and regulations may expressly permit, make any disposition by way of transshipment, re-export, diversion or otherwise, of U.S. origin goods and technical data (including computer software), or the direct product thereof, supplied by MD&A hereunder. The obligations of the parties to comply with all applicable U.S. export control laws and regulations shall survive any termination, or discharge of any other contract obligations.

Customer undertakes to keep fully informed of, and to comply with, the export control laws and regulations of the U.S. Government and any amendments thereof. Customer certifies that the parts, materials, services, technical data, software or other information or assistance furnished by MD&A under the Contract will not be (a) used by any individual or entity listed as a prohibited party on any list of the U.S. Government of prohibited or denied parties, (b) sent to any party in a country listed as a prohibited country by the U.S. Government, or (c) used in the design, development, production, stockpiling or use of chemical, biological, or nuclear weapons either by Customer or by any entity acting on Customer's behalf.

Notwithstanding any other provisions herein, Customer shall be responsible for timely obtaining any required authorization, such as an export license, import license, foreign exchange permit, work permit or any other governmental authorization, even though any such authorization may be applied for by MD&A. Customer and MD&A shall provide each other reasonable assistance in obtaining required authorizations. MD&A shall not be liable if any authorization is delayed, denied, revoked,

restricted or not renewed and Customer shall not be relieved thereby of its obligations to pay MD&A for its parts or services or any other charges which are the obligation of the Customer hereunder.

16. RESERVATION OF RIGHTS. MD&A Reserves the right to make copies, prepare derivative works of, or reverse engineer any portion of the components, parts, materials or other information supplied or created under the Contract. Such copies, derivative works or reverse engineering information and data shall be the sole property of MD&A, the use of which shall not be restricted in anyway by Customer. MD&A reserves the right to use any portion of the components, parts, materials or other information supplied or created under the Contract in the development of any other products or intellectual property of any kind, the ownership of which shall vest exclusively in MD&A. The work performed by MD&A shall not be considered "work for hire." Any and all information related to, or arising out of, MD&A's Intellectual Property or Improvements is deemed to be the information of MD&A. Customer agrees that it will not use any information of MD&A or any Improvement made by either party as a basis for the design or creation of any item, application or software. All right, title and interest in and to the Intellectual Property of MD&A and all Improvements shall remain with, and vest exclusively in MD&A. If any such right, title or interest becomes vested in Customer by operation of law or otherwise, Customer will do everything necessary, to vest all such right, title and interest in MD&A. Customer will execute such further and other documents and do such further and other things as may be necessary to carry out and give effect to the obligations contained in this paragraph, provided however, neither party is obligated to enter into a further business relationship with the other party.

17. DISPUTE RESOLUTION. All disputes arising in connection with the Contract shall be settled, if possible, by amicable negotiation of the parties. In the event of any dispute, controversy or claim arising out of, connected with, or relating to this Contract, within 30 days of notice of such dispute, the Parties agree to arrange a face-to-face meeting between their respective senior executive officers or their designated representatives to resolve such dispute.

For services performed or parts sold within the United States of America, if the matter is not resolved by negotiations, either party shall have the right to pursue any legal remedy available.

For services performed or parts sold outside of the United States of America, if the matter is not resolved by negotiations, the dispute or controversy shall be referred to arbitration without recourse to any court. The notice shall identify the name and address of the arbitrator appointed by the party giving notice and the points of dispute.

Within thirty (30) days after receipt of such notice, the other party shall give notice to the first party of the appointment and name and address of the second arbitrator. Within thirty (30) days after appointment of the second arbitrator, the arbitrators so appointed shall appoint an additional arbitrator to serve as chairman of the arbitration tribunal. If the second party fails to appoint its arbitrator within thirty (30) days after receipt of notice of the appointment of the first arbitrator, or, if the arbitrators appointed by the parties fail to appoint an arbitrator to serve as chairman within sixty (60) days after the appointment of the first arbitrator, then the President of the International Court of Arbitration of the International Chamber of Commerce shall have the power, on the request of a party, to make appointments which have not been made. The seat of arbitration shall be in Albany, New York U.S.A., and the arbitral award shall be made in Albany. The arbitration shall be conducted in English and in accordance with the Rules of Conciliation and Arbitration of the International Chamber of Commerce. The parties shall have the right to present documentary evidence and witnesses and shall also have the right to cross examine witnesses.

The arbitration decision shall be decided by majority vote, provided that in the event of a tie vote on any matter, the chairman of the arbitration shall have a second or casting vote on that matter. In arriving at their decision, the arbitrators shall consider the pertinent facts and circumstances and be guided by the terms of this Contract; and, if a solution is not found in the terms of this Contract, the arbitrators shall apply the provisions of the applicable laws governing this Contract under Article 18. The arbitrators are precluded from considering or awarding punitive, consequential or exemplary damages to any party in any arbitration conducted pursuant to this Article 17.

The parties agree that any arbitral award shall be final and binding, that this Contract and the resulting obligations are commercial and that the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards (the "New York Convention") applies to this Contract and to any award or order resulting from any arbitration conducted hereunder. Except for initiating actions to obtain a judgment recognizing or enforcing an arbitral award or order, the parties agree not to commence or otherwise be involved in any court action or proceeding concerning a dispute arising out of this Contract and hereby irrevocably waive and exclude all rights of appeal, challenge, or recourse to any court from any arbitral award or order resulting from any arbitration conducted under this Article 17.

Reasonable expenses of the arbitration shall be shared equally. On request of any party, a transcript of the hearings shall be prepared and made available to the parties.

18. GENERAL. The provisions of this Contract are for the benefit of the parties hereto and not for any other party or person except as specifically provided herein.

Any services furnished by MD&A hereunder will be performed in compliance with the Fair Labor Standards Act of 1938, as amended and applicable. MD&A will comply with applicable federal, state, and local laws and regulations as of the date of any quotation which relate to (a) equal employment opportunity (including the seven paragraphs appearing in Section 202 of Executive Order 11246, as amended); (b) workers' compensation; and (c) the performance of any services in MD&A's facilities. Price and, if necessary, delivery will be equitably adjusted to compensate MD&A for the cost of compliance with any other laws or regulations.

The delegation or assignment by Customer of any or all of its duties or rights hereunder without MD&A's prior written consent shall be void. Any representation, promise, warranty, course of dealing or trade usage not contained or referenced herein will not be binding on MD&A. MD&A reserves the right to assign any portion of the Contract or work to any affiliated entity, division or subsidiary within the Mitsubishi Hitachi Power Systems, Ltd. corporation.

The 18 Articles in these Terms and Conditions, including MD&A's quotation, collectively referred to herein as the "Contract", contain the entire and only agreement between Customer and MD&A respecting the terms and conditions and supersedes and cancels all previous negotiations, agreements, commitments, representations and writings in respect thereto. No modification, amendment, rescission, waiver or other change shall be binding on MD&A unless agreed to in writing by MD&A's authorized representative.

The validity, performance, and all matters relating to the interpretation and effect of this Contract and any amendment hereof shall be exclusively governed by the law of the State of New York without giving effect to any conflicts of laws or choice of law rules that would apply the law of another jurisdiction. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. The invalidity, in whole or part, of any of the articles or paragraphs in these Terms and Conditions will not affect the remainder of such article or paragraph or any other article or paragraph. Nothing in this Contract shall be construed to impose any overall "system responsibility" on MD&A. When used in this Contract, the terms (a) "including" and "includes" mean "including but not limited to" the specifically enumerated things, states, or actions that follow such terms, and (b) "or" means "one or the other or all" of the specifically enumerated things, states, or actions that follow such term.

Any information, suggestions or ideas transmitted by the Customer to MD&A are not to be regarded as secret or submitted in confidence, unless agreed to by MD&A in writing.

The following Articles shall survive termination of this Contract: Article 1 (Warranty), Article 2 (Limitation of Liability), Article 3 (Consequential Damages), Article 4 (Indemnity), Article 6 (Patents), Article 12 (Taxes), Article 14 (Prohibition of Nuclear Use), Article 15 (Compliance with Laws), Article 16 (Reservation of Rights), Article 17 (Dispute Resolution), Article 18 (General) and any remaining payment obligations of Customer.

TECHNICAL CLARIFICATIONS

1. The conditions of any tests related to work performed by MD&A, shall be mutually agreed upon and MD&A shall be notified of, and may be represented at, all tests that may be made.

2. Customer is responsible for treatment and removal of hazardous substances and related contamination of any nature.

3. Work will be performed at our St Louis Facility, located at 3804 Weber Road, St Louis, MO. 63125. Return shipping will be billed at cost + 17%.

4. L1 Wheel Indication
   a. PAUT noted indication on TE L-1 wheel. Magnetic particle inspection of the L1 wheel will be performed after bucket removal. Wheel indication, if noted during mag particle inspection will be evaluated and repair recommendation provided as required.

5. Boresonic Examination Clarification:
   a. Workscope includes
      i. Removal, supply and install of 1 boreplug per rotor.
      ii. Bore visual and dimensional inspection (preliminary and final).
      iii. Power honing to 63 micro in finish with up to .020” material removal on the diameter
      iv. Fully automated boresonic inspection with eddy current bore surface inspection (in lieu of bore MT).
   b. Work will be subcontracted to 3rd party NDE vendor.
   c. Boresonic examinations is to perform a multi-channel, dual-mode, ultrasonic examination from the rotor-bore surface. Remote visual inspection & digital bore mapping is also performed using an automated multiplexing boresonic scanning and examination system.
   d. Assumes that the rotor bore diameter is 3.0” or larger. A smaller bore diameter, and/or access restrictions such as steps, bottles and/or tapers are considered out of scope and may require additional time on site due to additional equipment configuration, calibration and scanning requirements and will be extra. All available rotor dimensional, geometric data and previous inspection reports should be provided to prior to mobilization.
   e. Bore preparation will be by power honing, graduating from coarse grit to finer grit honing stones. No more than 0.020” will be removed from the bore. No repair honing or field machining is included.

6. High Speed Balance Clarification
   a. Customer to provide the following:
      i. Unit history of operation i.e., water induction incidents, packing rubs on start up, high vibration.
      ii. Past bucket replacement, which stages, where the buckets came from, original design or modified
      iii. Past repair work such as journal machining, dovetail machining
   b. The rotor must pass the incoming checks in the HSB facility per instruction. The following is the list of required tests and inspections:
      i. Full inspection of the rotor per HSB inspection forms.

ii. Rotor boresonic inspection or UT of the periphery inspection of the rotor bore. On units greater than 20 years old a test is required within last 10 years for rotors with bore. On rotors without a bore a PAUT of the periphery is required if forging is pre 1970.

c. Adapter plates to couple a rotor to the balance bunker drive usually employ existing rabbet diameters and existing bolt holes. Dimensional information on the coupling needs to be provided to the balance cell as soon as possible to determine if existing adapter plates can be used, otherwise cycle time of an adapter plate needs to be factored in. Any adapter plate design options (to expedite cycle and reduce cost) that require modification to the field must be approved by HSB Engineering and agreed to by the customer.

d. Data from the final balance run and overspeed test if applicable will be provided to the customer in the final report. This proposal assumes a maximum of 25 runs.

e. While high speed balance verifies the balance and smooth operation of the rotor throughout the entire speed range it should be noted that additional full train factors, including alignment and balance of adjacent rotors may affect the subject rotor on site.

7. Extra work scope includes:
   a. All non-specified repairs.

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Caustic Soda & Acid Tanks Replacement Works Costa Sur Water Plant

2/2/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	02/02/2022	

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Caustic Soda & Acid Tanks Replacement Works Costa Sur Power Plant
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Power Plant Caustic Soda & Acid Tanks Replacement	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

The Contractor is required to furnish all engineering, design, labor, materials, and equipment to manufacture and deliver four (4) 8,200 gallons stainless tanks to be used for storage and supply of sulfuric acid and caustic soda for the operations and maintenance of the Demin Water Treatment Plant of the Costa Sur Power Plant.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for Costa Sur Power Plant Caustic Soda & Acid Tanks Replacement will consist of the following:

1) Design and fabrication of four (4) 8,200 gallons 316L Stainless Stee tanks.

2) The dimensions for the tanks shall be:
    a) Diameter – 8'-0"
    b) Length – 22'-0"
    c) Thickness – 3/8"

3) The following accessories shall be design and manufacture with the tank:
    a) One On2-1/2" Inlet
    b) One 4" Overflow
    c) One 2" Spare Plug Nozzle with Plug
    d) One 1-1/2" Nozzle
    e) One 2" Nozzle
    f) One 6" Spare Nozzle
    g) Two 4" Spare Nozzle
    h) One 4" Drain Nozzle
    i) One 2" Spare Nozzle with Plug
    j) One 24" Manhole
    k) Two 20" Pump Mounting Bases

4) Design and fabrication of a 316L SS Ladder
    a) Width – 1'-8" to 2'-3"
    b) Length – 15'-0"

5) Design and fabrication of a 316L SS Railings
    a) Height – 3'-6"
    b) Length – 60'-0"

6) Design and fabrication of a 316L SS Tank Bases
    a) Height – 2'-4"
    b) Width – 0'- 11"
    c) Thickness – 0'-1/2"

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards

2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
Procurement & Delivery	$750,000.00
Total Project Estimated Cost	**$750,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name	Date
Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

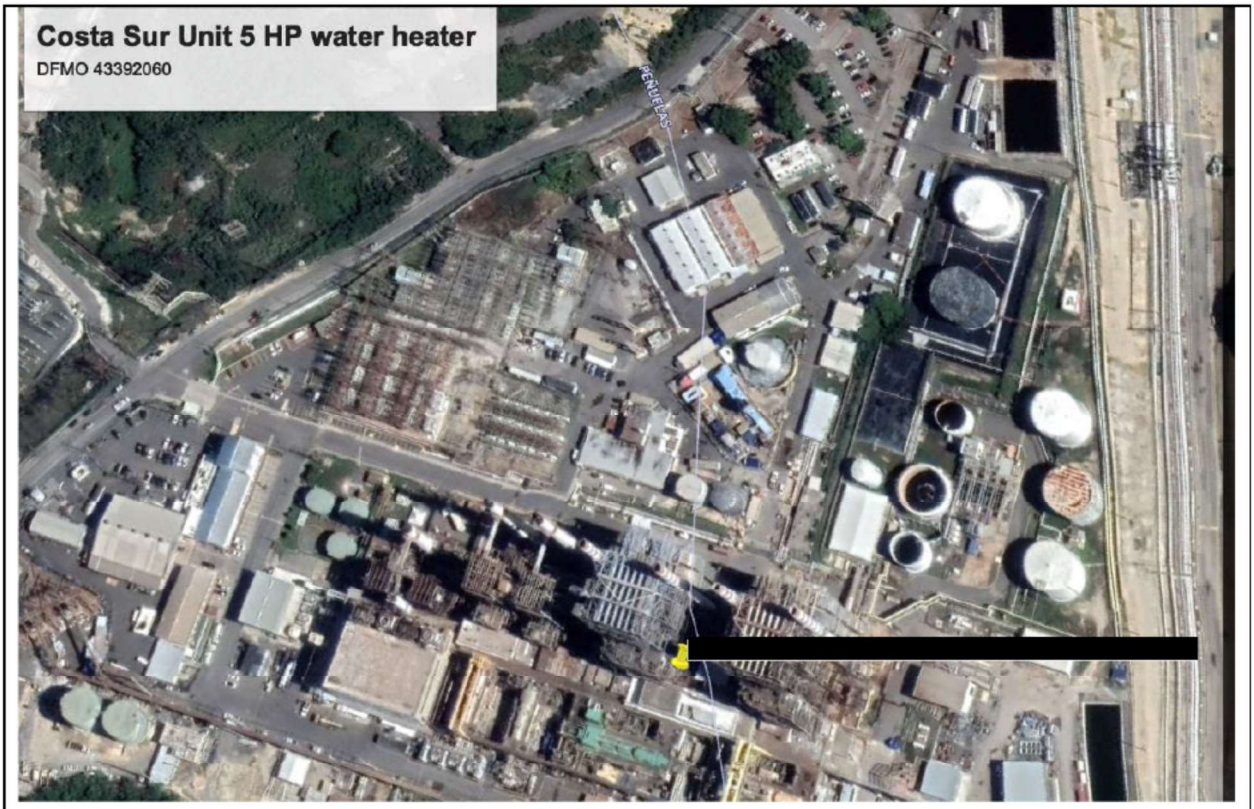
10.1. Project Detailed Cost Estimates

- Please see attached Scope of Work.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Scope of Work – Caustic Soda & Acid Tanks Replacement Works (Procurement & Delivery)

The Contractor is required to furnish all engineering, design, labor, materials and equipment to manufacture and deliver four (4) 8,200 gallons stainless tanks to be used for storage and supply of sulfuric acid and caustic soda for the operations and maintenance of the Demin Water Treatment Plant of the Costa Sur Power Plant.

Activities covered by the scope of services shall include:

1) Design and fabrication of four (4) 8,200 gallons 316L Stainless Stee tanks.
2) The dimensions for the tanks shall be:
    a) Diameter – 8'-0"
    b) Length – 22'-0"
    c) Thickness – 3/8"
3) The following accessories shall be design and manufacture with the tank:
    a) One On2-1/2" Inlet
    b) One 4" Overflow
    c) One 2" Spare Plug Nozzle with Plug
    d) One 1-1/2" Nozzle
    e) One 2" Nozzle
    f) One 6" Spare Nozzle
    g) Two 4" Spare Nozzle
    h) One 4" Drain Nozzle
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    j) One 24" Manhole
    k) Two 20" Pump Mounting Bases
4) Design and fabrication of a 316L SS Ladder
    a) Width – 1'-8" to 2'-3"
    b) Length – 15'-0"
5) Design and fabrication of a 316L SS Railings
    a) Height – 3'-6"
    b) Length – 60'-0"
6) Design and fabrication of a 316L SS Tank Bases
    a) Height – 2'-4"
    b) Width – 0'- 11"
    c) Thickness – 0'-1/2"

The Contractor shall comply with the following Codes for the design and manufacture of the tanks:

a) U.L. 142
b) ASME
c) ASTM
d) Internal Pressure Design – Atmospheric
e) External Pressure Design – Atmospheric

End of Scope of Work

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Costa Sur Power Plant

Unit 6 – HP/IP/LP Inspection (Failure)

11/29/2021

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
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- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Unit 6 - HPIPLP Inspection (Failure)
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Costa Sur Unit 6 Turbine	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

The power plant economic performance is not only driven by it's thermal efficiency, but also by its assets availability and reliability. Major programmed outages are scheduled following the guidelines provided by the original equipment manufacturer in order to fully evaluate such assets. The main objective of this project is to perform a detailed inspection of the Unit 6 - HP/IP/LP turbines, which were removed after an outage on October 2020. Such project is important in order to prevent a catastrophic failure and service interruptions.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of this project is to fully inspect the turbine LPB rotor (Lower Pressure Turbine Rotor Segment B) and their stationary parts (diaphragms) that were removed from unit 6 on the outage of October 2020. The inspection will include nondestructive tests. The rotor and diaphragms will be shipped from the plant to a shop in EUA.

After the inspection, a report with the repair recommendations will be generated to be evaluated by PREPA. Neither the repair nor installation costs are part of the scope of this project. Regarding the HP/IP and LPA rotors, they will be inspected on site by PREPA personnel since no damage was experienced on them. Thrust bearing inspection, oil flushing, boroscopic inspection and bump check procedure will be performed on these rotors to ensure proper operation.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
    a. Other improvements, not required by codes and standards
    b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

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Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

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• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
I. G2 components (HPIP Spare, LPA Spare, LPB Damage in Service): • Rotor & Diaphragm Inspection	$391,960.50
• Perform PAUT of HPIP, LP and LPB rotor (3 rotors)	$28,710.00
• Transportation	$375,280.00
II. Spare LPB rotor and diaphragms Inspection (4th set): • Rotor and Diaphragm Inspection	$124,050.00
• Perform PAUT LPB rotor (1 rotor)	$9,570.00
• Transportation: Roundtrip shipping of LPB rotor on Prepa shipping skid	$74,800.00
• Transportation: Roundtrip shipping of LPB diaphragms (up to 2 truckload each way)	$ 56,160.00
Total Project Estimated Cost	**$1,060,530.50**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

_____ _____

Program Manager's Printed Name Date

Title	Signature

Section 9. PREPA Project Sponsor Comments

Comments
<Insert any comments here>

PREPA Project Sponsor's Printed Name	Date
Title	Signature

Section 10. Attachments

10.1. Project Detailed Cost Estimates

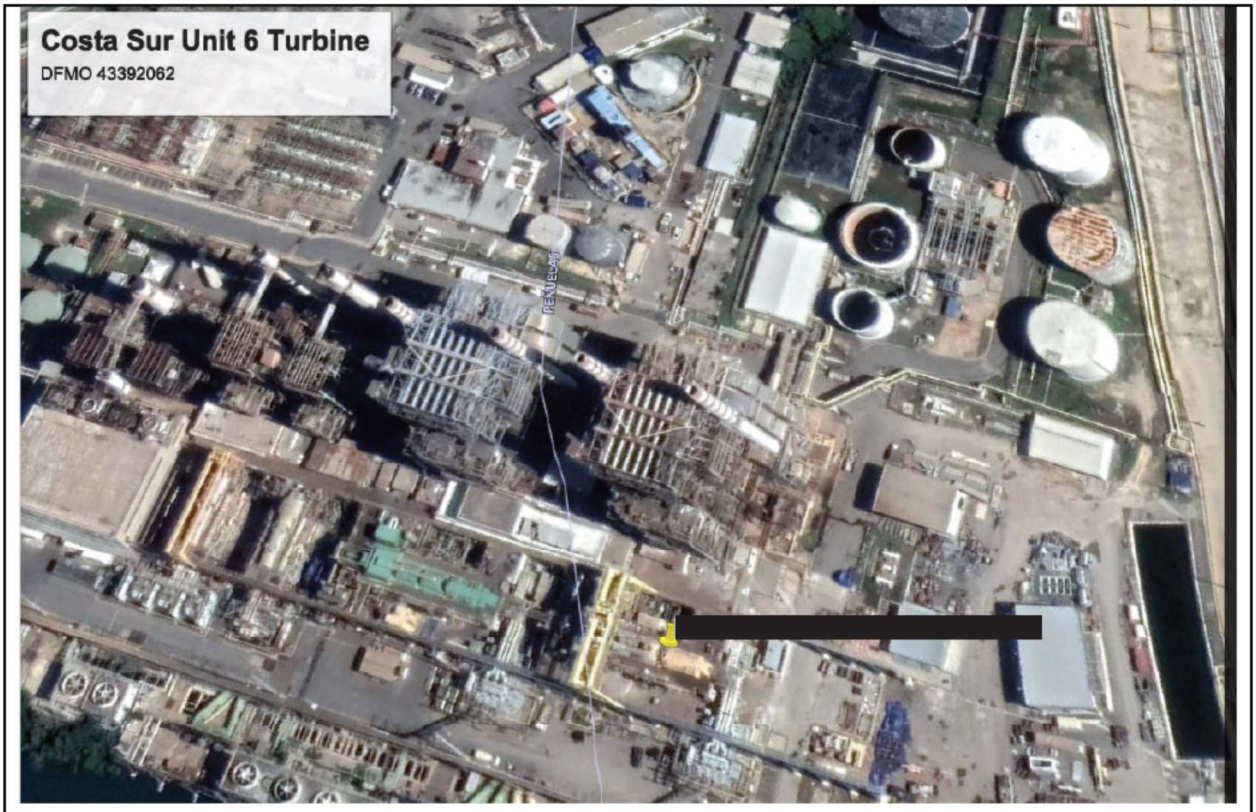
Please see attached the following:

- Memo_ Proyectos_2022_Angel_Perez_Rev_IJR
- PROPOSAL 201198R2 – MD&A LLC_Prepa South Coast Spare Inspection

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

MECHANICAL DYNAMICS & ANALYSIS LLC
3804 Weber Rd, St. Louis, Missouri, 63125
PHONE: (314) 880-3000 FAX: (314) 638-3473
www.MDAturbines.com

PROPOSAL 201198R2

SUBMITTED TO:

PREPA

SOUTH COAST, UNIT 5 & 6 SPARE

SUBMITTED:

9/9/2021

MECHANICAL DYNAMICS & ANALYSIS LLC
3804 Weber Rd, St. Louis, Missouri, 63125
PHONE: (314) 880-3000 FAX: (314) 638-3473
www.MDAturbines.com

9/9/2021

PROPOSAL 201198R2

Miguel Angel Beauchamp Ramos
PREPA - South Coast
Road 127, Km 15.7
Guayanilla, PR 00656

Email: MIGUEL.BEAUCHAMP@prepa.com

Tel: (787)521 5179

Re: **PREPA - South Coast 5 & 6 Spare**
Rotor and Diaphragm Inspection

Dear Miguel Angel Beauchamp Ramos :

Mechanical Dynamics & Analysis is pleased to offer the attached Proposal for performing the above referenced work.

MD&A's proposal is organized as follows:

Section 1 – **Pricing**
- Workscope & Pricing
- MD&A Rate Schedule(s)

Section 2 – **Technical**
- Technical Clarifications

Section 3 – **Commercial**
- Supplemental Terms & Conditions
- MD&A Terms & Conditions

MD&A appreciates having this potential opportunity to serve PREPA at its South Coast Station.

Sincerely,

Honey Mae Lee
Steampath Proposal Manager

c: J. Theoktisto, MD&A Proposals & Contracts Manager
D. Gregory, MD&A VP of Turbine-Generator Repairs
J. Wheeler, MD&A Repairs Steampath Shop Manager

Section 1 - Pricing

Workscope & Pricing
MD&A Rate Schedules

WORKSCOPE & PRICING

MD&A proposes to perform the following workscope on the South Coast Spare G2 Components: We will provide all the labor, equipment and materials (consumables) necessary for the following workscope:

Basescope: G2 components (HPIP Spare, LPA Spare, LPB Damage in Service),

- **Rotor and Diaphragm Inspection**
  - Receive the HPIP (spare), LPA (spare) and LPB (damaged in service) rotors, packing cases and diaphragms in the St. Louis shop
  - Perform incoming inspection
  - Remove spill strips and packing as required
  - Blast clean rotors and diaphragms with 220 Alox
  - Perform periphery NDE of rotors and diaphragms
  - Perform incoming dimensional inspections
    - Rotor
      - As found and final rotor runout
      - Journal Diameters
      - Coupling and rabbit fit measurement
    - Diaphragm and Packing Cases
      - As found area checks
      - Diaphragm Drop Checks
      - Roundness and joint gap checks
  - Prepare repair recommendation
  - Prep rotor for shipping
  - **Firm Price: $391,960.50**
  - **Duration: up to 21 days inshop**

- **Perform PAUT of HPIP, LP and LPB rotor (3 rotors)**
  - Perform PAUT of HPIP Rotor (11 stages)
  - Perform PAUT of LPA Rotor 6 stages, double flow.
  - Perform PAUT of LPB Rotor 6 stages, double flow.
  - **Cost + 10% Estimate: $28,710**
  - **Duration: 3 days inshop**
  - **Note: Estimate is based on work being performed in 2-3 consecutive days. Additional mob/demob may be required if not all rotors are available. Additional engineering analysis of detectable flaws, if required, is extra.**

- **Transportation**
  - Mob/demob technician to witness component loading at site
  - Roundtrip Shipping of HPIP Rotor on PREPA shipping skid
  - Roundtrip shipping of LPA rotor on Prepa shipping skid
  - Roundtrip shipping of LPB rotor on Prepa shipping skid
  - Roundtrip shipping of HPIP and LP diaphragms (up to 4 truckload each way)
  - Mod/demob technician to witness unloading at site
  - **Cost + 17% estimate: $375,280**
  - **Schedule: 15 days transit time each way**

Option: Spare LPB rotor and diaphragms Inspection (4th set)

- Rotor and Diaphragm Inspection
  - Receive Spare LPB rotor and diaphragms in the St. Louis shop
  - Perform incoming inspection
  - Remove spill strips and packing as required
  - Blast clean rotors and diaphragms with 220 Alox
  - Perform periphery NDE of rotors and diaphragms
  - Perform incoming dimensional inspections
    - Rotor
      - As found and final rotor runout
      - Journal Diameters
      - Coupling and rabbit fit measurement
    - Diaphragm
      - As found area checks
      - Diaphragm Drop Checks
      - Roundness and joint gap checks
  - Prepare repair recommendation
  - Prep rotor for shipping
  - **Firm Price: $124,050**
  - **Duration: additional 14 days inshop**

- **Perform PAUT LPB rotor (1 rotor)**
  - Perform PAUT of LPB Rotor 6 stages, double flow.
  - **Cost + 10% Estimate: $9,570**
  - **Duration: 1 days inshop**
  - **Note: Estimate is not valid for stand alone. Estimate is based on work being performed with 3 other rotors in the basescope. Mob/demob may be required if not all rotors are available.**
  - **Additional mob/demob may be required if not all rotors are available. Additional engineering analysis of detectable flaws, if required, is extra.**

- **Transportation**
  - Roundtrip shipping of LPB rotor on Prepa shipping skid
  - **Cost + 17% estimate: $74,800**

  - Roundtrip shipping of LPB diaphragms (up to 2 truckload each way)
  - **Cost + 17% estimate: $56,160**
  - **Schedule: 15 days transit time each way**

See Technical Clarifications for detailed exclusions or clarifications to this workscope being bid.

2021 RATE SCHEDULE

U.S. and CANADA *(01/01/21 THRU 12/31/21)*

	Hourly Rates *(Note 2)* S.T.	O.T.
Engineering Rates		
Field Engineer, Technical Field Advisor, Generator Specialist	$ 236.00	$ 354.00
Project Management, Steampath Engineering Supervision	$ 257.00	$ 385.50
Engineering Consultant, Specialty Field Engineer	$ 321.00	$ 481.50
Controls, Excitation, Balancing, Alignment, Shell/Casing Repair		
Principal Engineer	$ 367.00	$ 550.50
Labor Rates		
Steampath Specialist, Lead Seal Technician, CAD Designer, Reverse Engineering Technician	$ 184.00	$ 276.00
Steampath Work Leader	$ 138.00	$ 207.00
Steampath Technician	$ 126.50	$ 190.00
Blader, Machinist, Welder, Seal Technician		
Gas Turbine Bucket/Blade Specialist	$ 190.00	$ 285.00
Gas Turbine Repair Technician	$ 146.00	$ 219.00
Generator Technician	$ 178.00	$ 267.00
Craft Labor, Administrative/Clerical	Available upon request	

Equipment, Parts, Services	**Daily**	**Weekly**
Turbine Tool Container *(Note 3)*	$1,265.00	$7,590.00
Purchased/Subcontracted Parts and Services	Cost + 17%	
Steampath Consumables *(Note 4)*	$ 12.00/person/hour	

Travel and Living Expenses	
Per Diem *(Note 5)*	$ 250.00/person
Travel Expenses *(Note 6)*	Cost + 10%
Personal Vehicle (to and from worksite)	IRS Standard Rate + 10%

NOTES:

1. *Rates are based on a minimum of ten (10) hours per day, six (6) days per week per person, unless noted differently in the proposal. Any required stand-by time will be billed at S.T. rates and limited to ten (10) hours per day, six (6) days per week per person.*
2. *O.T. is defined as work over eight (8) hours on weekdays and all hours worked on Saturdays, Sundays, and Holidays.*
3. *Pricing does not include shipping and freight, which will be invoiced at cost plus 17%.*
4. *Rate excludes weld filler materials in some high deposition applications and all silver solder.*
5. *Firm price per diem rate includes local transportation, lodging, meals, laundry, communications and incidentals and will be invoiced on a 7 day per week basis. Price shown is based on rural to medium suburban areas. Large metropolitan locations (such as NYC, Chicago, Los Angeles, etc.) or locations where seasonal/special event rates apply will be quoted upon request.*
6. *Travel hours will be invoiced on a straight time basis for actual hours traveled.*

TERMS:

1. *Payment terms – Net 30 days.*
2. *1½% per month finance charge applied to late payments.*
3. *All prices in U.S. Dollars.*
4. *Subject to MD&A TERMS AND CONDITIONS, SALE OF SERVICES AND PARTS (dated 9/11/17).*

2021 MD&A Tool/Equipment Rental Schedule

is available upon request.

MD&A LLC, 19 British American Blvd., Latham, NY 12110
Tel: 518-399-3616, Fax: 518-399-3929
WWW.MDATURBINES.COM

2021 TOOL/EQUIPMENT RENTAL SCHEDULE

U.S. and CANADA

(01/01/21 THRU 12/31/21)

Equipment Rentals *(Note1)*	**Daily**	**Weekly**
Turbine Tool Container	$ 1,265.00	$ 7,590.00
Generator Repair Equipment and Tool Rental		
Induction Heating Set	N/A	$ 6,800.00
Generator Tool Trailer	N/A	$ 2,950.00
Power Rollers	N/A	$ 1,650.00
Field Removal System *(Note 3)*	N/A	$ 8,620.00
Stator Cooling Water Vacuum–Pressure Test Skid	$ 685.00	$ 4,110.00
Voltage Regulator Test Set	$ 105.00	$ 630.00
AC Hi-Pot	$ 570.00	$ 3,420.00
Test Box	$ 310.00	$ 1,850.00
Stator ElCid Test Equipment	$ 915.00	$ 5,490.00
Specialty Generator Equipment	Available upon request	
Turbine Repair Equipment and Tool Rental		
Portable Lathe (over 60 tons)	$ 660.00	$ 3,950.00
Portable Lathe (60 tons or less)	$ 467.00	$ 2,800.00
Portable Machine Shops	$ 500.00	$ 3,000.00
Line Boring Bars (1 ½" to 4" diameter)	$ 355.00	$ 2,130.00
Line Boring Bars (over 4" diameter)	$ 375.00	$ 2,250.00
Vertical Turning Lathe/Boring Machine	$ 265.00	$ 1,590.00
Flange Facing Machine	$ 250.00	$ 1,500.00
Metal Disintegration Machine (MDM) *(Note2)*	$ 990.00	$ 5,940.00
Stud Removal Machine	$ 310.00	$ 1,860.00
Lamina Hydraulic Drill and Power Pack	$ 420.00	$ 2,520.00
Cylinder Boring Machine	$ 285.00	$ 1,710.00
Portable Honing Machine	$ 135.00	$ 800.00
CNC Milling Machine	$ 260.00	$ 1,560.00
Three Axis Master Milling Machine	$ 275.00	$ 1,650.00
Knee Milling Machine, 24"	$ 310.00	$ 1,860.00
Bucket/Blade Milling Machine	$ 142.00	$ 850.00
Punch Press	$ 142.00	$ 850.00
Cover/Shroud Roller	$ 142.00	$ 850.00
Welding Machine	$ 150.00	$ 900.00
Laser Joint Flatness Measurement Instrumentation *(Note 3)*	$ 365.00	$ 2,190.00
Welding Package (manual welding machine, cables, stingers)	$ 165.00	$ 990.00
Automatic MIG Orbital Welding System (no consumables included)	$ 465.00	$ 2,790.00
Automatic TIG Orbital Welding System (no consumables included)	$ 1,250.00	$ 7,500.00
ASME Certified Weld Procedures (labor supervisor required)	$2,800.00/procedure/use	
Heat Treating Equipment (6-ways, heating pads, thermocouples, etc.)	$ 325.00	$ 1,950.00
Turbobalancer	$ 308.00	$ 1,848.00
ADRE 408	$ 500.00	$ 3,000.00
Rotor Shipping Skids and Containers	Available upon request	
Other Tooling and Equipment	Available upon request	

NOTES:

1. *Pricing does not include shipping and freight. Shipping and freight will be invoiced at cost plus 17%.*
2. *Rate does not include consumables. All consumables will be charged at cost plus 17%.*
3. *Requires the use of an MD&A Specialty Field Engineer (not included in rental rate).*

TERMS:

1. *Payment terms – Net 30 days.*
2. *1½% per month finance charge applied to late payments.*
3. *All prices in U.S. Dollars.*
4. *Subject to MD&A TERMS AND CONDITIONS, SALE OF SERVICES AND PARTS (dated 9/11/17).*

2021 MD&A Rate Schedule

is available upon request.

MD&A LLC, 19 British American Blvd , Latham, NY 12110
Tel: 518-399-3616, Fax: 518-399-3929
WWW.MDATURBINES.COM

Section 2 - Technical

Technical Clarifications

TECHNICAL CLARIFICATIONS

GENERAL

1. The conditions of any tests related to work performed by MD&A, shall be mutually agreed upon and MD&A shall be notified of, and may be represented at, all tests that may be made.

2. Customer is responsible for treatment and removal of hazardous substances and related contamination of any nature.

3. Extra work scope includes:
    a. All non-specified repairs.
    b. Specialty NDE (example: Phase Array UT and Boresonic)

Section 3 - Commercial

Supplemental Terms & Conditions
MD&A Terms & Conditions

PRICING CLARIFICATIONS
SUPPLEMENTAL TERMS & CONDITIONS

1. **Price/Payment**
   a. We propose the following Payment Schedule:
      i. 25% invoiced upon award.
      ii. 25% invoiced upon completion of inspection.
      iii. 50% invoiced upon completion of work.
   b. All invoices net thirty (30).
   c. Work permits, customs, duties and taxes, if any, are an extra.
   d. If bonding is required, the bond cost allowance is based on known workscope. If contract extras are awarded, all invoices for such extra work will be surcharged to cover additional bond costs.
   e. All of the scope items quoted individually contain a proportionate amount of project management and fixed site overheads. Therefore, the individual scope item pricing can not be used for work scope deletions.

2. **Extra Work**
   a. MD&A will be reimbursed for extra scope work, with Customer's prior approval per the attached Rate Schedule(s).
   b. Extra work can be performed on either a time and material basis or on a lump sum firm price basis, as requested. MD&A shall not be required to comply with any requested change order until Customer and MD&A have reached written agreement on appropriate adjustments in price, schedule and scope of work.
   c. MD&A employees are capable of performing safe work in power plants. They are trained and are in compliance with the most current OSHA safety standards. Additional Customer required safety training that has not been specified can be performed on a T&M basis.
   d. *"This Proposal may be impacted by unforeseen circumstances arising out of the Coronavirus pandemic that require extra costs. MD&A will do its best to notify the Customer of such circumstances as soon as they become aware, however the Customer shall be responsible for any extra costs."*

3. **Validity**
   a. Proposal is valid for ninety (90) days. Extensions may be requested by the Customer.
   b. Due to practical considerations concerning the demand for our services and the scheduling of resources, all offers of service are subject to prior commitment.

MD&A TERMS AND CONDITIONS
SERVICES AND PARTS

NOTICE: Sale of any services and/or parts ordered by Customer is expressly conditioned on Customer's assent to the additional or different terms contained herein, including MD&A's quotation. Any additional or different terms proposed by Customer are expressly objected to and will not be binding upon MD&A unless specifically assented to in writing by MD&A. Any order for, or any statement of intent to purchase services/parts, or any direction to perform work and MD&A's performance, shall constitute assent to MD&A's terms and conditions. MD&A's quotation is valid for 90 days, unless withdrawn prior to receipt of Customer's acceptance.

1. WARRANTY.

a. Services and Parts. Services performed on Customer's equipment by MD&A and any parts supplied by MD&A are warranted to conform to the Contract specifications and to be free from defects in workmanship, material and title for a period of twelve months following the equipment's return to service, or eighteen months following completion of work or delivery of the part, whichever occurs first. If any services or parts fail to meet the foregoing warranty, at MD&A's option, MD&A shall correct such failure, (a) by reperforming any portion of the nonconforming services or repairing or replacing any nonconforming or defective parts; or (b) by making available Ex Works MD&A's facility (Incoterms 2010), any necessary repaired or replacement parts. Where a nonconforming or defective part cannot be corrected by MD&A's reasonable efforts, the parties will negotiate an equitable adjustment in price. All costs and risks of access to the equipment, disassembly, and reassembly associated with the corrective action shall be borne by Customer, if not included in the original work scope. The supply of repaired or replacement parts, or reperformed services shall not extend the duration of the warranty period.

b. Rentals. With respect to rental services, MD&A warrants only that rental equipment when delivered is in good operating condition. If the equipment rented hereunder is not in good operating condition due to no fault of Customer and Customer notifies MD&A promptly, MD&A shall thereupon (at its option) either repair the equipment or rent replacement equipment, subject to availability.

c. Exclusive. The preceding paragraphs set forth the exclusive remedies for claims (except as to title) based on failure to conform to the Contract specifications or defects in workmanship, material, parts or services, or professional errors or omissions which may be asserted under any theory including, for example, breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise. Upon the expiration of the warranty period, all such liability shall terminate and Customer shall have a reasonable time, within ten (10) days after the warranty period, to give written notice of any nonconformance or defects that appear during the warranty period. Except as set forth in Article 6, the foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY.

d. Limits. MD&A's obligations under this Article 1 shall not apply to any part or portion thereof, which (a) is nonconforming or defective due to normal wear and tear including that due to environment or operation, or (b) has a normal life inherently shorter than the warranty period, or (c) is not properly stored, installed, used or maintained other than pursuant to MD&A's written instructions or approval, or (d) has been subjected to any other kind of misuse or detrimental exposure or has been involved in an accident. In addition, this warranty shall be void if (a) Customer makes any repairs to, or effects any changes in, parts or any portion thereof, which have not been authorized by MD&A in writing, or (b) MD&A is not promptly notified of any failure in writing or has not been given prompt and complete access to the failed parts or equipment including full access to all diagnostic and repair efforts.

The conditions of any acceptance and other tests shall be mutually agreed upon and MD&A shall be notified of, and may be represented at all tests.

e. Latent Defects. In no event shall MD&A be liable for any loss or damage whatsoever arising from its failure to discover or repair latent defects or defects inherent in the design of parts or equipment serviced or caused by the use of parts by Customer against the advice of MD&A.

2. LIMITATIONS OF LIABILITY.

a. In no event, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, shall MD&A's liability to Customer, its subsidiaries and affiliates, successors or assigns, or its insurers for any loss or damage arising out of, connected with, or resulting from the Contract, or from MD&A's performance or breach, or from any parts or services covered by or furnished under the Contract or any extension or expansion thereof (including remedial warranty efforts), exceed the Contract price.

MD&A and Customer expressly agree that under no circumstances, including indemnity obligations, shall MD&A be liable to Customer for any of the following:

i. Loss of profits, whether direct or indirect
ii. Loss of revenues, whether direct or indirect
iii. Cost of purchased power
iv. Cost of replacement power
v. Downtime costs

Customer recognizes that MD&A's insurance will not cover all risks that Customer may be exposed to as a result of this Contract, specifically the exclusions listed directly above (numbered 1-5), for which MD&A excludes all liability. Customer has reviewed MD&A's insurance coverages, as outlined in Article 5, and Customer agrees that it shall take all reasonable efforts to procure insurance to protect against any risks and damages that it may incur which are not insured for by MD&A, and for which MD&A shall not be liable as a result of this Article 2.

Except as to title to any parts furnished, all such liability shall terminate upon the expiration of the warranty period specified in Article 1. Any such claim of liability must be commenced in no event later than one year from the termination of the warranty period in accordance with Article 17. This limitation of liability shall not apply to the indemnity for bodily injury or death as set forth in Article 4.

b. If MD&A furnishes Customer with advice or assistance concerning any part supplied hereunder or any part, system or equipment in which any such part may be installed and which is not required pursuant to this Contract, the furnishing of such advice or assistance will not subject MD&A to any liability, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise.

c. Customer waives all rights of recovery against MD&A and all rights of subrogation, whether Customer's claim is brought under breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, for loss or damage to the property of Customer to the extent such claim is covered by insurance maintained by Customer. For the purposes of Articles 2 and 3, the term "MD&A" includes MD&A and its subcontractors, suppliers, subsidiaries and affiliates, their directors, officers, agents, employees, successors and assigns and authorized representatives.

3. CONSEQUENTIAL DAMAGES. Notwithstanding anything else contained in this Contract, in no event, whether as a result of breach of contract, indemnity, warranty, tort (including MD&A's negligence), strict liability or otherwise, shall MD&A be liable to Customer or its subsidiaries and affiliates, successors or assigns, or its insurers for any special, incidental, exemplary, indirect or consequential damages, including, without limitation, loss of profits or revenues, loss of use of any property, parts or any associated equipment, damage to associated equipment, cost of capital, cost of purchased power, cost of substitute equipment, facilities, parts, services or replacement power, downtime costs or claims of customers of Customer for such damages and Customer will indemnify MD&A against any such claims from Customer's customer.

4. INDEMNITY. MD&A and Customer each agree to defend, indemnify, and hold harmless the other party, including the other party's subcontractors, suppliers, subsidiaries and affiliates, their directors, officers, agents, employees, successors and assigns and authorized representatives, from and against any claim, loss, damage or expense for all bodily injury or death, but only to the extent that such bodily injury or death is caused by the indemnifying party's negligence. In the event that such bodily injury or death is caused by the joint or concurrent negligence of MD&A and Customer, the claim, loss, damage or expense shall be borne by each party in proportion to its own negligence.

5. INSURANCE. MD&A, at its expense, shall procure and maintain in effect without interruption during the term of this Contract, policies of insurance providing the coverages and limits specified, and complying with the other requirements stated below (all amounts below are stated in US dollars):

a. Worker's Compensation in statutory amounts and Employer's Liability with a minimum limit of $1,000,000 each accident, $1,000,000 Disease - each Employee, $1,000,000 Disease Policy Limit.

b. Commercial General Liability on an Occurrence Basis, with the following coverages and limits:

i.	Per Occurrence	$1,000,000
ii.	General Aggregate	$1,000,000
iii.	Products-Completed Operations Aggregate	$1,000,000
iv.	Personal & Advertising Injury Each Occurrence	$1,000,000

c. Automobile Liability covering automobiles of MD&A, including owned, hired and non-owned automobiles, for Bodily Injury and Property Damage with a combined single limit of $1,000,000 each Occurrence.

d. Excess Liability in Umbrella Form with a limit of $4,000,000 each Occurrence, $4,000,000 Aggregate.

6. PATENTS. MD&A warrants that parts furnished hereunder shall be delivered free of any rightful claim of any third party for infringement of any U.S. patent. If notified promptly in writing and given authority, information and assistance, MD&A shall defend, or may settle, at its expense, any suit or proceeding against Customer so far as based on a claimed infringement which would result in a breach of this warranty and MD&A shall pay all damages and costs awarded therein against Customer due to such breach. In case any part is in such suit held to constitute such an infringement and the use for the purpose intended of said part is enjoined, MD&A shall, at its expense and option, either procure for Customer the right to continue using said part, or replace same with a noninfringing part, or modify same so it becomes noninfringing, or remove the part and refund the Contract price. The foregoing states the entire liability of MD&A for patent infringement.

The preceding paragraph shall not apply to any parts specified by Customer or manufactured to Customer's design, or purchased from other sources, or to the use of any parts furnished hereunder in conjunction with any other parts in a combination not furnished by MD&A as part of this Contract. As to any such parts, or use in such combination, MD&A assumes no liability whatsoever for patent infringement and Customer will hold MD&A harmless against any infringement claim arising therefrom.

In the case of rental equipment MD&A may, at any time after it becomes aware of a possible infringement, elect to require that the equipment be returned and excuse Customer from further rental payments. This paragraph contains the entire liability of MD&A for patent infringement by rental equipment.

7. DELIVERY. Completion dates are approximate and are based upon prompt receipt of the equipment and all necessary information from Customer, or ready access to same if work is to be done at Customer's facility. Unless otherwise specified by MD&A, all shipments of parts are Ex Works MD&A's facility (Incoterms 2010), shipping and insurance prepaid by Customer. In the case of rental equipment, shipping dates quoted are based on rental stocks available at the time of quotation and are, therefore, subject to prior rentals.

8. EXCUSABLE DELAYS. MD&A shall not be liable for any delay in delivery or performance, or for any failure to manufacture, deliver, or perform due to (a) any cause beyond its reasonable control; or (b) any act of God, act of Customer, act of civil or military authority, government priority, fire, severe weather condition, earthquake, strike or other labor disturbance, flood, epidemic, war (declared or undeclared, including civil unrest), riot, terrorist act, delay in transportation or car shortage; or (c) act (or omission) of Customer, including failure to promptly: (i) provide MD&A with information and approvals necessary to permit MD&A to proceed with performance immediately and without interruption, (ii) comply with the terms of payment, or (iii) provide MD&A with such evidence as MD&A may request that any export or import license or permit has been issued; or (d) inability on account of any cause beyond the reasonable control of MD&A to obtain necessary materials, components, services or facilities. The date of delivery or of performance shall be extended for a period equal to the time lost by reason of delay, plus such additional time as may be reasonably necessary to overcome the effect of such excusable delay. MD&A shall notify Customer, as soon as practicable, of the revised date of delivery or of performance. If MD&A is delayed by acts or omissions of Customer, or

by the prerequisite work of Customer's other contractors or suppliers, MD&A shall also be entitled to an equitable price adjustment.

9. PAYMENTS AND FINANCIAL CONDITION. Unless otherwise specified by MD&A in its quotation, payments under the Contract shall be either (a) received in MD&A's account, or (b) secured by a letter of credit satisfactory to MD&A, before MD&A has any obligation to begin performance under the Contract. If a letter of credit is utilized, payment(s) shall be made upon presentation of documents (mutually agreed to in advance by the parties) against a confirmed irrevocable letter of credit issued or confirmed by MD&A authorized bank. The letter of credit shall (a) be established by the Customer, at Customer's expense (including confirmation, amendments and maintenance charges), and (b) remain in effect for a period of three months after the last item of the scope of work is scheduled to be performed under the Contract. The letter of credit shall provide for partial payments pro rata on partial performance and partial shipments from MD&A's facility and for the payment of any charges for storage (including storage at MD&A's facility), price adjustments, cancellation or termination, and all other payments due from Customer under the Contract against MD&A's presentation of documents, and will otherwise be acceptable to MD&A. Customer will increase the amount(s) or extend the validity period(s) and make appropriate modifications to any letter of credit within ten (10) days of MD&A's notification that such is necessary to provide for payments to become due. If MD&A consents to delay shipments, payment shall become due on the date when MD&A is prepared to make shipment. Parts held for Customer shall be at the risk and expense of Customer.

If Customer fails to fulfill any condition of its payment obligations, MD&A may suspend performance and delivery. Any cost incurred by MD&A in accordance with such suspension, including storage costs (including storage at MD&A's facility), shall be payable by Customer upon submission of MD&A's invoices.

Any order for services/parts by Customer shall constitute a representation that Customer is solvent. If the financial condition of Customer at any time does not, in the judgment of MD&A, justify continuance of MD&A's obligations hereunder on the terms of payment agreed upon, MD&A may require full or partial payment in advance or shall be entitled to terminate the Contract and receive termination charges. In the event of bankruptcy or insolvency of Customer or in the event any proceeding is brought against Customer, voluntarily or involuntarily, under the bankruptcy or any insolvency laws, MD&A shall be entitled to cancel any order then outstanding at any time during the period allowed for filing claims against Customer and shall receive reimbursement for its proper cancellation charges. MD&A's rights under this Article 9 are in addition to all rights available to it at law or in equity.

MD&A shall have a lien on and may retain possession of equipment repaired, modified, inspected, tested, maintained or serviced under this Contract until its charges for such services are paid. If such charges are not paid within ninety (90) days following completion of the work and invoicing Customer, MD&A may, upon not less than seven (7) days written notice by certified mail to Customer at Customer's last known address, sell the equipment at public or private sale and apply the net proceeds to MD&A's charges.

10. TERMINATION.

a. By Customer. Customer shall be entitled to terminate the Contract in the event MD&A fails to commence reasonable cure within thirty (30) days after notice from Customer specifying a material default. MD&A's liability for material default shall be limited to the direct costs that Customer must pay a third party to correct the default, but in no event shall exceed the Contract price. MD&A shall be entitled to recover reasonable termination charges on any order that is terminated unless MD&A is in prior material breach of these Terms and Conditions. Termination of an order shall not relieve either party of any obligation arising prior to termination.

b. By MD&A. If Customer fails to fulfill any condition of its payment obligations and does not correct such failure in the manner and time satisfactory to MD&A, then MD&A may, terminate the Contract in respect to the portion of the parts not delivered and work not yet performed. Customer shall pay MD&A its reasonable and proper termination charges in the event of such termination, in addition to the amounts owed up to the date of termination.

11. TITLE. Title to parts not yet incorporated into Customer's equipment will pass to Customer upon MD&A's receipt of all payments for the parts/services under this Contract. Title and right of possession of equipment repaired, modified, inspected, tested, or maintained under this Contract shall remain with Customer, subject to any applicable lien rights of MD&A and to its right of sale in the event of nonpayment as provided in Article 9. Title to all rental equipment shall remain with MD&A.

12. TAXES. In addition to any price specified herein, Customer shall pay the gross amount of any present or future sales, use, excise, value-added, withholding, or other similar tax applicable to the price, sale, or delivery of any parts or services furnished hereunder or to their use by MD&A or Customer, or Customer shall furnish MD&A with a tax exemption certificate acceptable to the taxing authorities.

13. SOFTWARE. Unless otherwise agreed in writing, no software rights are granted to Customer under this Contract. In the event that Customer desires to license any software used by MD&A, Customer must contact the owner of such software to negotiate a software license agreement with such owner in order to use such software. MD&A makes no representation that it is the owner or licensee of any software, or that it has any right to sell, or grant any license to Customer to use, any software.

14. PROHIBITION ON NUCLEAR USE.

a. Parts, materials, equipment and services provided hereunder, are not intended for and shall not be used in connection with any nuclear facility or activity. Customer represents and warrants that it shall not use them or permit others to use such materials, equipment or services for any such purpose, and that it will not transfer or permit to be transferred any parts, materials, equipment and services provided hereunder to any third party without having first obtained the agreement of such third party or parties not to use them for any such purpose.

b. Notwithstanding the foregoing, if any parts and materials sold, equipment rented and services provided by MD&A to Customer under the Contract, shall be used at Customer's commercial nuclear power station[s] identified in the Contract and located within the USA (hereinafter, the "Plant[s]"), the following terms and conditions shall apply:

i. Customer shall, without cost to MD&A, obtain and maintain insurance to cover "public liability" arising out of a "nuclear incident" (as those terms are defined in the Atomic Energy Act of 1954, as amended, hereinafter referred to as the "Act") at, or arising out of, the operation of the Plant[s], the policy to be provided by American Nuclear Insurers/Mutual Atomic Energy Liability Underwriters. This insurance shall cover the liability of Customer, MD&A, and any other person or organization that may have legal responsibility for public liability arising out of a nuclear

incident. The limits shall be in the amounts required to meet financial protection requirements by the Act, and applicable regulations of the U. S. Nuclear Regulatory Commission ("NRC").

ii. Customer shall also enter into the governmental indemnity agreement required by the Act, and applicable regulations of the NRC, with coverage and limits as may be required by the NRC.

iii. In the event the nuclear liability protection system in effect on the effective date of the Contract expires or is repealed, changed or modified, Customer shall, without cost to MD&A, obtain and maintain liability protection provided through government indemnity, limitation of liability and/or liability insurance to the extent available and consistent with customary industry practice in the United States. Such substitute liability protection shall not result in a material impairment of the protection afforded MD&A by such nuclear liability protection system and this Article 14.

iv. Customer hereby waives all rights of recourse and subrogation which it may have or acquire against MD&A with respect to liability for nuclear damage.

v. MD&A shall not have any liability to Customer or its insurers for nuclear damage to any property located at the site of or used in connection with the Plant[s] or any other nuclear plant of Customer. To the extent reasonably available, Customer shall, at no cost to MD&A, obtain and maintain insurance against loss or destruction of or damage to Customer's property within the Plant[s] site boundaries arising out of or resulting from a nuclear incident. Such insurance shall have limits of coverage not less than $500 million. Customer shall indemnify MD&A, its suppliers and its directors, officers and employees for any and all liability that they may have to third parties, including Customer's insurers and other financial guarantors, for physical loss or destruction of or damage to the property of third parties that is located within the Plant[s] site boundary and used in the operation of the Plant[s], to the extent that such physical loss, destruction or damage results from or arises out of a nuclear incident or otherwise.

vi. In the event of a nuclear incident at or arising out of the operation of the Plant[s], Customer waives and will require its insurer to waive all rights of recovery against MD&A, its subcontractors and suppliers of any tier, whether in contract, warranty, indemnity, tort (including MD&A's negligence), strict liability or otherwise, for (1) physical damage to or loss or destruction of any Customer property, (2) third-party claims, and (3) any and all costs or expenses incurred by MD&A in investigation, settlement and defense of any claims arising out of such incident, including attorneys' and experts' fees, settlement awards and costs, court costs, disbursements, and internal expenses resulting from such claims.

vii. Customer shall not transfer or use, or permit the transfer or use of, any parts, materials, equipment and services provided under this Contract at any nuclear power plant other than the Plant[s] specified in this Contract. In the event of such transfer or use, MD&A shall have no liability whatsoever for any nuclear or other damage, injury or contamination. In addition to any other legal or equitable rights of MD&A, Customer shall indemnify MD&A against any such liability, and shall reimburse MD&A for any and all costs or expenses incurred by MD&A in investigation, settlement and defense of any claims arising out of such use, including attorneys' and experts' fees, settlement awards and costs, court costs, disbursements, and internal expenses resulting from such claims.

viii. Any decontamination necessary for MD&A's performance (including remedial warranty efforts) shall be performed by Customer without cost to MD&A. Any of MD&A's parts, materials or equipment which become contaminated (including becoming radioactive) at the work site shall, at MD&A's option, be decontaminated or purchased by Customer without cost to MD&A.

ix. For purposes of this Article 14, the following definitions apply:
"liability" means liability of any kind at any time whether in contract, warranty, indemnity, tort (including negligence), strict liability or otherwise;
"nuclear damage" means any loss, damage, or loss of use, which in whole or in part is caused by, arises out of, results from, or is in any way related, directly or indirectly, to the radioactive properties or a combination of radioactive properties with toxic, explosive or other hazardous properties of source, special nuclear or byproduct material, as those materials are defined in the Act, including any loss of life or personal injury (including to Customer's employees), or any loss of, loss of use of, or damage to, property of Customer or others, on or off the site, including the Plant[s].
"site" or "plant site" means the area identified as the Plant location in either (a) the nuclear liability insurance policy or (b) the governmental agreement of indemnity issued pursuant to the Act, whichever is more inclusive.

x. Customer's obligations under this Article 14 shall be effective through the decommissioning of the Plant[s] and any other nuclear plant or plants to which they apply.

15. COMPLIANCE WITH LAWS. All transactions hereunder shall at all times be subject to and conditioned upon compliance with all applicable export control laws and regulations of the U.S. Government and any amendments thereof. Customer agrees that it shall not, except as said laws and regulations may expressly permit, make any disposition by way of transshipment, re-export, diversion or otherwise, of U.S. origin goods and technical data (including computer software), or the direct product thereof, supplied by MD&A hereunder. The obligations of the parties to comply with all applicable U.S. export control laws and regulations shall survive any termination, or discharge of any other contract obligations.

Customer undertakes to keep fully informed of, and to comply with, the export control laws and regulations of the U.S. Government and any amendments thereof. Customer certifies that the parts, materials, services, technical data, software or other information or assistance furnished by MD&A under the Contract will not be (a) used by any individual or entity listed as a prohibited party on any list of the U.S. Government of prohibited or denied parties, (b) sent to any party in a country listed as a prohibited country by the U.S. Government, or (c) used in the design, development, production, stockpiling or use of chemical, biological, or nuclear weapons either by Customer or by any entity acting on Customer's behalf.

Notwithstanding any other provisions herein, Customer shall be responsible for timely obtaining any required authorization, such as an export license, import license, foreign exchange permit, work permit or any other governmental authorization, even though any such authorization may be applied for by MD&A. Customer and MD&A shall provide each other reasonable assistance in obtaining required authorizations. MD&A shall not be liable if any authorization is delayed, denied, revoked,

restricted or not renewed and Customer shall not be relieved thereby of its obligations to pay MD&A for its parts or services or any other charges which are the obligation of the Customer hereunder.

16. RESERVATION OF RIGHTS. MD&A Reserves the right to make copies, prepare derivative works of, or reverse engineer any portion of the components, parts, materials or other information supplied or created under the Contract. Such copies, derivative works or reverse engineering information and data shall be the sole property of MD&A, the use of which shall not be restricted in anyway by Customer. MD&A reserves the right to use any portion of the components, parts, materials or other information supplied or created under the Contract in the development of any other products or intellectual property of any kind, the ownership of which shall vest exclusively in MD&A. The work performed by MD&A shall not be considered "work for hire." Any and all information related to, or arising out of, MD&A's Intellectual Property or Improvements is deemed to be the information of MD&A. Customer agrees that it will not use any information of MD&A or any Improvement made by either party as a basis for the design or creation of any item, application or software. All right, title and interest in and to the Intellectual Property of MD&A and all Improvements shall remain with, and vest exclusively in MD&A. If any such right, title or interest becomes vested in Customer by operation of law or otherwise, Customer will do everything necessary, to vest all such right, title and interest in MD&A. Customer will execute such further and other documents and do such further and other things as may be necessary to carry out and give effect to the obligations contained in this paragraph, provided however, neither party is obligated to enter into a further business relationship with the other party.

17. DISPUTE RESOLUTION. All disputes arising in connection with the Contract shall be settled, if possible, by amicable negotiation of the parties. In the event of any dispute, controversy or claim arising out of, connected with, or relating to this Contract, within 30 days of notice of such dispute, the Parties agree to arrange a face-to-face meeting between their respective senior executive officers or their designated representatives to resolve such dispute.

For services performed or parts sold within the United States of America, if the matter is not resolved by negotiations, either party shall have the right to pursue any legal remedy available.

For services performed or parts sold outside of the United States of America, if the matter is not resolved by negotiations, the dispute or controversy shall be referred to arbitration without recourse to any court. The notice shall identify the name and address of the arbitrator appointed by the party giving notice and the points of dispute.

Within thirty (30) days after receipt of such notice, the other party shall give notice to the first party of the appointment and name and address of the second arbitrator. Within thirty (30) days after appointment of the second arbitrator, the arbitrators so appointed shall appoint an additional arbitrator to serve as chairman of the arbitration tribunal. If the second party fails to appoint its arbitrator within thirty (30) days after receipt of notice of the appointment of the first arbitrator, or, if the arbitrators appointed by the parties fail to appoint an arbitrator to serve as chairman within sixty (60) days after the appointment of the first arbitrator, then the President of the International Court of Arbitration of the International Chamber of Commerce shall have the power, on the request of a party, to make appointments which have not been made. The seat of arbitration shall be in Albany, New York U.S.A., and the arbitral award shall be made in Albany. The arbitration shall be conducted in English and in accordance with the Rules of Conciliation and Arbitration of the International Chamber of Commerce. The parties shall have the right to present documentary evidence and witnesses and shall also have the right to cross examine witnesses.

The arbitration decision shall be decided by majority vote, provided that in the event of a tie vote on any matter, the chairman of the arbitration shall have a second or casting vote on that matter. In arriving at their decision, the arbitrators shall consider the pertinent facts and circumstances and be guided by the terms of this Contract; and, if a solution is not found in the terms of this Contract, the arbitrators shall apply the provisions of the applicable laws governing this Contract under Article 18. The arbitrators are precluded from considering or awarding punitive, consequential or exemplary damages to any party in any arbitration conducted pursuant to this Article 17.

The parties agree that any arbitral award shall be final and binding, that this Contract and the resulting obligations are commercial and that the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards (the "New York Convention") applies to this Contract and to any award or order resulting from any arbitration conducted hereunder. Except for initiating actions to obtain a judgment recognizing or enforcing an arbitral award or order, the parties agree not to commence or otherwise be involved in any court action or proceeding concerning a dispute arising out of this Contract and hereby irrevocably waive and exclude all rights of appeal, challenge, or recourse to any court from any arbitral award or order resulting from any arbitration conducted under this Article 17.

Reasonable expenses of the arbitration shall be shared equally. On request of any party, a transcript of the hearings shall be prepared and made available to the parties.

18. GENERAL. The provisions of this Contract are for the benefit of the parties hereto and not for any other party or person except as specifically provided herein.

Any services furnished by MD&A hereunder will be performed in compliance with the Fair Labor Standards Act of 1938, as amended and applicable. MD&A will comply with applicable federal, state, and local laws and regulations as of the date of any quotation which relate to (a) equal employment opportunity (including the seven paragraphs appearing in Section 202 of Executive Order 11246, as amended); (b) workers' compensation; and (c) the performance of any services in MD&A's facilities. Price and, if necessary, delivery will be equitably adjusted to compensate MD&A for the cost of compliance with any other laws or regulations.

The delegation or assignment by Customer of any or all of its duties or rights hereunder without MD&A's prior written consent shall be void. Any representation, promise, warranty, course of dealing or trade usage not contained or referenced herein will not be binding on MD&A. MD&A reserves the right to assign any portion of the Contract or work to any affiliated entity, division or subsidiary within the Mitsubishi Hitachi Power Systems, Ltd. corporation.

The 18 Articles in these Terms and Conditions, including MD&A's quotation, collectively referred to herein as the "Contract", contain the entire and only agreement between Customer and MD&A respecting the terms and conditions and supersedes and cancels all previous negotiations, agreements, commitments, representations and writings in respect thereto. No modification, amendment, rescission, waiver or other change shall be binding on MD&A unless agreed to in writing by MD&A's authorized representative.

The validity, performance, and all matters relating to the interpretation and effect of this Contract and any amendment hereof shall be exclusively governed by the law of the State of New York without giving effect to any conflicts of laws or choice of law rules that would apply the law of another jurisdiction. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. The invalidity, in whole or part, of any of the articles or paragraphs in these Terms and Conditions will not affect the remainder of such article or paragraph or any other article or paragraph. Nothing in this Contract shall be construed to impose any overall "system responsibility" on MD&A. When used in this Contract, the terms (a) "including" and "includes" mean "including but not limited to" the specifically enumerated things, states, or actions that follow such terms, and (b) "or" means "one or the other or all" of the specifically enumerated things, states, or actions that follow such term.

Any information, suggestions or ideas transmitted by the Customer to MD&A are not to be regarded as secret or submitted in confidence, unless agreed to by MD&A in writing.

The following Articles shall survive termination of this Contract: Article 1 (Warranty), Article 2 (Limitation of Liability), Article 3 (Consequential Damages), Article 4 (Indemnity), Article 6 (Patents), Article 12 (Taxes), Article 14 (Prohibition of Nuclear Use), Article 15 (Compliance with Laws), Article 16 (Reservation of Rights), Article 17 (Dispute Resolution), Article 18 (General) and any remaining payment obligations of Customer.

Government of Puerto Rico

Puerto Rico Electric Power Authority

Hurricane Maria DR-PR-4339

PROJECT SCOPE OF WORK WITH COST ESTIMATES

Submittal to COR3 and FEMA

Low Pressure Turbine Rotor Refurbished Unit 3 Palo Seco Steam Plant

2/3/2022

Introduction

The purpose of this document is to present and update a Project Scope of Work (SOW) with Cost Estimates to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. The completed document will be reviewed by COR3 and FEMA to create and version a specific project worksheet and post fixed-cost estimates to repair, restore, or replace eligible facilities including Section 406 hazard mitigation for a specific project.

Puerto Rico Electric Power Authority (PREPA) is the agency that provides the electric service to the entire island of Puerto Rico. As such, the facilities, sites, and systems identified in this Scope of Work are eligible as critical services facilities as defined in the PAAP (Section 428) and BBA 2018 guidance documents. Additional details may be found in Sections 3 and 4, respectively.

This document will be updated with information developed during the initial design and engineering phase through the construction phase.

The sections included in this document are:

- *Project Information*
- *Facilities*
- *Scope of Work*
- *Codes and Standards*
- *Cost Estimate*
- *406 Hazard Mitigation Proposal*
- *Environmental and Historic Preservation (EHP) Requirements*
- *Program Manager Certification*
- *PREPA Project Sponsor Comments*
- *Attachments*

Document Revision History

Version	Date	Summary of Changes
v.1	02/03/2022	

Section 1. Project Information

General Information

Recipient	Central Office for Recovery, Reconstruction and Resiliency (COR3)
Sub-Recipient	Puerto Rico Electric Power Authority (PREPA)
Project Title	Low Pressure Turbine Rotor Refurbished Unit 3 Palo Seco Steam Plant
PREPA Project Number	<to be entered by PREPA>

Federal Information

(provided by FEMA)

Damage Number(s)	250040
Damaged Inventory/Asset Category	Island Wide Generation Plants
FEMA Project Number *(Formerly Project Worksheet)*	136271 - MEPA078 PREPA Island Wide FAASt Project, Hurricane Maria 4339DR-PR
Amendment Number	

Program Manager: ***<Name>***

<Insert title here>

PREPA Project Sponsor: ***<Name >***

<Insert title here>

Section 2. Facilities

2.1. Facilities List

Name	GPS Location
Palo Seco Steam Plant Low Pressure Turbine Rotor Refurbished Unit 3	[redacted]

Note: *GPS coordinates are required for all facilities.*

2.2. Facilities Description

On September 20, 2017 the entire island of Puerto Rico was ravaged by Hurricane Maria, making landfall as high-end category 4 hurricane. As a result of severe winds, wind-driven debris, salt spray, storm surge, mudslides, flooding, and rain, all essential electrical delivery services including power generation were damaged or destroyed, resulting in a complete loss of power and the longest blackout in U.S. history.

Furthermore, PREPA needs to perform constantly works of conservation, repairs, and retrofitting of its generation units and their auxiliary equipment, including, without limitation, boilers, turbines, rotors, generators, motors, pumps, breakers, and control systems. These works are of the utmost importance as it has become more evident by the recent forced outages.

To improve the generation asset's reliability, increasing their availability, and provide continuous generation service to the People of Puerto Rico, it is crucial to keep these assets operational and in the best possible condition. Therefore, the prioritization of conservation, repairs, and retrofitting works projects is at the top priority list.

It is necessary to inspect, transport, maintain, and repair of the power turbine spare low-pressure rotor for the plant's unit 3.

Section 3. Scope of Work

3.1. Scope of Work Description

The scope of work for the Low Pressure Turbine Rotor Refurbished of the Palo Seco Steam Plant's Unit 3 will consist of the following:

a) These specifications cover the work required under this Purchase Order for the refurbishment of Turbine Rotors, diaphragms and related components of the Palo Seco Steam Plant, Unit 3. Contractor is required to comply with several special conditions herewith detailed for the general and detailed work.

b) The Contractor shall supply the Technical Field Advisor Services, the site project management team and the craft labor necessary to performs disassembly and re-assembly of the turbine and the generator.

General Works (Inspection)

1) The following is the specified unit equipment:

   HP-IP & LP Rotor Buckets, HP, IP, LP – Diaphragms, Nozzle Plate, Turbine Bearings, Oil Deflectors, Steam Packing Housing, Gland Cases and Dummy Rings, Top Hats, Inlet Sleeve and Steam inlet Bore.

2) The general works are the following:

   a. Cleaning and sandblasting of the HP-IP and LP rotor blades and diaphragms, LP inlet flow guide, gland cases and dummy rings

      1. The rotors shall be blast cleaned using 220-mesh aluminum oxide and water blast to remove any residue of the blasting media.

      2. Surface cleaning with water shall be done using water dispersant or surfactant product approved by PREPA.

      3. Contractor shall protect "journals" while blasting.

   b. Non-Destructive Test (NDT) to the specified unit equipment (as require) using magnetic particle, ultrasonic test, dye check or X-ray method, as necessary and approved by the Engineer.

   c. Perform 100% equipment checks to determine corrections to be done to bring parts to factory tolerances.

      1. The Contractor shall take a "runout" reading of all rotor stages and the seal area. Including the HP-IP rotor and the new LP rotor.

2. Dimensionally inspect HP-IP and LP journals, bearings, bearings bore, oil seal, inner cylinder and gland seal, Bore Bearings Turbine.

3. Measure coupling rabbet fit and face reading, bolts and coupling holes diameter.

4. Perform parallel check and measure thrust collar.

5. Open close correct HP-IP/LP coupling as required.

6. Clean and magnetic particle the thrust fit (collar and shaft). (If applicable).

7. Verify couplings rabbet, face readings, and correct where applicable as per OEM procedures.

8. Perform all necessary stage readings for the machining of the spill strips of the diaphragm.

9. Inspect Top Hats, Inlet sleeves and Bell seals.

10. Inspect Inlet Sleeve.

11. Inspect Steam inlet Bore.

d. Measure and perform ultrasonic test to turbine and generator bearings.

e. Submit a written report of conditions as found.

Detailed Scope of Work (Repair Scope)

1) Detailed Work for Unit

a. Diaphragms HP-IP and LP work to be performed per diaphragm shall follow the following repair classification. The inspection report and the final decision of the Engineer shall classify the diaphragm by their repair needs, minor, medium o mayor. Bidders will use the tables in Annex A to bid for the different classifications.

1. Minor Repair:
- Straighten trailing edges as necessary.
- Perform an area check and record.
- Remove high metal caused by FOD.
- Repair fabrication lines on horizontal joints.
- Polish each partition to improve surface finish.
- Replace spill strips.

2. Medium Repair:
1. Straighten trailing edges as necessary.
2. Perform an area check and record.

3. Remove high metal caused by FOD.
4. Repair impact damage by welding and blending to contour (From 0.500" to 0.625" of weld).
5. Polish each partition to improve surface finish.
6. Repair fabrication lines on horizontal joints.
7. Replace spill strips.

3. Major repair:

1. Perform an area check and record.
2. Make contour gage.
3. Cut back partitions to the desired amount.
4. Weld builds up the partitions and sidewalls. (From 0.625" to 0.750" of weld)
5. Grind and polish convex side to contour.
6. Grind the concave side.
7. Set area and record results.
8. Repair fabrication lines on horizontal joints.
9. Replace spill strips.
10. Repair bore and hook fit on packing holder.

b. Spill strips shall be supplied and installed by the Contractor.

c. <u>HP-IP and LP Rotor Repairs</u>

1. Remove and install bucket wheel including all necessary work.

2. Straighten and blend foreign object damage to bucket and vane sections. (To all wheels)

3. Replace all shroud bands of bucket wheels, hand prepare tenons. (By welding procedure or any other mean approved by the Engineer)

4. Replace all erosion shields stage (must be supplied by the Contractor).

5. Machine, if necessary, shaft journal to remove cracking, pitting, scoring etc. as required by the Engineer. (Up to 0.020 on diameter")

6. Machine packing land as necessary to remove cracking, erosion, scoring, etc. to restore land configuration as requested by the Engineer. (Up to 0.020" on diameter)

7. Clean and Polish each non new bucket wheel blade in order to improve surface finish.

8. Resealing of the HP-IP rotor cylinder. (If applicable)

9. Remove, install, and align the extension shaft.

10. Run Out check HP-IP and the new LP.

11. Reaming to size on both the Governor and Generator ends of the new LP rotor. Final dimensions shall be approved by the Engineer.

12. Low speed balance for HP-IP

d. Nozzle Plate Repair

1. Flatness checks of steam face.

2. Cut back all partitions, weld, hand finish and stress relieve.

3. Adjust austenitic ring blocks and align nozzle segment assembly.

4. Clean and Polish each partition in order to improve surface finish.

5. Machine to dimensions the new nozzle.

6. Machine the sealing face of the shell with the boring bar to obtain proper sealing contact area (if required).

e. Oil Deflector Repair

1. Clean and check all dimensions and clearance. Repair as necessary with the approval of the Engineer.

f. Clean and Repair Bearings

1. Repair Bore Bearings Turbine. (Weld repair and Machine to dimensions)

2. Perform TIG Weld or Spin Casting as required, and machine to dimension with the approval of the Engineer.

g. Gland Seal and Dummy Rings

1. Repair the centering pin, slot crush pin, and hook fit.

2. Repair or replace supporting blocks. Shall be machine to obtain required liner clearances. All materials shall be supplied by the Contractor.

h. Remove and Install Top Hat(S)

1. Quote by unitary pricing.

2. Perform all the required works and test to remove and install the Top Hats and their related components (Inlet Sleeve, Bell Seals). Including but not limited to X-ray and PWHT testing procedures.

i. Oil Flushing

The Oil Flushing contractor is required to furnish all labor, materials, tools, equipment, facilities, supervision, on site job administration and superintendence required, as requested by PREPA and shall perform all work expeditiously and to the entire satisfaction of the Contracting Officer. The Oil Flushing contractor shall comply with the following specification:

1. Ultra-high velocity flushing equipment capable of achieving 30 to 40 feet per second mass flow.
2. Use of 0.5-micron individual filtration at each individual pedestal.
3. Results are to be ISO Standard 13/10 or greater.
4. Flushing the Turbine Lubrication and Control System.
5. The oil flushing company shall have a minimum of five years of experience in the performance of oil flushing to steam turbine similar or equal to the reference unit.
6. The bidder shall provide with the proposal the name of the Oil Flushing Company including the certification of experience services and the certification that the company shall comply with the above requirements.

3.2. Type of Project

Indicate whether the intended plan is a(n):

1. **Restoration to Codes/Standards**: Restores the facility(s) to pre-disaster function and to approved codes/standards
2. **Improved Project**: Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
   a. Other improvements, not required by codes and standards
   b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved or Alternate) *If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide rationale for recommendation.*
Restores to Codes/Standards

Note: *If preliminary Architectural and Engineering (A&E) work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.*

3.3. Preliminary Architectural and Engineering (A&E)

Is architectural and engineering funding required to help define the intended scope of work?

No

Project complexity does not require Architecture and/or Engineering services for design.

Section 4. Codes and Standards

Which of the following types of codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

4.1. Codes, Specifications, and Standards

Yes/No. If yes, describe how incorporated below.
• (ASCE MOP 74) Guidelines for Electrical Transmission Line Structural Loading, Third Edition - American Society of Civil Engineers (ASCE) • (ASCE/SEI 7-16) Minimum Design Loads and Associated Criteria for Buildings and Other Structure - American Society of Civil Engineers (ASCE) • Distribution – 50-4, 1724D-106, 1724E-150, 1724E-151, 1724E-152, 1724E-153, 1725E-154, 1728F-700, 1728F-803, 1728F-804, 1728F-806, 1730B-121, 1730-B2 - U.S. Department of Agriculture Rural Electric Service (RUS) • International Building Code (IBC) - International Code Council (ICC) • International Energy Conservation Code (IECC) - International Code Council (ICC) • International Existing Building Code (IEBC) - International Code Council (ICC) • National Electric Safety Code (NESC) - Institute of Electrical and Electronics Engineers • National Electrical Code (NEC) - National Fire Protection Association (NFPA) • FM 4470 for Class 1 Roof Constructions - National Roofing Contractors Association (NRCA)

4.2. Industry Standards

Yes/No. If yes, describe how incorporated below.
• 2018 NFPA 101 Life Safety Code - National Fire Protection Association (NFPA) • 2010 NFPA 72 Fire Alarm and Signaling Code - National Fire Protection Association (NFPA) • ASCE.7 Section C 6.0 Wind Loads - American Society of Civil Engineers (ASCE) • International Building Code (IBC) - International Code Council (ICC) • Page 10 PREPA Standards and Specifications - Puerto Rico Electric Power Authority (PREPA) • Pattern Distribution Systems Manual - Puerto Rico Electric Power Authority (PREPA) • RUS - Applicable Bulletins for Electrical and Electronic Installations - US Department of Agriculture, Rural Utilities Service (RUS) • Underground Distribution Patterns Manual - Puerto Rico Electric Power Authority (PREPA)

Section 5. Cost Estimate

The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies. Cost is based historical pricing.

Cost Type	Amount ($M)
Repair Work + 20% Labor	$3,500,000.00
Total Project Estimated Cost	**$3,500,000.00**

Section 6. 406 Hazard Mitigation Proposal

6.1. 406 Mitigation Opportunity Scope of Work

Hazard mitigation scope was not identified for this work.

6.2. 406 Mitigation Opportunity Cost Estimate

There are no costs associated with hazard mitigation.

Note: *If available, detailed engineering cost estimates will be included as an attachment.*

Section 7. EHP Requirements

EHP considerations will be detailed in PREPA's EHP scoping document and EHP Checklist. Review will be performed under FEMA's project formulation review.

Section 8. Program Manager Lead Certification

Based on my knowledge and information available to date, I certify that the contents of this document accurately reflect the project scope of work and cost estimates.

Program Manager's Printed Name

Date

Title

Signature

Section 9. PREPA Project Sponsor Comments

Comments

<Insert any comments here>

PREPA Project Sponsor's Printed Name _____ Date _____

Title _____ Signature _____

Section 10. Attachments

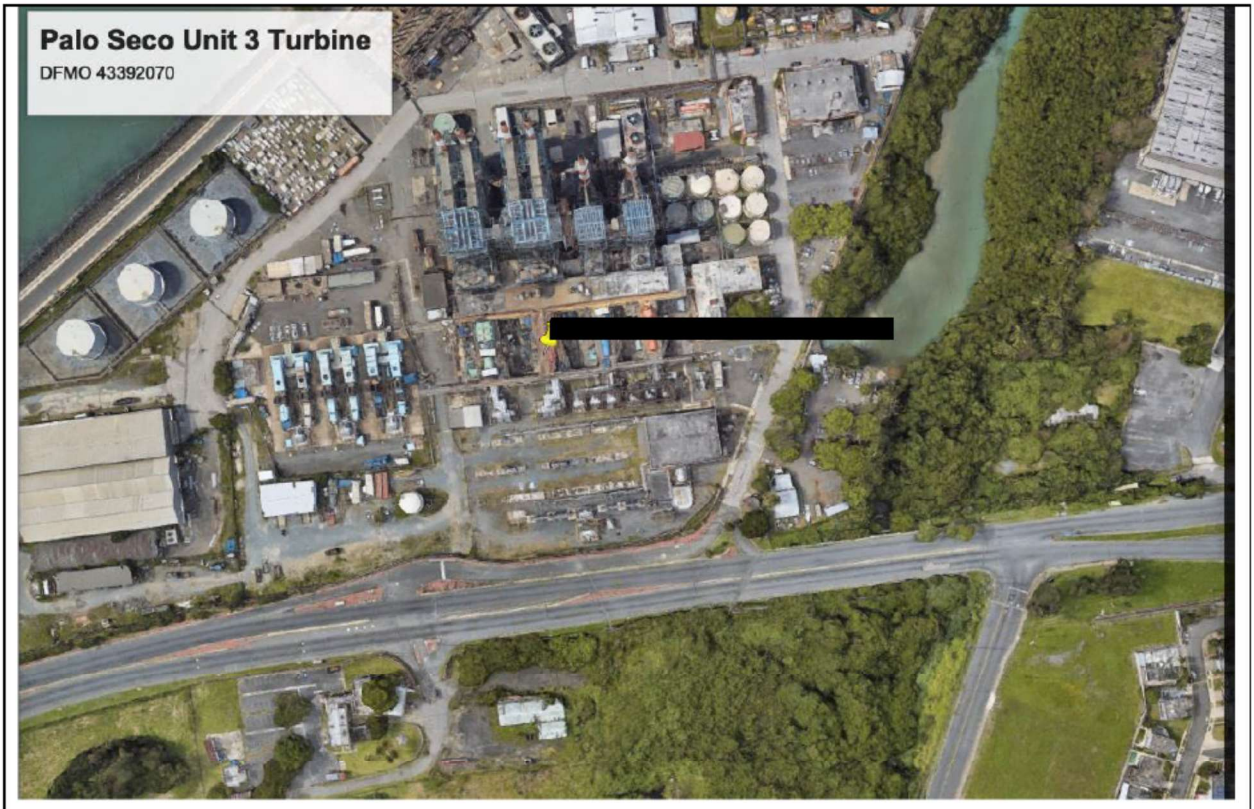
10.1. Project Detailed Cost Estimates

- Please see attached Scope of Work and Technical Specifications for Purchase Order:TS-M28-07.

10.2. Engineering Studies and Designs

N/A

10.3. Location Maps and Site Pictures



10.4. Other: (Please Describe)

N/A

Provide all the labor, equipment and materials necessary for the following work scope:

INSHOP

□ LP ROTOR INSHOP REPAIR

- Mobilize technicians to remove buckets from Spare LP Rotor
- Roundtrip shipping of damaged LP rotor and spare buckets to St Louis
- Remove L-1 TE and GE from damage rotor
- Blast clean and NDE
- Perform dimensional inspection
- Modify lock pin groove on in-service rotor
- Install spare buckets with upgrade L-1 pin design will be installed.
- Low Speed Balance

Duration: 30 days including roundtrip ocean transit.

LP DIAPHRAGM INSHOP REPAIR

- Ship diaphragms with rotor
- Blast clean and NDE
- Record data and perform harmonic analysis of L-1 stationary diaphragm.

SPECIAL CONDITIONS AND TECHNICAL SPECIFICATIONS

PURCHASE ORDER TS-M28-07

ARTICLE 1. **The Requirements**

1.1 The Contractor is required to furnish all labor, materials not provided by PREPA, tools, equipment, facilities, supervision, on site job administration and superintendence required, as requested by PREPA and shall perform all repair work expeditiously and to the entire satisfaction of the Contracting Officer. The work shall be conducted in accordance with this specification, as directed by the Contracting Officer; and as described in Article 2, Scope of Work, of the main Agreement.

1.2 All work performed under this Specifications shall be done in a safe and workmanlike manner and in strict conformance with all rules, regulations and ordinances, etc., of government agencies having jurisdiction over the class of work involved and including the American National Standards Institute (ANSI), the American Society of Mechanical Engineers (ASME), the National Board of Inspection Codes (NBIC), the Environmental Protection Agency (EPA), the Occupational Safety and Health Office (OSHO) requirements and the latest edition of all other applicable codes and standards.

1.3 The Contractor shall develop a schedule of the activities to be performed in connection with the work of the Purchase Order and shall submit the same to PREPA for the approval of the Engineer.

1.4 All work on a particular unit shall be carried out on a continuous schedule following the commencement date specified by PREPA and the proposed work schedule submitted by the Contractor and accepted by PREPA.

1.5 The Contractor shall furnish the Engineer summary weekly reports of the various divisions of the work under the Purchase Order, whether in the mills or shops or in the field, stating the existing status, rate of progress, estimated time of completion and cause of delays, if any.

1.6 Concurrent to all work, a written report of conditions as found, work performed, clearances and test data recorded should be submitted. A final report should be submitted within twenty (20) consecutive days after completion of all work.

1.7 The Contractor shall furnish all tools and equipment required to perform the inspection, adjustments, repairs and/or replacements expeditiously and to the satisfaction of the Engineer.

1.8. All welding performed under this Purchase Order shall be in accordance with welding procedures, required by this kind of work an shall comply with all the procedures and certifications established by ASME and the AWS, if applicable.

1.9 The bidder is required to fill all blanks of Annex A, if not he will not be considered as complying with all information and shall be rejected.

ARTICLE 2. **Scope of Work**

2.1. General and detailed Scope

a. These specifications cover the work required under this Purchase Order for the refurbishment of Turbine Rotors, diaphragms and related components of the Palo Seco Steam Plant, Unit 3. Contractor is required to comply with several special conditions herewith detailed for the general and detailed work.

b. The Contractor shall supply the Technical Field Advisor Services, the site project management team, and the craft labor necessary to performs disassembly and re-assembly of the turbine and the generator.

c. **General Works (Inspection)**

The following general works are to be performed as the basic work and inspection of the specified unit equipment of the reference Power Plant **and shall be perform in fifteen (15) consecutive weekdays.**

1) The following is the specified unit equipment:

HP-IP & LP Rotor Buckets, HP, IP, LP – Diaphragms, Nozzle Plate, Turbine Bearings, Oil Deflectors, Steam Packing Housing, Gland Cases and Dummy Rings, Top Hats, Inlet Sleeve and Steam inlet Bore.

2) The general works are the following:

a) Cleaning and sandblasting of the HP-IP and LP rotor blades and diaphragms, LP inlet flow guide, gland cases and dummy rings

1) The rotors shall be blast cleaned using 220-mesh aluminum oxide and water blast to remove any residue of the blasting media.

2) Surface cleaning with water shall be done using water dispersant or surfactant product approved by PREPA.

3) Contractor shall protect "journals" while blasting.

b) Non-Destructive Test (NDT) to the specified unit equipment (as require) using magnetic particle, ultrasonic test, dye check or X-ray method, as necessary and approved by the Engineer.

c) Perform 100% equipment checks to determine corrections to be done to bring parts to factory tolerances.

1- The Contractor shall take a "runout" reading of all rotor stages and the seal area. Including the HP-IP rotor and the new LP rotor.

2- Dimensionally inspect HP-IP and LP journals, bearings, bearings bore, oil seal, inner cylinder and gland seal, Bore Bearings Turbine.

3- Measure coupling rabbet fit and face reading, bolts and coupling holes diameter.

4- Perform parallel check and measure thrust collar.

5- Open close correct HP-IP/LP coupling as required.

6- Clean and magnetic particle the thrust fit (collar and shaft). (If applicable)

7- Verify couplings rabbet, face readings, and correct where applicable as per OEM procedures.

8- Perform all necessary stage readings for the machining of the spill strips of the diaphragm.

9- Inspect Top Hats, Inlet sleeves and Bell seals

10- Inspect Inlet Sleeve

11- Inspect Steam inlet Bore

d) Measure and perform ultrasonic test to turbine and generator bearings.

e) Submit a written report of conditions as found.

d. **Detailed Scope of Work (Repair Scope)**

The following detailed scope of work **shall be completed in forty seven (47) consecutive days** and shall be performed in the area or facility of the Palo Seco Power Station. The use of local workshop in Puerto Rico should be use if the nature of the work to be performed require the use of specialize machining. The Bidder shall submit an itemized quotation for all works in item d.1) of the Detailed Scope of Work of the Technical Specification. All findings to restore the equipment to the original manufacturer's specifications shall be done using the Detailed Scope of Work as the guide. All works included herein will require an approval of the Engineer before their performance. Parts, which are beyond repair, shall be replaced as authorized by the **Engineer on five (5) consecutive weekdays.**

1) Detailed Work for Unit

a) Diaphragms HP-IP and LP work to be performed per diaphragm shall follow the following repair classification. The inspection report and the final decision of the Engineer shall classify the diaphragm by their repair needs, minor, medium o mayor. Bidders will use the tables in Annex A to bid for the different classifications.

1- Minor Repair:

- Straighten trailing edges as necessary.
- Perform an area check and record.
- Remove high metal caused by FOD.
- Repair fabrication lines on horizontal joints.
- Polish each partition to improve surface finish.
- Replace spill strips.

2- Medium Repair:

- Straighten trailing edges as necessary.
- Perform an area check and record.
- Remove high metal caused by FOD.
- Repair impact damage by welding and blending to contour. (from 0.500" to 0.625" of weld)
- Polish each partition to improve surface finish.
- Repair fabrication lines on horizontal joints.
- Replace spill strips

3- Major repair:

- Perform an area check and record.
- Make contour gage.
- Cut back partitions to the desired amount.
- Weld builds up the partitions and sidewalls. (from 0.625" to 0.750" of weld)
- Grind and polish convex side to contour.
- Grind the concave side.
- Set area and record results.
- Repair fabrication lines on horizontal joints.
- Replace spill strips.
- Repair bore and hook fit on packing holder.

Note: To be considerate a major repair the inspection and evaluation of the diaphragms shall indicate that over fifty (50) percent of the partitions of the diaphragms are in a condition that requires a weld builds up by partitions as specified above (3) Major Repair).

b) Spill strips shall be supplied and installed by the Contractor.

c) HP-IP and LP Rotor Repairs

1) Remove and install bucket wheel including all necessary work.

2) Straighten and blend foreign object damage to bucket and vane sections. (to all wheels)

3) Replace all shroud bands of bucket wheels, hand prepare tenons. (by welding procedure or any other mean approved by the Engineer)

4) Replace all erosion shields stage (must be supplied by the Contractor).

5) Machine if necessary shaft journal to remove cracking, pitting, scoring etc. as required by the Engineer. (up to 0.020 on diameter")

6) Machine packing land as necessary to remove cracking, erosion, scoring, etc. to restore land configuration as requested by the Engineer. (up to 0.020" on diameter)

7) Clean and Polish each non new bucket wheel blade in order to improve surface finish.

8) Resealing of the HP-IP rotor cylinder(If applicable)

9) Remove, install and align the extension shaft

10) Run Out check HP-IP and the new LP.

11) Reaming to size on both the Governor and Generator ends of the new LP rotor. Final dimensions shall be approved by the Engineer.

12) Low speed balance for HP-IP

d) Nozzle Plate Repair

1) Flatness checks of steam face.

2) Cut back all partitions, weld, hand finish and stress relieve.

3) Adjust austenitic ring blocks and align nozzle segment assembly.

4) Clean and Polish each partition in order to improve surface finish.

5) Machine to dimensions the new nozzle

6) Machine the sealing face of the shell with the boring bar to obtain proper sealing contact area (if require).

Note: The Nozzle Plate repair will be quoted as a separate item and is not part of the base scope of work.

e) Oil Deflector Repair

1. Clean and check all dimensions and clearance. Repair as necessary with the approval of the Engineer.

f) Clean and Repair Bearings

1. Repair Bore Bearings Turbine (weld repair and Machine to dimensions)
2. Perform TIG Weld or Spin Casting as required, and machine to dimension with the approval of the Engineer.

g) Gland Seal and Dummy Rings

1) Repair the centering pin, slot crush pin, and hook fit.

2) Repair or replace supporting blocks. Shall be machine to obtain required liner clearances. All materials shall be supplied by the Contractor.

h) Remove and Install Top Hat(S)

1) Quote by unitary pricing

2) Perform all the required works and test to remove and install the Top Hats and there related components (Inlet Sleeve, Bell Seals). Including but not limited to X-ray and PWHT testing procedures.

i) Oil Flushing

The Oil Flushing contractor is required to furnish all labor, materials, tools, equipment, facilities, supervision, on site job administration and superintendence required, as requested by PREPA and shall perform all work expeditiously and to the entire satisfaction of the Contracting Officer. The Oil Flushing contractor shall comply with the following specification:

1) Ultra high velocity flushing equipment capable of achieving 30 to 40 feet per second mass flow

2) Use of 0.5 micron individual filtration at each individual pedestal

3) Results are to be ISO Standard 13/10 or greater

4) Flushing the Turbine Lubrication and Control System

5) The oil flushing company shall have a minimum of five years of experience in the performance of oil flushing to steam turbine similar or equal to the reference unit.

6) The bidder shall provide with the proposal the name of the Oil Flushing Company including the certification of experience services and the certification that the company shall comply with the above requirements

ARTICLE 3. **To be furnished by Contractor**

3.1. All labor forces and supervision, job administration and superintendence personnel required, as requested by PREPA.

3.2. Necessary tools, and equipment to perform the work such as hoists, drills, grinders, air tuggers, fork lifts, cherry picker, chain falls, hydraulic and air jacks, welding machines, ladders, scaffolds, welding equipment, air compressors, tubes expansion and cutting machines, etc.

3.3. **All materials and spare parts not provided by PREPA shall be purchased by the Contractor at PREPA's request and approved by the Engineer.**

3.4. Field office facilities for Contractor's personnel.

3.5. Safety equipment, such as helmets, welder's jackets, goggles, gloves, etc.

3.6. Adequate working uniform and proper identification of Contractor's personnel.

3.7. The Contractor shall furnish materials and accessories, and expendable materials like cleaning agents, solvents, thread and gasket compounds, greases, wiping cloths, blasting materials, welding rod, drinking cups, ice, paper towels, toilet paper, etc.

3.8. All other resources or activities needed for performing the job, not furnished by PREPA, according to the Scope of Work.

3.9. Transportation of components to and from shop, as applicable.

3.10. Fabrication and delivery of parts that were broken in such a way that repair is impossible, and of which there are no replacement spare parts, as applicable.

3.11. Cleaning and painting equipment and material required for painting equipment components and others, as applicable and approved by PREPA.

3.12. Concrete foundations for equipments skids, as applicable.

3.13. **The Contractor shall provide if necessary the Punch and Roll for the shroud bands**.

Article 4. **To be furnished by PREPA**

4.1. Water, service air for pneumatic tools and electric power 120, 220 volts single phase and 480 three phase volts for tools and require machinery.

4.2. Those drawings of equipment which are available.

4.3. Parking facilities, if available.

4.4. A supervisor for local inspection and management of project.

4.5. A complete set of buckets and hardware.

4.6. A complete set of packing segments and hardware.

4.7. One new LP rotor

ARTICLE 5. **Additional Definitions**

Owner or "PREPA"

Puerto Rico Electric Power Authority
GPO Box 364267
San Juan, Puerto Rico 00936-4267

Any reference in any document, drawing or part of this Specification to the "Puerto Rico Water Resources Authority" shall be construed to be "Puerto Rico Electric Power Authority".

ARTICLE 6. **Commencement, Prosecution and Completion**

The Contractor shall start his work at the time indicated in PREPA's notice to proceed and shall at all times during the continuance of the Purchase Order, prosecute the work with such force and equipment as, in the judgment of the Engineer, are necessary to complete it within the time specified in Article 4, Commencement and Completion of Work of the Terms and Conditions. The Contractor's work program and operation shall be subject at all times to the approval of the Engineer.

ARTICLE 7. **Transportation and Storage of Materials and/or Equipment (if applicable)**

7.1. The Contractor shall be responsible for picking up and loading the materials and/or equipment from the delivery point and for transporting, unloading, uncaging, and handling the same at the site. The Contractor shall unload all materials and/or equipment within forty-eight (48) hours after arrival at the site. The salvage materials, dunnage, and scrap resulting from such work shall be disposed of by the Contractor. In the event the re-handling or relocating of materials will be deemed necessary by the Engineer, and in the best interest of the job as a whole, the Contractor shall, under the direction of the Engineer, do such re-handling at no extra charge.

7.2. The Contractor shall provide, for all equipment and material, suitable warehouse or other means of protection including weather protection and proper maintenance, satisfactory to the Engineer. Equipment subject to moisture contamination shall be kept dry with adequate heating elements by the Contractor at his own cost, in a manner satisfactory to the Engineer. The Contractor must provide inside protected storage space as the work, materials and equipment may require.

7.3. The Contractor shall protect and be responsible for all equipment supplied by PREPA against damage, theft or misuse. No equipment or material supplied by PREPA shall be placed directly on the ground, but on sleepers or structures so as to provide proper protection against the elements and the corrosive soil conditions.

ARTICLE 8. **Shipment (if applicable)**

8.1. Prior to shipment, as applicable, the Contractor shall submit the following:

A. Six (6) sets of certified test data to the Engineer.

B. Three (3) sets to the Head, Materials and Management Division and one (1) set to the Engineer of the following:

1) Shipping notices.

2) Packing list for each separate package to be shipped, showing apparatus reference markings, package weight and dimensions.

3) Two (2) copies of application for shipping instructions (one to the Head, Materials Management Division and one the Engineer).

8.2 With shipment, the Contractor shall include a packing list with each package, which shall be plainly marked "Packing List Enclosed".

ARTICLE 9. **Existing Facilities Protection**

9.1. The Contractor's operations shall be carried out with extreme care at all times to avoid damages to structures and facilities, and interference with units in operation at the site. The Contractor shall be responsible for any interference with the operation that is attributable to his negligence or fault in the performance of the work.

9.2. The Contractor shall protect to the satisfaction of the Engineer all existing site structures and equipment from damage. The Contractor at his own expense shall immediately repair any damage to these structures or equipment.

ARTICLE 10. **Subcontracts**

It shall be the Contractor's responsibility to supervise the work of his subcontractors at all times. For additional information, refer to instructions for bidders.

ARTICLE 11. **Billings by the Contractor**

11.1. All billings by the Contractor must meet PREPA's Engineer approval prior to invoices processing for payment.

11.2. All billings must be accompanied by the proper supporting papers, each showing PREPA's authorized representatives acceptance.

11.3. Vendor's and subcontractors' invoices and subcontractors' and contractors' time sheets must show PREPA's Project Manager Approval and must be submitted in original form.

11.4. **Invoice for payment are payable within thirty (30) days after receipt of invoice.**

ARTICLE 12. **Use of Site**

No materials or debris may be burned on the premises unless specific permission is obtained.

ARTICLE 13. **Progress Reports**

13.1. The Contractor shall furnish to the Engineer a summary report of the work done by the different divisions of the work under the Purchase Order, whether in the mills or shops or in the field, stating the existing status, rate of progress, estimated time of completion and cause of delays, if any. Monthly reports shall be submitted.

13.2. The Contractor shall also furnish to the Engineer a detailed weekly force report covering all craft, labor and supervision of the Contractor, and each of his subcontractors with a general description of the work performed by each craft, indicating man hours spent in the various phases of the work.

13.3. The Contractor shall submit to the Engineer his purchase order numbers, dates, description of the materials involved and the delivery dates specified. Such information is to be submitted at monthly intervals so that the Engineer will be cognizant of the current progress being made by the Contractor in the placing of orders.

13.4. The Contractor shall be solely responsible for expediting the delivery of all material and equipment to be furnished by him so that construction progress shall be maintained according to the schedule in force.

13.5. During the course of the work, the Contractor shall confer at least on a regular weekly scheduled basis with the Engineer and superintendents for the purpose of formulating the detailed work in accordance with the schedules.

ARTICLE 14. **Overtime**

When and if overtime is ordered by the Engineer, the Contractor shall be reimbursed for such authorized overtime only based on the increase in the hourly rate of labor over the straight time rate during such overtime, plus actual insurance and payroll taxes for the overtime period. No overhead of profit will be allowed on such overtime. No reimbursement will be made for overtime payment to persons engaged in the work higher than foreman. No reimbursement shall be made to the Contractor for overtime payment if ordered because of failure to meet Purchase Order commitments.

ARTICLE 15. **Engineer's Supervision and Inspection**

The Engineer's supervision and inspection is for the purpose of assuring him that the work is being properly executed in accordance with the drawings and specifications. The fact that the Project Manager is instructed to give the Contractor all desired assistance in interpreting shall not relieve the Contractor of any responsibility for the work as intended by the Purchase Order documents.

ARTICLE 16. **Testing**

16.1. Upon completion of the installation, or at such time as designated by the Engineer, all equipment and systems shall be field tested by the Contractor at his own expense. Such tests shall be witnessed by the Engineer and shall be subject to his approval. The Contractor shall furnish the necessary labor, field supervision, test instruments, material and test connections required for checking, setting, adjusting and testing the installation.

16.2. The Contractor shall maintain records of all tests performed and shall submit the records to the Engineer prior to energizing or running the equipment.

16.3. All installation deficiencies discovered during the tests shall be corrected as directed by the Engineer at the Contractor's expense.

ARTICLE 17. **Check List**

17.1. A checklist of all items in the work schedule must be prepared by the Contractor.

17.2. The Engineer must approve all items finished through his signature at the right side of such items in the checklist.

ARTICLE 18. **Schedule of Proposed Progress**

18.1. All in accordance to Article 4.2, Schedule of Proposed Progress of the Terms and Conditions, the Contractor shall submit within the time called for in the bid documents, his detailed schedule of Proposed Progress, **which shall be updated weekly.**

18.2. The Contractor's Construction Progress Schedule shall meet the approval of the Engineer.

ARTICLE 19. **Time Extensions**

The Contractor shall apply for time extensions for construction changes, unforeseeable causes, changed conditions, etc., as indicated throughout the Specification only if the schedule of proposed progress is affected. Under no circumstances shall the Contracting Officer consider applications for extra time if the master schedule is not clearly affected.

ARTICLE 20. **Executive Order No. 4385 dated January 3, 1985**

In compliance with Executive Order 4385 dated January 3, 1985 and in accordance with Article 105 of this order, the Contractor shall submit the following information to PREPA:

21.1. Trimester reports (at least one report for Purchase Orders of less than three months duration) containing the following information:

A. The names, ages and titles of all persons hired during the period covered by the report.

B. The names and ages of all persons dismissed or terminated during the period covered by the report, as well as the reason in each particular case.

21.2. A relation of all job positions available, specifying in addition, its requirements.

Attachment B

SOW	FACILITY NAME	PROJECT NAME	PROPOSED SCOPE OF WORK
1009*[7]	San Juan Power Plant	Cooling Tower Repair Work, San Juan Steam Plant – Unit 10	Work for the design, manufacture, delivery, and erection for one (1) new cell of 3,000 GPM, and the dismantling of the one (1) existing cell of the cooling towers of the San Juan Plant unit 10.
1021*	San Juan Power Plant	Unit 8 Turbine Rehabilitation	Inspection and replacement of the high pressure, intermediate pressure and low-pressure rotors of the turbine and perform all the testing and commissioning of the equipment.
1022*	San Juan Power Plant	Unit 7 Turbine Rehabilitation	Inspection and replacement of the high pressure, intermediate pressure and low-pressure rotors of the turbine and perform all the testing and commissioning of the equipment.
1027*	San Juan Power Plant	Unit 7 – Major Outage – Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work	Boiler sections replacement and repairs & auxiliary equipment inspection work.
1028*	San Juan Power Plant	Unit 8 – Major Outage – Boiler Sections Replacement and Repairs & Auxiliary Equipment Inspection Work	Boiler sections replacement and repairs & auxiliary equipment inspection work.
3051	Costa Sur Power Plant	Replacement of Air Preheater's Baskets Unit 5	Removal and replacement of the existing air-preheaters cold and hot section's baskets, sector plates, adjusters, static seal, axial plates among other components and repair air heater out casing.
3058	Costa Sur Power Plant	CS 5 Major Inspection Unit 5 – HP IP LP Turbine Rotor Replacement	Procurement for the inspection and refurbishment of the spare turbine rotors (HP/IP, LPA & LPB) for the October 2022 programmed outage.

[7] Asterisks represent Deferred Projects.

SOW	FACILITY NAME	PROJECT NAME	PROPOSED SCOPE OF WORK
3061	Costa Sur Power Plant	Caustic Soda & Acid Tanks Replacement Works Costa Sur Water Plant	Procurement and delivery of 4 stainless steel tanks (2 storage & 2 service) for the demi water plant. One pair for soda ash and one pair for sulfuric acid. Installation by plant crew.
3062	Costa Sur Power Plant	Unit 6 – HP/IP/LP Inspection (Failure)	Perform the inspection and non-destructive testing on the Lower Pressure Turbine Rotor Segment B (LP-B) due to an event that caused a major failure on this component.
4070*	Palo Seco Steam Plant	Low Pressure Turbine Rotor Refurbished Unit 3 Palo Seco Steam Plant	Inspection, transportation, maintenance and repair of the power turbine spare low-pressure rotor.