Under normal operation conditions, two out of three of the accepting apron conveyors shall be capable of handling the complete boiler feed load of PRF. Mobile equipment operators shall use their discretion as to which apron conveyor to load at the necessary time. Vibrating feeders #105 and #205 shall transfer fuel consistently from loaded apron conveyors to the powerhouse feed conveyors via the main transportation conveyor sets #110/115 and #210/215, respectively. The 300-series transfer train shall be capable of feeding fuel to either of the main transport conveyors #115 and #215 via reversible belt conveyor #315, adding a degree of possible redundancy.

The scope of supply for this contract starts at the inlet flange of the three (3) PRF apron conveyors.

3.4 FUEL TRANSPORTATION TO THE POWERHOUSE

The fuel transportation system to the powerhouse will start at the outlet flange of PRF transfer conveyors #115 and #215. Fuel will discharge from the PRF transfer belt conveyors onto two (2) Powerhouse feed belt conveyors. The powerhouse feed conveyors will then transfer the PRF out of the storage building and into the boiler building. They shall be responsible for the main elevation gain to reach the boiler feed required height. These two (2) elevating powerhouse feed conveyors will deliver the PRF onto two (2) other belt conveyors, #125 and 225, which shall be responsible for lateral transfer across the powerhouse and towards the boiler feed points.

The powerhouse feed system will then discharge onto two boiler unit reversible transfer conveyors, #130 and 230. These shall be fully functioning belt conveyors with reversible drives to add the capability of feeding either boiler unit with each. Each boiler shall have two (2) dedicated screw-type cross-feed conveyors that will feed the fuel directly into the boilers. Reversible transfer conveyor #130 shall discharge onto boiler #1 cross-feed screw conveyor #136 and boiler #2 cross-feed screw conveyor #236, while reversible conveyor #230 shall discharge onto boiler #1 cross-feed screw conveyor #138 and boiler #2 cross-feed screw conveyor #238.

The system is an over feed system so that the excess fuel from the cross-feed screw conveyors will be discharged onto two (2) boiler return conveyors (#140 and 240). Conveyors #140 and 240 will discharge back onto the distribution conveyor via boiler return conveyors #345 and 350.

This system can be seen visually from the Fuel Flow Diagram (0697 _02 FD030) attached to this specification.

3.5 FIRE PROTECTION

3.5.1 A fire protection system shall be provided by Others.

3.6 DUST COLLECTION AND SUPPRESSION

3.6.1 Dust collection and suppression systems shall be provided for all transfer points and hoppers.

3.6.2 Dust collection and suppression systems shall be sized to maintain dust concentrations in the various conveyor transfer and loading points, and enclosed conveyor galleries. The dust collection and suppression system shall be interlocked with the conveyor system to prevent operation of the conveyors in the event the dust collection and suppression system is out of service.

3.6.3 The dust collectors shall be installed with backdraft dampers.

3.7 STRUCTURAL

3.7.1 Design and furnish complete structural supports for the conveyors, hoppers, and appurtenances. Provide access via platforms, stairs, and ladders to all areas which may require attention during operation and maintenance in compliance with OSHA requirements.

3.7.2 Provide equipment supports designed for live, dead, and seismic load combinations.

3.8 SUPPORTS AND WALKWAYS

3.8.1 Platforms and walkways shall be provided to access all equipment and areas requiring routine access.

3.8.2 Platforms and walkways shall be designed for 100 psf live load.

3.8.3 Handrails and ladders shall be designed in accordance with all applicable codes.

3.8.4 Supports, platforms and walkways shall be fabricated from structural steel and be primed for field painting.

3.9 ELECTRICAL REQUIRMENTS

3.9.1 Motors shall be in accordance with the requirements listed in Attachment E.

3.10 INSTRUMENTATION

3.10.1 Unless otherwise specified, all process switches (temperature, level, speed, etc.) shall be furnished with contacts rated for 5 amps, 120 VAC. Switches shall have dry contacts.

3.10.2 All motor control devices, such as limit switches, pressure switches, etc., shall be provided with dry contacts and wired to terminals.

3.10.3 All items to be installed shall be in NEMA 4 enclosures.

3.10.4 All instruments shall be provided with alphanumeric SS tags in accordance with ISA 5.

3.10.5 All control valves shall be manufactured by ASCO or equal. Valves shall be 120 VAC with Class H coil and waterproof enclosure.

3.11 LIGHTING SYSTEMS

3.11.1 The lighting systems shall be provided by Others.

3.12 REDUNDANCY REQUIREMENTS

3.12.1 Evaluate and determine single point failure areas that would impact the operation of the plant and provide recommendations for redundancy.

3.13 EQUIPMENT SUPPLY REQUIREMENTS

3.13.1 Equipment shall be shipped in the fewest practical number of shop fabricated and assembled sections. As applicable, all component parts of machinery or equipment shall have been formed, machined, welded, stress relieved, tested for defects, balanced, fitted and assembled in the fabricator's shops, then disassembled as necessary for shipment.

3.13.2 All items shall be identified to facilitate handling and field installation.

3.13.3 All pressure part surfaces, except interior surfaces shall be thoroughly cleaned of all mill scale, grease, weld spatter, slag, and other foreign matter in accordance with Supplier's standard practice. Interior surfaces of pressure parts shall be cleaned using Supplier's standard procedures.

3.13.4 All exposed surfaces shall be given one (1) coat of inorganic zinc oxide primer, excepting that nameplates and other finished surfaces shall be coated with a slushing compound.

3.13.5 All structural steel shall be thoroughly cleaned in accordance with SSPC-SP10, Commercial or Near White Blast, and primed with an inorganic zinc oxide primer. Primer shall be held back 3 inches at all field welded joints.

3.13.6 Hot surfaces of equipment that will be insulated will not be field finish painted. An inorganic zinc oxide primer shall be used on these surfaces.

3.13.7 Cleaning and painting shall be done after fabrication. Application of the primer shall be in strict accordance with the manufacturer's printed instructions (mixing, curing, equipment cleaning, application techniques).

3.13.8 Components that will be shop finished painted shall be painted with the manufacturer's standard paint, final paint color to be approved by the Owner.

3.14 CONTROL SYSTEM

3.14.1 The systems shall be controlled through PLC incorporating a human machine interface (HMI). Important data and control signals along with system diagnostic information shall be sent to the DCS.

The vendor shall supply all equipment and associated control end devices from transfer chutes to transfer conveyors to shuttle conveyors and silos, and all equipment downstream. Control devices associated with conveyor controls shall be wired to a PLC panel located in the DCS room. The panel is supplied by the vendor. Controls shall include motor controls, motor thermal switches, conveyor pull cords, conveyor over travel switches, speed switches, position switches, plugged chute switches, conveyor local control panels, horns & beacons, bunker level transmitters and level switches, fire alarm status and dust collector statuses. Heating & Ventilating controls as well as dust collector controls and all controls associated with bunkers and downstream equipment shall be provided. The control systems shall be able to interface with the boiler control schemes in the DCS.

4. REPORTS AND QUALITY ASSURANCE

4.1 TESTING

4.1.1 **Shop Test**

4.1.1.1 All motors, controls and machinery shall be connected and all machinery on the crane shall be operated under its own power at rated voltage. The volts, amperes and watts shall be recorded for each operation. Electrical circuit and interlocks shall be tested for correct operation and sequence and all tests shall be witnessed and approved by the Buyer.

4.1.2 **Site Tests**

The Buyer will perform the following tests on the equipment with the assistance of the Seller's technical advisor:

4.1.2.1 125% of the rated capacity test as per CMAA Specification 70

4.1.2.2 Throughput/capacity tests over a 3-day period to confirm performance guarantees

4.1.2.3 The load shall be both raised and lowered at both creep and normal speeds of hoisting.

4.1.2.4 The crane shall be operated to transport test loads of 100% of the rated capacity for the full available lengths of the runway and bridge.

4.1.2.5 Verification and recordings of test weights shall be in the presence of the Buyer.

4.1.2.6 Before starting the test, the hoist shall be operated under light loads for at least two (2) hours in order to run-in the gearing and to ensure proper lubrication. After this run-in period the cranes shall be inspected to determine if all parts have remained in correct alignment and no excessive wear has occurred.

4.1.2.7 Electrical input and hoisting and lowering speed data shall be compiled and recorded. All interlocks and safety devices shall be tested.

4.1.2.8 In addition a deflection check of each main girder frame shall be made with the trolley in its central position supporting the maximum safe working load.

4.1.2.9 On completion of the tests the crane will be checked for alignment, breakage and excessive wear.

4.2 GUARANTEES AND WARRANTY

4.2.1 The equipment shall be guaranteed to meet the performance requirements as stated in Attachment C.

4.3 REPORTS

With equipment shipment, the Seller shall submit the following:

4.3.1 Certified test reports for all tests.

4.3.2 **Instrumentation**

4.3.2.1 An ISA style data sheet shall be provided for each instrument supplied under this specification. Representative copies can be supplied by the Buyer if required. Each data sheet shall include, as a minimum, the following:

Tag Number	Service
Process Fluid	Process Span
Calibration	Sizing Data
Setpoint	Contact Rating
Enclosure NEMA Rating	Manufacturer

Model Number

All data sheets shall be submitted to and must receive Buyer approval prior to Seller purchasing any instrument.

4.3.2.2 Instrument tag numbers will be assigned by the Seller and reviewed by the Buyer. The Buyer will supply a tag structure and loop range for the Seller to use. Any instrument tag number revisions will be supplied by the Buyer to the Seller as comments on the Buyer's return of the Seller's Piping & Instrumentation Diagrams.

4.3.3 **Instrument Calibration**

4.3.3.1 All instruments shall be calibrated. A Calibration Sheet shall be provided for each instrument supplied under this specification. Each Calibration Sheet shall include, as a minimum, the following information:

- Date
- Tag Number
- Service
- Calibration Reference
- Signature of Calibrator

4.3.3.2 Each analog instrument shall be calibrated at 0%, 25%, 50%, 75%, and 100% of span, showing the desired and actual reading.

4.3.3.3 Each digital instrument shall be transitioned from normal to above setpoint and back to normal. Desired and actual setpoints shall be recorded as well as reset.

4.4 QUALITY CONTROL

Seller Quality Control activities shall be in accordance with SLCI Specification PSQC-001.

5. MARKINGS, NAMEPLATES AND SHIPMENT

5.1 MARKING

All equipment and components shall be identified with equipment numbers per Attachment C and match-marked to assist field assembly and erection. All items shipped shall be accompanied by instructions for storing and protection.

5.2 IDENTIFICATION PLATES

5.2.1 Equipment names and numbers shall be as stated in Attachment C.

5.2.2 Any fittings and material shipped loose shall have a metal tag with identifying number securely affixed by means of metal chain.

5.2.3 The rated load of the cranes and hoists shall be marked on each side of the equipment and shall be visible from the operating floor. Additionally, permanent stainless steel data plates shall be affixed prominently on each crane and block. The following information shall be provided on the equipment nameplate: Service, Maximum load capacity, CMAA type

5.2.4 All control panels shall bear the UL508 label.

5.3 SHIPPING

5.3.1 Seller Preparation for Shipment shall be in accordance with SLCI Specification PSQC-001.

5.3.2 All equipment and components shall be properly packaged to withstand shipment without damage. Each package shall be clearly labeled on the outside as to its contents. Seller shall include a complete packing list and bill of material.

5.3.3 All equipment shall be sealed to prevent entry of water, dirt or other foreign matter. Seals used on nozzles shall not affect threads, weld preparation or flange faces.

6. SPARE PARTS AND SPECIAL TOOLS

6.1 SPARE PARTS

The Seller shall supply all spares needed for startup and testing. Quote separately from the base proposal.

The Seller shall provide a list of spare parts and consumables required during the installation, startup, and on-site testing for all equipment furnished.

6.2 SPECIAL TOOLS

The Seller shall provide all special tools and devices required for the installation, operation, and maintenance of the furnished equipment, whether from the Seller or any sub-Seller. The special tools shall be accompanied by any necessary explanatory information.

Attachment A

Information and Drawing Requirements from Seller (LATER)

Attachment B

Project Specific Data

B1 SITE CONDITIONS

Plant Location:	Barrio Cambalache, Arecibo, Puerto Rico
Plant Elevation:	15 ft ASL
Equipment Location:	Indoors/Outdoors
Ambient Conditions:	
Outdoor	
Dry Bulb Temperature (°F):	86
Wet Bulb Temperature (°F):	79.7 @ 86 coincidental dry bulb
Relative Humidity (%):	76
Design High Temperature (°F):	100
Design Low Temperature (°F):	60
Indoor	
Dry Bulb Temperature (°F):	100
Design High Temperature (°F):	115
Design Low Temperature (°F):	60
Building Code	IBC 2009 as adopted/amended by the Puerto Rico 2011 Building Code
Site Classification	Site Class E
Seismic Zone:	IBC (I=1.25), Ss=1.15, S1=0.38
Wind Conditions:	Exposure C; hurricane prone region; wind speed (3 second gust) = 145mph, Iw = 1.15
Ground Snow Load (psf):	0 (Pg ground snow)

B2 PROJECT DESIGN

This project will consist of two (2) spreader-stoker boilers and one (1) steam turbine in a 2-on-1 configuration. The boilers will be designed for processed refuse fuel derived from municipal solid waste. Boiler generated steam will be fed to a non-reheat, condensing steam turbine to generate electricity. The steam turbine discharge will be exhausted to a surface condenser and cooling water will be supplied by a mechanical draft evaporative cooling tower. Boiler feedwater will be heated by steam turbine extractions through a series of indirect & direct contact feedwater heaters in this Rankine cycle system.

B3 UTILITIES AVAILABLE

Power Supply:

	480 Volts, 3 phase, 60 Hz, 65 kA IC Motor Voltage 460V
	120 Volts, 1 phase, 60 Hz, 22 kA IC
	125 Volts DC, for Critical Control Power
	120 Volts, 1 phase, 60 HZ, 22 kA IC, for essential power from UPS

Motors per Specification E200

B4 FUEL CHARACTERISTICS

Energy Answers named the fuel utilized in its system Processed Refuse Fuel (PRF) in order to clearly identify it as a fuel which is created from refuse but requires only minimum processing (shredding) in place of multi-step processing necessary to manufacture traditional Refuse Derived Fuel (RDF). Energy Answers' PRF technology ensures that virtually all the combustible material in the fuel is actually burned whereas in traditional RDF processes, a high percentage of the incoming material is removed in the preparation of the RDF and sent to landfill.

The Project is designed to produce renewable power by combusting primarily PRF, with urban wood waste, tire chips, and ASR as supplementary fuels. Only PRF whose initial sources were residential wastes, non-hazardous industrial wastes, or commercial wastes will be accepted at the Facility. Non-hazardous residential and/or commercial waste from other regions may also be accepted at the off-site fuel production facilities, if necessary, to supplement waste generated within the primary service area.

The PRF technology creates a uniformly small particulate sized fuel material through the shredding process that increases the available surface area for combustion. The fuel is burned on a travelling grate in specifically designed boilers.

Unacceptable materials that are not suitable for processing will be removed at the on-site fuel production facility prior to processing. The scope of this facility is not included in this specification.

A quality assurance plan will be implemented at the PRF Production Facility to prevent delivery to the Power Plant of loads of PRF generated from unacceptable waste. Unacceptable and non-processible materials will be removed at the PRF production facilities and transported to markets or designated landfill disposal sites. The acceptable and unacceptable materials for production of PRF for the Power Plant are described as follows:

B4.1 Acceptable Materials

Acceptable materials that will be processed into PRF includes that portion of solid waste which has the characteristics of waste collected and disposed of as part of normal household municipal waste collection programs, as well as commercial/retail waste and non-hazardous waste from industrial facilities. Acceptable waste includes, but is not limited to, garbage, trash, rubbish, and refuse. Acceptable waste also includes those wastes allowed to be received and processed in accordance with the operating permits for the Power Plant. It does not include "Unacceptable Materials."

Based on 1996 and 1997 operating data from the SEMASS facility, approximately 0.9% (by weight) of the initial wastes received by that facility was non-processible or unacceptable materials (which were removed prior to processing). It is expected that similar circumstances will be experienced at the PRF Production Facility serving the Power Plant.

USEPA provides an average national MSW composition which is considered appropriate for planning purposes for this project. It is expected that the waste processed into PRF, at the PRF production facility, will generally conform to the reference waste analysis presented in **Table 1**, shown below. **Table 2**, shown below, lists the anticipated break-down of particle size related to the delivered PRF.

Table 1 – PRF Waste Analysis Breakdown

Component	Percentage of Incoming Material (by weight)
Paper and Paperboard	22.3
Glass	6.1
Steel	6.1
Aluminum	1.5
Other non-ferrous Metals	0.3
Plastics	16.9
Rubber and Leather	3.8
Textiles	5.9

Wood	7.6
Other Organic	1.9
Food Waste	18.2
Yard Trimmings	6.9
Miscellaneous Inorganic	2.2
TOTAL	100

Table 2 – Break-down of Particle Size of Delivered PRF

Mesh Size	Range(Weight % passed)	
3 Dimensional (ins)	Recommended	Range
6	100	100
4	95	85-100
2	85	75-95
1	70	60-80
¾	60	50-70
½	50	40-60
¼	30	20-40
1/8	20	10-30
1/16	10	5-15

B4.2 Unacceptable Materials

Unacceptable materials that will not be processed into PRF includes radioactive material, explosive material, cesspool and other human wastes, industrial sludge, liquids, ashes and other combustion residues, human and animal remains, motor vehicles, trailers, marine vessels, pathological and biological wastes, infectious and chemotherapeutic wastes, foundry sand, offal, agricultural and farm machinery and equipment, lead-acid automobile batteries, cathode ray tubes, button batteries, fluorescent bulbs, mercury-bearing electrical switches and thermostats or any material which may present a substantial endangerment to health or safety or a reasonable possibility of adversely affecting the operations of the Power Plant.

B4.3 PRF Inspection

The Power Plant will establish contractual terms with fuel suppliers to ensure that waste will be inspected thoroughly at the PRF Production Facility to remove readily identifiable unacceptable wastes which may be contained in the waste stream prior to processing. It is expected that the waste processed into PRF at the PRF Production Facilities will generally conform to the reference waste analysis presented in **Table 3**, shown below.

Table 3 – Ultimate Analysis of PRF

Components	Percentage (by weight)
Moisture	24.12
Inerts (Ash)	14.61
N	0.77
H	4.29
O	21.69
S	0.10
C	33.97
Cl	0.70
TOTAL	100.00
Minimum Higher Heating Value (BTU/lb)	5,400
Average Higher Heating Value (BTU/lb)	5,700
Maximum Higher Heating Value (BTU/lb)	7,600

The actual composition of PRF is expected to vary to some degree both seasonally and as a result of waste reduction and recycling programs implemented in the Barrio Cambalache area. The Power Plant will have the flexibility to combust acceptable PRF over the potential variations in PRF composition. To account for variations in the quality of incoming acceptable materials for PRF production, the Power Plant will be designed to accommodate PRF having the range of composition as follows:

- HHV (BTU/lb) 5,400 – 7,600
- Moisture up to 42% (by weight)
- Inerts up to 24% (by weight)

Attachment C

Design Requirements

C1 PRF HANDLING SYSTEM FUNCTION

The function of the complete PRF Material Handling System is to store, reclaim, and feed PRF in an efficient and effective manner to the two new boilers associated with the Arecibo Renewable and Alternate Energy Project.

The PRF plant handling facilities shall be a triple (3) line system capable of providing 100% redundancy to all units at boiler maximum combustion rate (BMCR) using PRF having an average heating value. As there is no facility to store PRF in the powerhouse, the system will run on a continuous basis 24 hour per day, 7 days per week, and 365 days per year.

C1.1 Power Plant consumption rates

The Power Plant will be designed to combust an average of 2,100 tons per day (TPD) of PRF and Supplemental Fuels, having a reference HHV of 5,700 BTU/lb, to generate electricity and steam. On an annual average basis, each of the two (2) boilers will be operated at a heat input rate of 500 million BTU per hour (MMBTU/hr). This heat input rate (i.e., operating level) translates to a fuel feed rate for each of the two boilers of approximately 44 tons of PRF per hour.

Table 4, shown below, lists the weekly quantity of fuel combusted at maximum continuous rating operating level (MCR). (This equates to each boiler operated at a heat input rate of 550 million BTU/hr (MMBTU/hr).

Table 5, shown below, lists the weekly quantity of fuel combusted at annual average operating level operating level, heat input rate of 500 MMBTU/hr.

Table 4 – Weekly Fuel Combusted at Maximum Short-Term Operating

Fuel Heating Value (BTU/lb)	Fuel Combusted at the Power Plant (tons per week)
5,400	17,111
5,700	16,211
7,600	12,158

Table 5 – Weekly Fuel Combusted at Annual Average Operating

Fuel Heating Value (BTU/lb)	Fuel Combusted at the Power Plant (tons per week)
5,400	15,556
5,700	14,737
7,600	11,053

C1.2 Basis of Design

The fuel handling system shall be designed to obtain maximum reliability and efficiency using current technology with all selected equipment having proven capability for the service requirement. The general philosophy is to employ equipment capable of providing a consistent product and feed rate to the boilers and maintain an uninterrupted supply of fuel at the 5,700 BTU/lb HHV to the boilers at 100% MCR (24 hours/day, 7 days/week, fifty-two weeks/year).

All equipment will be suitable for continuous operation.

At these conditions, fuel reclaim and feed to the powerhouse shall be designed to handle capacity of 100 tph (50 tph per each conveyor line). This capacity is based on the accumulative capacity of two (2) separate feed systems from the fuel storage building in continuous operation at 100% MCR with a 10% margin added.

All equipment and conveyors must have the ability to capably handle this operating capacity. Conveyor belt widths and speed shall be selected for their capability to comfortably handle this tonnage rate without creating wind born suspension of fuel and minimize the generation of dust.

Conveyor drives shall be selected to meet the horsepower requirements of the peak tonnage and also to maximize the use of standardization for replacement purposes.

All conveyors shall be designed to start up under fully loaded conditions.

All conveyors shall be provided with the necessary safety switches at both the head and tail end and walkways shall have a continuous emergency stop pull cord system.

All chutework that will experience contact with fuel flow shall be lined with continuous stainless steel liner plates and chute corners shall be rounded to aid fuel flow and minimize fuel hang-ups.

All conveyor idlers shall be a minimum of CEMA C5 class and have a rated minimum L10 life of 50,000 hours.

All conveyor belting and lubricating oils shall be of a fire resistant nature.

C1.3 Specified Design Guidelines

Table 7, show below, lists the specified design guidelines to be used by the contractor for the design of the PRF handling facilities.

Table 7 – Specified Design Guidelines

Description	Design Guideline
PRF Bulk Density (as received)	20 PCF
PRF Bulk Density (conveyor design)	10 PCF
Conveyor belt width	Determined by the Seller
Conveyor belt Speed (max)	250 fpm
CEMA percentage belt loading	No more than 100%
Conveyor peak design capacity	50 tph
Maximum conveyor slope	13 degrees

Attachment D

Equipment Data

Seller to supply description and details in their standard format with proposal.

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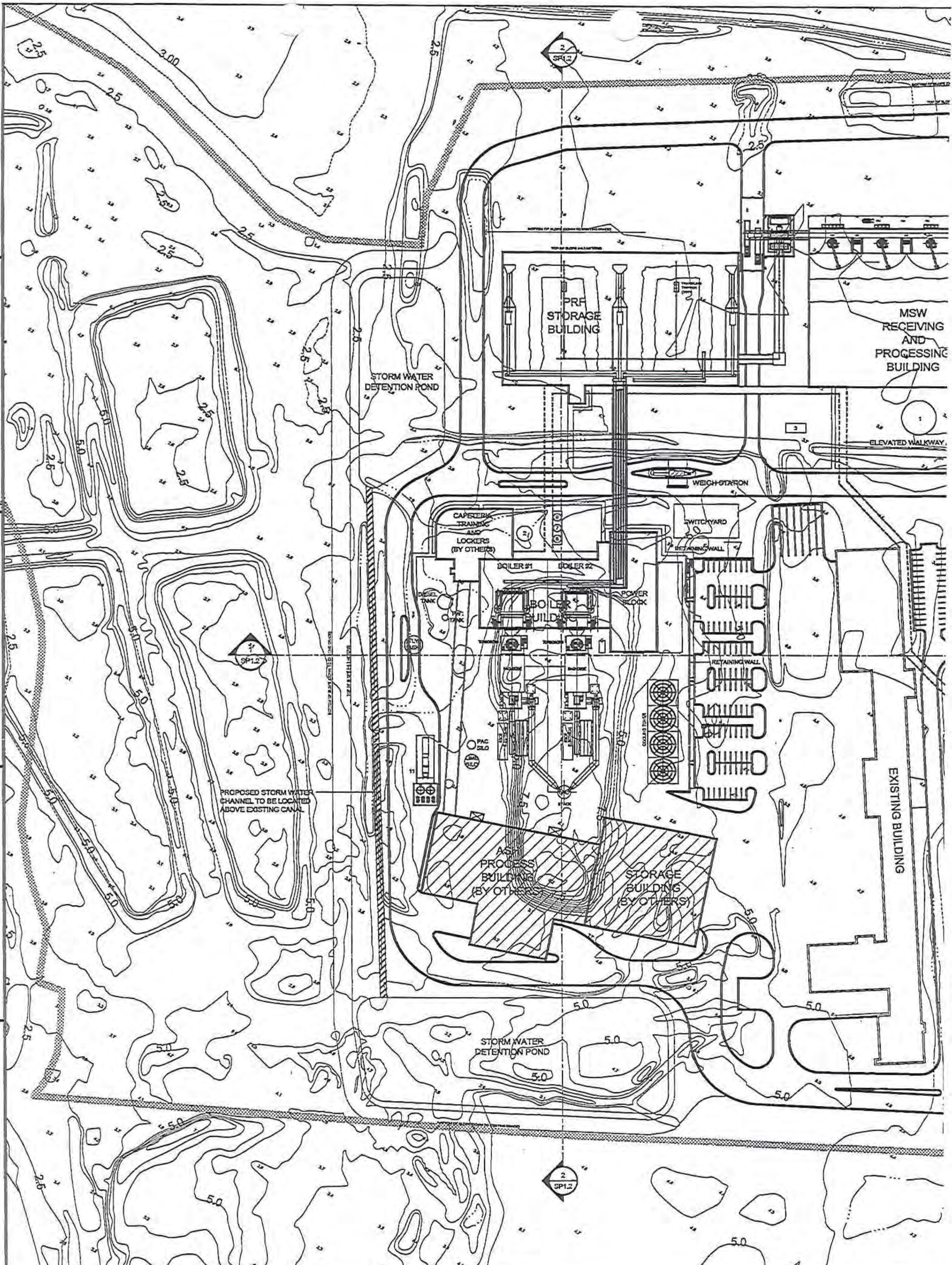

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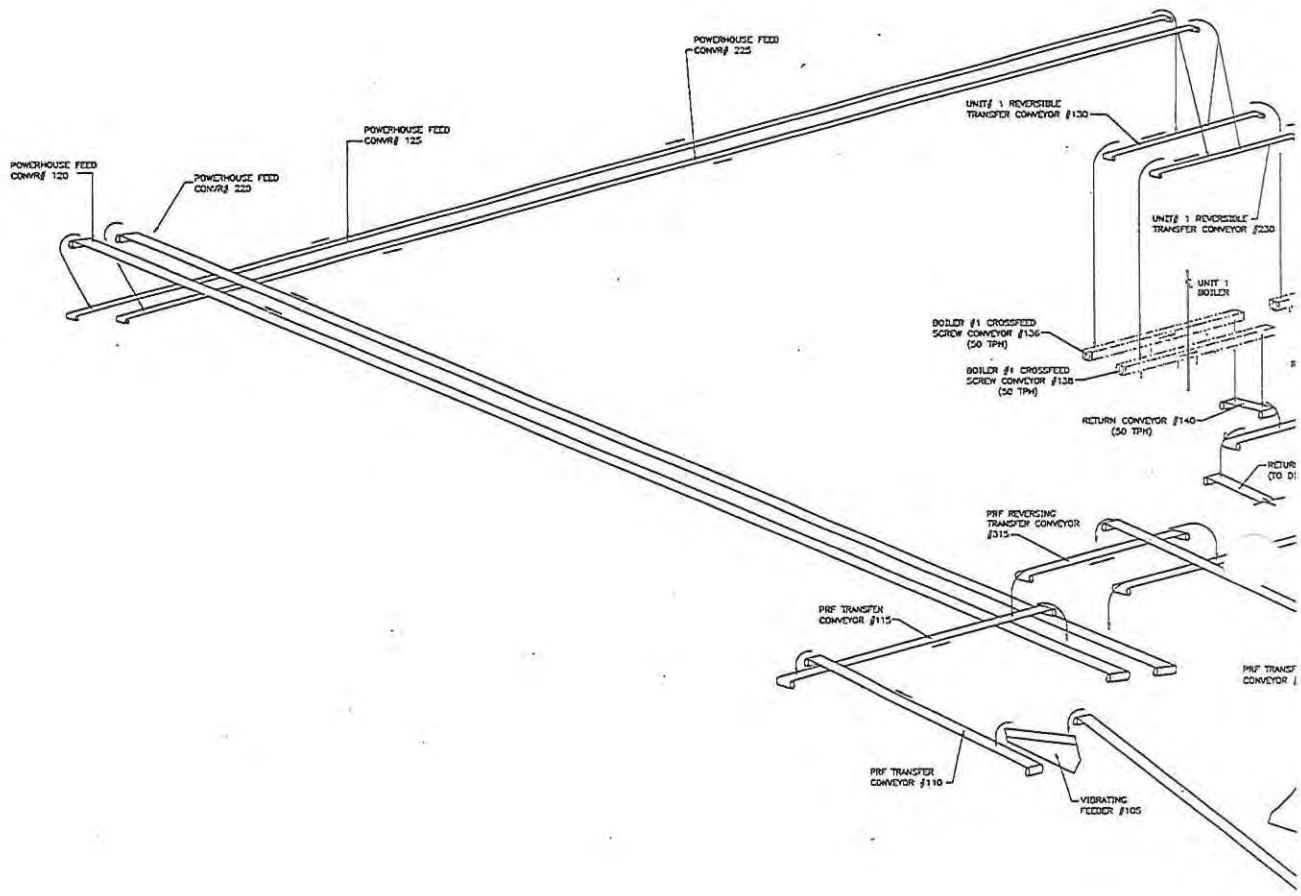

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SNC·LAVALIN
Constructors
Bothell, Washington

SPECIFICATION SP-F905.1

REVISION 0

FOR

PRF MATERIAL HANDLING SYSTEM

FOR

PROPOSAL NO. 22069700

ARECIBO RENEWABLE AND ALTERNATE ENERGY PROJECT
ARECIBO, PUERTO RICO

ORIGINAL

Engineer: _____ Date: 8/22/11

Project Technical Manager: _____ Date: 8/22/11

Approval: _____ Date: 8/22/11

REVISION INDEX

Revision 0 dated August 22, 2011

Original Issue

TABLE OF CONTENTS

1. EXTENT OF WORK

This Specification covers the requirements for the engineering, design, manufacture and delivery of a complete Processed Refuse Fuel Handling System including all required accessories and appurtenances as specified herein.

WORK INCLUDE COMPLETENESS AND INTENT

The work called for in this Specification shall be complete in every detail and shall conform to the particular details set out in the Specification. Any equipment not specifically mentioned in the specification but is required for the safe, efficient, proper and convenient operation and maintenance of the equipment shall be deemed to have been included and shall be included by the bidder.

Plant reliability is of the utmost importance. Consequently, the intent of this Specification is to obtain equipment of proven reliability and design for the Processed Refuse Fuel (PRF) handling facilities.

The PRF handling and transfer system to the powerhouse shall operate on an "on demand" basis to provide adequate PRF fuel to satisfy the demands of two power plant units amounting to a total power generation of 77 MW. The reclaim and delivery system to the powerhouse shall be capable of operating 24 hours per day, 7 days per week, 356 days per year.

Bidders shall make the best selection of equipment and materials based on the requirements of the Specification and having due regard for the conditions under which the equipment will operate.

TERMINAL POINTS FOR THIS CONTRACT

The terminal points for this contract shall be:

a) Discharge of two (2) belt conveyor travelling trippers into Fuel Storage Building
b) The inlet of the three (3) apron conveyors being fed by mobile equipment and responsible for fuel feed uptake.
c) The inlet flange of the screw crossfeed conveyors located on the fuel feed hoppers within the powerhouse.
d) The final outlet flanges of the screw crossfeed conveyors to the final discharge of the return conveyor system.
e) The underside of all baseplates for supporting the PRF handling facilities.
f) PRF equipment concrete foundations within the fuel receiving building.
g) PRF equipment supporting floor steel within the powerhouse.
h) Instrument and service air supply to individual components.
i) Junction boxes, cubicles and motor terminal boxes.
j) Fixed grounding points for external grounding of equipment being supplied.

1.1 WORK INCLUDED

The information included in this Specification relates to the complete supply of all structural, mechanical, and electrical equipment associated with the required PRF handling facilities.

The work shall consist of the design, manufacture, testing, delivery, and guaranteeing of all equipment and structure associated with the complete PRF handling facilities for the Arecibo Renewable Energy Project.

The work shall conform to the requirements of this specification and the associated drawings.

This will consist of the following equipment and associated structures:

See "0697 _02 FD030 – Fuel Flow Diagram" for a depiction of system equipment layout, numbering, and fuel flow progression

- Three (3) apron conveyors, to be loaded by means of mobile transport equipment
- Three (3) vibrating conveyor feeders
- Five (5) fully functional PRF transfer belt conveyors from the vibrating feeder outlets to the powerhouse feed conveyors.
- One (1) reversing transfer belt conveyor for PRF redundancy line.
- Four (4) fully functional belt conveyors for transfer from storage building to the powerhouse, responsible for main elevation gain.
- Appropriate gallery housing and associated supporting structures for Powerhouse feed conveyors #120 and 220, exposed to outdoor conditions.
- Two (2) fully functioning reversible transfer conveyors for boiler unit feed redundancy.
- Four (4) screw type cross-feed conveyors, two per boiler unit.
- Four (4) transfer belt conveyors responsible for fuel return from boiler feed overflow to distribution conveyor.
- All appropriate and necessary sets of transition chute work, skirting, and supports at critical connection and transfer points.
- All additional steelwork and fabrication to complete a fully functional operating system.
- All conveyor and diverter gate drives.
- All applicable guarding.
- All associated safety switches and junction boxes.

- All liner plate material for interconnecting chutework. Flop gates, and conveyor skirting.
- All bolts, washers, and nuts for interconnecting chutework and support structure
- Surface preparation, prime and finish coat painting of all supplied equipment and structures.

1.2 ALTERNATIVES

The bidder shall in all cases bid against the requirements of the Specification and associated drawings. However, bidders may offer alternatives together with full technical and pricing details, provided that they firstly submit bids for the specified requirements.

Only alternatives that serve to reduce capital cost and improve efficiency of the operation will be considered.

1.3 WORK NOT INCLUDED

The following work is not included in this Specification and will be supplied by others:

- Fuel receiving building structure and foundations
- Fuel storage building structure and foundations
- Installation, testing, and commissioning of all PRF handling equipment provided by the contractor
- Design and construction of all concrete foundations associated with the PFR handling equipment. Note that the contractor shall provide all loads for equipment within his scope of work.
- Switchgear, motor control centers, trays and electrical cabling between purchasers supplied control room and contractor supplied junction boxes, unless otherwise specified in this Specification.
- Power supply to motor terminal boxes
- Lubricating oils, grease, and hydraulic oils (other than the initial fill)
- Auxiliary supplies of AC and DC to energize controls

2. APPLICABLE CODES, STANDARDS AND REGULATIONS

2.1 CODES AND STANDARDS

Equipment covered in this specification shall comply with all currently approved standards, safety codes, and test codes in effect as of the date of this specification, including the following:

American Chain Association	(ACA)
American Gear Manufacturer's Association	(AGMA)
Anti-Friction Bearing Manufacturers Association, Inc.	(AFBMA)
American Iron and Steel Institute	(AISI)
American Institute of Steel Construction	(AISC)
American National Standards Institute	(ANSI)
American Society for Testing Materials	(ASTM)
American Society of Mechanical Engineers	(ASME)
American Welding Society	(AWS)
Conveyor Equipment Manufacturer's Association	(CEMA)
Institute of Electrical & Electronic Engineers	(IEEE)
Instrument Society of America	(ISA)
National Electrical Code	(NEC)
National Electrical Manufacturers Association	(NEMA)
National Fire Protection Agency	(NFPA)
Occupational Health and Safety Act	(OSHA)
Steel Structures Painting Council	(SSPC)
Uniform Building Code	(UBC)\
Applicable Building Codes	(as noted in Attachment B)

3. TECHNICAL REQUIREMENTS

3.1 PRF HANDLING SYSTEM FUNCTION

The function of the complete PRF Handling System is to receive, store, reclaim, and feed PRF to the two new boilers associated with the Arecibo Renewable and Alternate Energy Project. The PRF plant handling facilities shall be a triple (3) line system capable of providing 100% redundancy to all units at boiler maximum combustion rate (BMCR) using PRF having an average heating value of 5,700 BTU/lb.

The complete system is designed to move to storage, store, reclaim and transport PRF to the power boilers in an efficient and effective manner. As there are minimal facilities to store PRF in the powerhouse the system will run on a continuous basis 24 hour per day, 7 days per week, and 365 days per year.

3.2 FUEL RECEIVING FACILITIES

The MSW receiving and processing system is **not** included in the scope of this material handling specification.

3.3 FUEL DISTRIBUTION AND RECLAIM

"0697 GA001" is a general arrangement which includes the PRF Storage Building and layout of the associated handling system.

Fuel distribution and reclaim within the fuel storage building will be performed by operators utilizing up to three (3) mobile rubber tired loaders such as a CAT 980 each having a 10 yd capacity bucket. These loaders will be responsible for reclaiming and depositing the PRF into one of three (3) PRF accepting apron conveyors.

Each of the PRF apron conveyors will serve to provide a consistent uptake of fuel and have the capacity to accept a fully loaded loader bucket at any time during normal operation. Fuel will be transferred by belt conveyor from the apron conveyors to associated PRF vibrating feeders. Each of the vibrating feeders shall meter a smooth flow of fuel from the fuel storage and transportation system to the powerhouse via a series of transfer conveyors. Seller to provide appropriate transfer chute work and skirt plates as needed.

Under normal operation conditions, two out of three of the accepting apron conveyors shall be capable of handling the complete boiler feed load of PRF. Mobile equipment operators shall use their discretion as to which apron conveyor to load at the necessary time. Vibrating feeders #105 and #205 shall transfer fuel consistently from loaded apron conveyors to the powerhouse feed conveyors via the main transportation conveyor sets #110/115 and #210/215, respectively. The 300-series transfer train shall be capable of feeding fuel to either of the main transport conveyors #115 and #215 via reversible belt conveyor #315, adding a degree of possible redundancy.

The scope of supply for this contract starts at the inlet flange of the three (3) PRF apron conveyors.

3.4 FUEL TRANSPORTATION TO THE POWERHOUSE

The fuel transportation system to the powerhouse will start at the outlet flange of PRF transfer conveyors #115 and #215. Fuel will discharge from the PRF transfer belt conveyors onto two (2) Powerhouse feed belt conveyors. The powerhouse feed conveyors will then transfer the PRF out of the storage building and into the boiler building. They shall be responsible for the main elevation gain to reach the boiler feed required height. These two (2) elevating powerhouse feed conveyors will deliver the PRF onto two (2) other belt conveyors, #125 and 225, which shall be responsible for lateral transfer across the powerhouse and towards the boiler feed points.

The powerhouse feed system will then discharge onto two boiler unit reversible transfer conveyors, #130 and 230. These shall be fully functioning belt conveyors with reversible drives to add the capability of feeding either boiler unit with each. Each boiler shall have two (2) dedicated screw-type cross-feed conveyors that will feed the fuel directly into the boilers. Reversible transfer conveyor #130 shall discharge onto boiler #1 cross-feed screw conveyor #136 and boiler #2 cross-feed screw conveyor #236, while reversible conveyor #230 shall discharge onto boiler #1 cross-feed screw conveyor #138 and boiler #2 cross-feed screw conveyor #238.

The system is an over feed system so that the excess fuel from the cross-feed screw conveyors will be discharged onto two (2) boiler return conveyors (#140 and 240). Conveyors #140 and 240 will discharge back onto the distribution conveyor via boiler return conveyors #345 and 350.

This system can be seen visually from the Fuel Flow Diagram (0697 _02 FD030) attached to this specification.

3.5 FIRE PROTECTION

3.5.1 A fire protection system shall be provided by Others.

3.6 DUST COLLECTION AND SUPPRESSION

3.6.1 Dust collection and suppression systems shall be provided for all transfer points and hoppers.

3.6.2 Dust collection and suppression systems shall be sized to maintain dust concentrations in the various conveyor transfer and loading points, and enclosed conveyor galleries. The dust collection and suppression system shall be interlocked with the conveyor system to prevent operation of the conveyors in the event the dust collection and suppression system is out of service.

3.6.3 The dust collectors shall be installed with backdraft dampers.

3.7 STRUCTURAL

3.7.1 Design and furnish complete structural supports for the conveyors, hoppers, and appurtenances. Provide access via platforms, stairs, and ladders to all areas which may require attention during operation and maintenance in compliance with OSHA requirements.

3.7.2 Provide equipment supports designed for live, dead, and seismic load combinations.

3.8 SUPPORTS AND WALKWAYS

3.8.1 Platforms and walkways shall be provided to access all equipment and areas requiring routine access.

3.8.2 Platforms and walkways shall be designed for 100 psf live load.

3.8.3 Handrails and ladders shall be designed in accordance with all applicable codes.

3.8.4 Supports, platforms and walkways shall be fabricated from structural steel and be primed for field painting.

3.9 ELECTRICAL REQUIRMENTS

3.9.1 Motors shall be in accordance with the requirements listed in Attachment E.

3.10 INSTRUMENTATION

3.10.1 Unless otherwise specified, all process switches (temperature, level, speed, etc.) shall be furnished with contacts rated for 5 amps, 120 VAC. Switches shall have dry contacts.

3.10.2 All motor control devices, such as limit switches, pressure switches, etc., shall be provided with dry contacts and wired to terminals.

3.10.3 All items to be installed shall be in NEMA 4 enclosures.

3.10.4 All instruments shall be provided with alphanumeric SS tags in accordance with ISA 5.

3.10.5 All control valves shall be manufactured by ASCO or equal. Valves shall be 120 VAC with Class H coil and waterproof enclosure.

3.11 LIGHTING SYSTEMS

3.11.1 The lighting systems shall be provided by Others.

3.12 REDUNDANCY REQUIREMENTS

3.12.1 Evaluate and determine single point failure areas that would impact the operation of the plant and provide recommendations for redundancy.

3.13 EQUIPMENT SUPPLY REQUIREMENTS

3.13.1 Equipment shall be shipped in the fewest practical number of shop fabricated and assembled sections. As applicable, all component parts of machinery or equipment shall have been formed, machined, welded, stress relieved, tested for defects, balanced, fitted and assembled in the fabricator's shops, then disassembled as necessary for shipment.

3.13.2 All items shall be identified to facilitate handling and field installation.

3.13.3 All pressure part surfaces, except interior surfaces shall be thoroughly cleaned of all mill scale, grease, weld spatter, slag, and other foreign matter in accordance with Supplier's standard practice. Interior surfaces of pressure parts shall be cleaned using Supplier's standard procedures.

3.13.4 All exposed surfaces shall be given one (1) coat of inorganic zinc oxide primer, excepting that nameplates and other finished surfaces shall be coated with a slushing compound.

3.13.5 All structural steel shall be thoroughly cleaned in accordance with SSPC-SP10, Commercial or Near White Blast, and primed with an inorganic zinc oxide primer. Primer shall be held back 3 inches at all field welded joints.

3.13.6 Hot surfaces of equipment that will be insulated will not be field finish painted. An inorganic zinc oxide primer shall be used on these surfaces.

3.13.7 Cleaning and painting shall be done after fabrication. Application of the primer shall be in strict accordance with the manufacturer's printed instructions (mixing, curing, equipment cleaning, application techniques).

3.13.8 Components that will be shop finished painted shall be painted with the manufacturer's standard paint, final paint color to be approved by the Owner.

3.14 CONTROL SYSTEM

3.14.1 The systems shall be controlled through PLC incorporating a human machine interface (HMI). Important data and control signals along with system diagnostic information shall be sent to the DCS.

The vendor shall supply all equipment and associated control end devices from transfer chutes to transfer conveyors to shuttle conveyors and silos, and all equipment downstream. Control devices associated with conveyor controls shall be wired to a PLC panel located in the DCS room. The panel is supplied by the vendor. Controls shall include motor controls, motor thermal switches, conveyor pull cords, conveyor over travel switches, speed switches, position switches, plugged chute switches, conveyor local control panels, horns & beacons, bunker level transmitters and level switches, fire alarm status and dust collector statuses. Heating & Ventilating controls as well as dust collector controls and all controls associated with bunkers and downstream equipment shall be provided. The control systems shall be able to interface with the boiler control schemes in the DCS.

4. REPORTS AND QUALITY ASSURANCE

4.1 TESTING

4.1.1 **Shop Test**

4.1.1.1 All motors, controls and machinery shall be connected and all machinery on the crane shall be operated under its own power at rated voltage. The volts, amperes and watts shall be recorded for each operation. Electrical circuit and interlocks shall be tested for correct operation and sequence and all tests shall be witnessed and approved by the Buyer.

4.1.2 **Site Tests**

The Buyer will perform the following tests on the equipment with the assistance of the Seller's technical advisor:

4.1.2.1 125% of the rated capacity test as per CMAA Specification 70

4.1.2.2 Throughput/capacity tests over a 3-day period to confirm performance guarantees

4.1.2.3 The load shall be both raised and lowered at both creep and normal speeds of hoisting.

4.1.2.4 The crane shall be operated to transport test loads of 100% of the rated capacity for the full available lengths of the runway and bridge.

4.1.2.5 Verification and recordings of test weights shall be in the presence of the Buyer.

4.1.2.6 Before starting the test, the hoist shall be operated under light loads for at least two (2) hours in order to run-in the gearing and to ensure proper lubrication. After this run-in period the cranes shall be inspected to determine if all parts have remained in correct alignment and no excessive wear has occurred.

4.1.2.7 Electrical input and hoisting and lowering speed data shall be compiled and recorded. All interlocks and safety devices shall be tested.

4.1.2.8 In addition a deflection check of each main girder frame shall be made with the trolley in its central position supporting the maximum safe working load.

4.1.2.9 On completion of the tests the crane will be checked for alignment, breakage and excessive wear.

4.2 GUARANTEES AND WARRANTY

4.2.1 The equipment shall be guaranteed to meet the performance requirements as stated in Attachment C.

4.3 REPORTS

With equipment shipment, the Seller shall submit the following:

4.3.1 Certified test reports for all tests.

4.3.2 **Instrumentation**

4.3.2.1 An ISA style data sheet shall be provided for each instrument supplied under this specification. Representative copies can be supplied by the Buyer if required. Each data sheet shall include, as a minimum, the following:

Tag Number	Service
Process Fluid	Process Span
Calibration	Sizing Data
Setpoint	Contact Rating
Enclosure NEMA Rating	Manufacturer

Model Number

All data sheets shall be submitted to and must receive Buyer approval prior to Seller purchasing any instrument.

4.3.2.2 Instrument tag numbers will be assigned by the Seller and reviewed by the Buyer. The Buyer will supply a tag structure and loop range for the Seller to use. Any instrument tag number revisions will be supplied by the Buyer to the Seller as comments on the Buyer's return of the Seller's Piping & Instrumentation Diagrams.

4.3.3 **Instrument Calibration**

4.3.3.1 All instruments shall be calibrated. A Calibration Sheet shall be provided for each instrument supplied under this specification. Each Calibration Sheet shall include, as a minimum, the following information:

- Date
- Tag Number
- Service
- Calibration Reference
- Signature of Calibrator

4.3.3.2 Each analog instrument shall be calibrated at 0%, 25%, 50%, 75%, and 100% of span, showing the desired and actual reading.

4.3.3.3 Each digital instrument shall be transitioned from normal to above setpoint and back to normal. Desired and actual setpoints shall be recorded as well as reset.

4.4 QUALITY CONTROL

Seller Quality Control activities shall be in accordance with SLCI Specification PSQC-001.

5. MARKINGS, NAMEPLATES AND SHIPMENT

5.1 MARKING

All equipment and components shall be identified with equipment numbers per Attachment C and match-marked to assist field assembly and erection. All items shipped shall be accompanied by instructions for storing and protection.

5.2 IDENTIFICATION PLATES

5.2.1 Equipment names and numbers shall be as stated in Attachment C.

5.2.2 Any fittings and material shipped loose shall have a metal tag with identifying number securely affixed by means of metal chain.

5.2.3 The rated load of the cranes and hoists shall be marked on each side of the equipment and shall be visible from the operating floor. Additionally, permanent stainless steel data plates shall be affixed prominently on each crane and block. The following information shall be provided on the equipment nameplate: Service, Maximum load capacity, CMAA type

5.2.4 All control panels shall bear the UL508 label.

5.3 SHIPPING

5.3.1 Seller Preparation for Shipment shall be in accordance with SLCI Specification PSQC-001.

5.3.2 All equipment and components shall be properly packaged to withstand shipment without damage. Each package shall be clearly labeled on the outside as to its contents. Seller shall include a complete packing list and bill of material.

5.3.3 All equipment shall be sealed to prevent entry of water, dirt or other foreign matter. Seals used on nozzles shall not affect threads, weld preparation or flange faces.

6. SPARE PARTS AND SPECIAL TOOLS

6.1 SPARE PARTS

The Seller shall supply all spares needed for startup and testing. Quote separately from the base proposal.

The Seller shall provide a list of spare parts and consumables required during the installation, startup, and on-site testing for all equipment furnished.

6.2 SPECIAL TOOLS

The Seller shall provide all special tools and devices required for the installation, operation, and maintenance of the furnished equipment, whether from the Seller or any sub-Seller. The special tools shall be accompanied by any necessary explanatory information.

Attachment A

Information and Drawing Requirements from Seller (LATER)

Attachment B

Project Specific Data

B1 SITE CONDITIONS

Plant Location:	Barrio Cambalache, Arecibo, Puerto Rico
Plant Elevation:	15 ft ASL
Equipment Location:	Indoors/Outdoors
Ambient Conditions:	
Outdoor	
Dry Bulb Temperature (°F):	86
Wet Bulb Temperature (°F):	79.7 @ 86 coincidental dry bulb
Relative Humidity (%):	76
Design High Temperature (°F):	100
Design Low Temperature (°F):	60
Indoor	
Dry Bulb Temperature (°F):	100
Design High Temperature (°F):	115
Design Low Temperature (°F):	60
Building Code	IBC 2009 as adopted/amended by the Puerto Rico 2011 Building Code
Site Classification	Site Class E
Seismic Zone:	IBC (I=1.25), Ss=1.15, S1=0.38
Wind Conditions:	Exposure C; hurricane prone region; wind speed (3 second gust) = 145mph, Iw = 1.15
Ground Snow Load (psf):	0 (Pg ground snow)

B2 PROJECT DESIGN

This project will consist of two (2) spreader-stoker boilers and one (1) steam turbine in a 2-on-1 configuration. The boilers will be designed for processed refuse fuel derived from municipal solid waste. Boiler generated steam will be fed to a non-reheat, condensing steam turbine to generate electricity. The steam turbine discharge will be exhausted to a surface condenser and cooling water will be supplied by a mechanical draft evaporative cooling tower. Boiler feedwater will be heated by steam turbine extractions through a series of indirect & direct contact feedwater heaters in this Rankine cycle system.

B3 UTILITIES AVAILABLE

Power Supply:

	480 Volts, 3 phase, 60 Hz, 65 kA IC Motor Voltage 460V
	120 Volts, 1 phase, 60 Hz, 22 kA IC
	125 Volts DC, for Critical Control Power
	120 Volts, 1 phase, 60 HZ, 22 kA IC, for essential power from UPS

Motors per Specification E200

B4 FUEL CHARACTERISTICS

Energy Answers named the fuel utilized in its system Processed Refuse Fuel (PRF) in order to clearly identify it as a fuel which is created from refuse but requires only minimum processing (shredding) in place of multi-step processing necessary to manufacture traditional Refuse Derived Fuel (RDF). Energy Answers' PRF technology ensures that virtually all the combustible material in the fuel is actually burned whereas in traditional RDF processes, a high percentage of the incoming material is removed in the preparation of the RDF and sent to landfill.

The Project is designed to produce renewable power by combusting primarily PRF, with urban wood waste, tire chips, and ASR as supplementary fuels. Only PRF whose initial sources were residential wastes, non-hazardous industrial wastes, or commercial wastes will be accepted at the Facility. Non-hazardous residential and/or commercial waste from other regions may also be accepted at the off-site fuel production facilities, if necessary, to supplement waste generated within the primary service area.

The PRF technology creates a uniformly small particulate sized fuel material through the shredding process that increases the available surface area for combustion. The fuel is burned on a travelling grate in specifically designed boilers.

Unacceptable materials that are not suitable for processing will be removed at the on-site fuel production facility prior to processing. The scope of this facility is not included in this specification.

A quality assurance plan will be implemented at the PRF Production Facility to prevent delivery to the Power Plant of loads of PRF generated from unacceptable waste. Unacceptable and non-processible materials will be removed at the PRF production facilities and transported to markets or designated landfill disposal sites. The acceptable and unacceptable materials for production of PRF for the Power Plant are described as follows:

B4.1 Acceptable Materials

Acceptable materials that will be processed into PRF includes that portion of solid waste which has the characteristics of waste collected and disposed of as part of normal household municipal waste collection programs, as well as commercial/retail waste and non-hazardous waste from industrial facilities. Acceptable waste includes, but is not limited to, garbage, trash, rubbish, and refuse. Acceptable waste also includes those wastes allowed to be received and processed in accordance with the operating permits for the Power Plant. It does not include "Unacceptable Materials."

Based on 1996 and 1997 operating data from the SEMASS facility, approximately 0.9% (by weight) of the initial wastes received by that facility was non-processible or unacceptable materials (which were removed prior to processing). It is expected that similar circumstances will be experienced at the PRF Production Facility serving the Power Plant.

USEPA provides an average national MSW composition which is considered appropriate for planning purposes for this project. It is expected that the waste processed into PRF, at the PRF production facility, will generally conform to the reference waste analysis presented in **Table 1**, shown below. **Table 2**, shown below, lists the anticipated break-down of particle size related to the delivered PRF.

Table 1 – PRF Waste Analysis Breakdown

Component	Percentage of Incoming Material (by weight)
Paper and Paperboard	22.3
Glass	6.1
Steel	6.1
Aluminum	1.5
Other non-ferrous Metals	0.3
Plastics	16.9
Rubber and Leather	3.8
Textiles	5.9

Wood	7.6
Other Organic	1.9
Food Waste	18.2
Yard Trimmings	6.9
Miscellaneous Inorganic	2.2
TOTAL	100

Table 2 – Break-down of Particle Size of Delivered PRF

Mesh Size	Range(Weight % passed)	
3 Dimensional (ins)	Recommended	Range
6	100	100
4	95	85-100
2	85	75-95
1	70	60-80
¾	60	50-70
½	50	40-60
¼	30	20-40
1/8	20	10-30
1/16	10	5-15

B4.2 Unacceptable Materials

Unacceptable materials that will not be processed into PRF includes radioactive material, explosive material, cesspool and other human wastes, industrial sludge, liquids, ashes and other combustion residues, human and animal remains, motor vehicles, trailers, marine vessels, pathological and biological wastes, infectious and chemotherapeutic wastes, foundry sand, offal, agricultural and farm machinery and equipment, lead-acid automobile batteries, cathode ray tubes, button batteries, fluorescent bulbs, mercury-bearing electrical switches and thermostats or any material which may present a substantial endangerment to health or safety or a reasonable possibility of adversely affecting the operations of the Power Plant.

B4.3 PRF Inspection

The Power Plant will establish contractual terms with fuel suppliers to ensure that waste will be inspected thoroughly at the PRF Production Facility to remove readily identifiable unacceptable wastes which may be contained in the waste stream prior to processing. It is expected that the waste processed into PRF at the PRF Production Facilities will generally conform to the reference waste analysis presented in **Table 3**, shown below.

Table 3 – Ultimate Analysis of PRF

Components	Percentage (by weight)
Moisture	24.12
Inerts (Ash)	14.61
N	0.77
H	4.29
O	21.69
S	0.10
C	33.97
Cl	0.70
TOTAL	100.00
Minimum Higher Heating Value (BTU/lb)	5,400
Average Higher Heating Value (BTU/lb)	5,700
Maximum Higher Heating Value (BTU/lb)	7,600

The actual composition of PRF is expected to vary to some degree both seasonally and as a result of waste reduction and recycling programs implemented in the Barrio Cambalache area. The Power Plant will have the flexibility to combust acceptable PRF over the potential variations in PRF composition. To account for variations in the quality of incoming acceptable materials for PRF production, the Power Plant will be designed to accommodate PRF having the range of composition as follows:

- HHV (BTU/lb) 5,400 – 7,600
- Moisture up to 42% (by weight)
- Inerts up to 24% (by weight)

Attachment C

Design Requirements

C1 PRF HANDLING SYSTEM FUNCTION

The function of the complete PRF Material Handling System is to store, reclaim, and feed PRF in an efficient and effective manner to the two new boilers associated with the Arecibo Renewable and Alternate Energy Project.

The PRF plant handling facilities shall be a triple (3) line system capable of providing 100% redundancy to all units at boiler maximum combustion rate (BMCR) using PRF having an average heating value. As there is no facility to store PRF in the powerhouse, the system will run on a continuous basis 24 hour per day, 7 days per week, and 365 days per year.

C1.1 Power Plant consumption rates

The Power Plant will be designed to combust an average of 2,100 tons per day (TPD) of PRF and Supplemental Fuels, having a reference HHV of 5,700 BTU/lb, to generate electricity and steam. On an annual average basis, each of the two (2) boilers will be operated at a heat input rate of 500 million BTU per hour (MMBTU/hr). This heat input rate (i.e., operating level) translates to a fuel feed rate for each of the two boilers of approximately 44 tons of PRF per hour.

Table 4, shown below, lists the weekly quantity of fuel combusted at maximum continuous rating operating level (MCR). (This equates to each boiler operated at a heat input rate of 550 million BTU/hr (MMBTU/hr).

Table 5, shown below, lists the weekly quantity of fuel combusted at annual average operating level operating level, heat input rate of 500 MMBTU/hr.

Table 4 – Weekly Fuel Combusted at Maximum Short-Term Operating

Fuel Heating Value (BTU/lb)	Fuel Combusted at the Power Plant (tons per week)
5,400	17,111
5,700	16,211
7,600	12,158

Table 5 – Weekly Fuel Combusted at Annual Average Operating

Fuel Heating Value (BTU/lb)	Fuel Combusted at the Power Plant (tons per week)
5,400	15,556
5,700	14,737
7,600	11,053

C1.2 Basis of Design

The fuel handling system shall be designed to obtain maximum reliability and efficiency using current technology with all selected equipment having proven capability for the service requirement. The general philosophy is to employ equipment capable of providing a consistent product and feed rate to the boilers and maintain an uninterrupted supply of fuel at the 5,700 BTU/lb HHV to the boilers at 100% MCR (24 hours/day, 7 days/week, fifty-two weeks/year).

All equipment will be suitable for continuous operation.

At these conditions, fuel reclaim and feed to the powerhouse shall be designed to handle capacity of 100 tph (50 tph per each conveyor line). This capacity is based on the accumulative capacity of two (2) separate feed systems from the fuel storage building in continuous operation at 100% MCR with a 10% margin added.

All equipment and conveyors must have the ability to capably handle this operating capacity. Conveyor belt widths and speed shall be selected for their capability to comfortably handle this tonnage rate without creating wind born suspension of fuel and minimize the generation of dust.

Conveyor drives shall be selected to meet the horsepower requirements of the peak tonnage and also to maximize the use of standardization for replacement purposes.

All conveyors shall be designed to start up under fully loaded conditions.

All conveyors shall be provided with the necessary safety switches at both the head and tail end and walkways shall have a continuous emergency stop pull cord system.

All chutework that will experience contact with fuel flow shall be lined with continuous stainless steel liner plates and chute corners shall be rounded to aid fuel flow and minimize fuel hang-ups.

All conveyor idlers shall be a minimum of CEMA C5 class and have a rated minimum L10 life of 50,000 hours.

All conveyor belting and lubricating oils shall be of a fire resistant nature.

C1.3 Specified Design Guidelines

Table 7, show below, lists the specified design guidelines to be used by the contractor for the design of the PRF handling facilities.

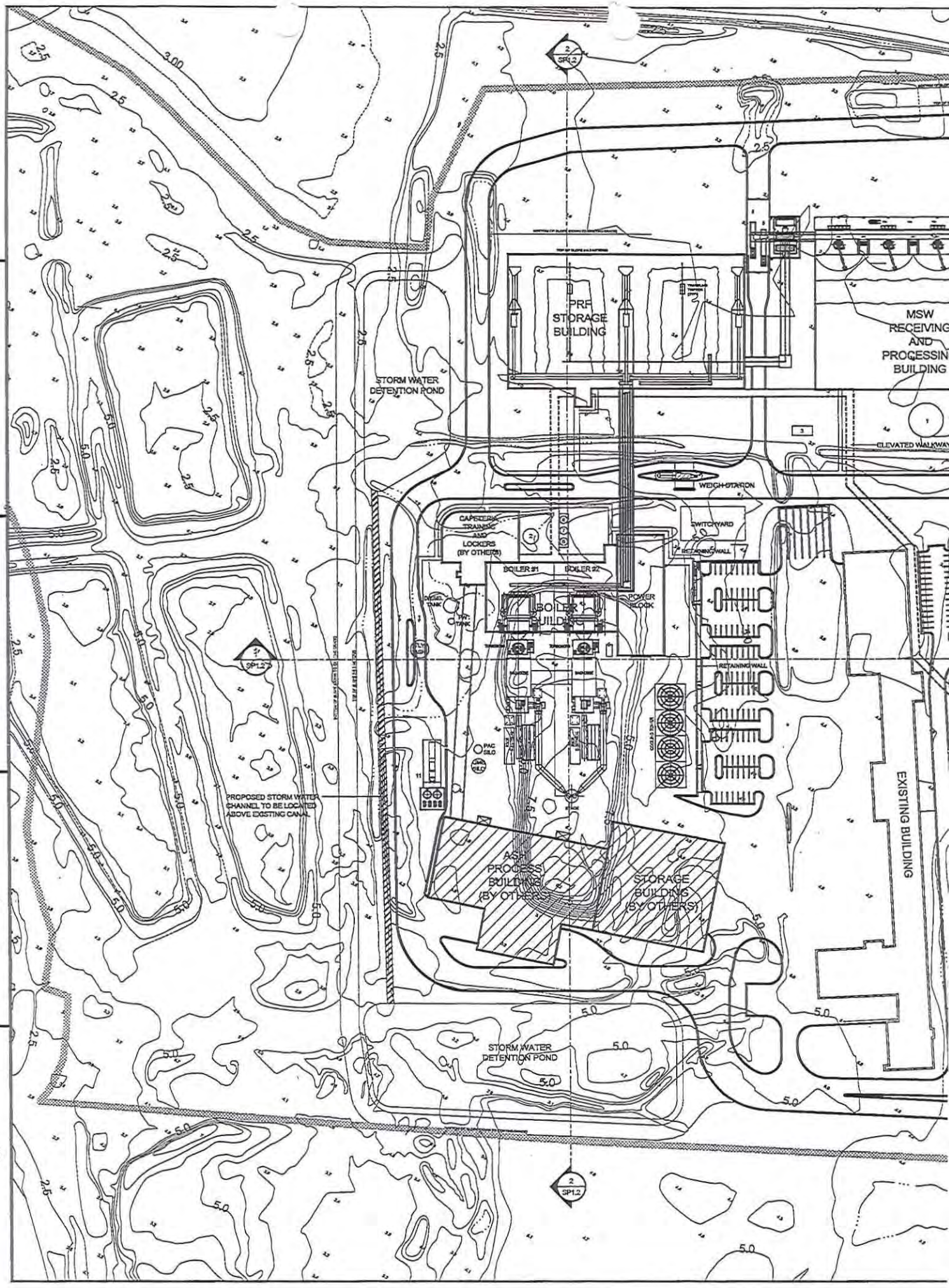
Table 7 – Specified Design Guidelines

Description	Design Guideline
PRF Bulk Density (as received)	20 PCF
PRF Bulk Density (conveyor design)	10 PCF
Conveyor belt width	Determined by the Seller
Conveyor belt Speed (max)	250 fpm
CEMA percentage belt loading	No more than 100%
Conveyor peak design capacity	50 tph
Maximum conveyor slope	13 degrees

Attachment D

Equipment Data

Seller to supply description and details in their standard format with proposal.



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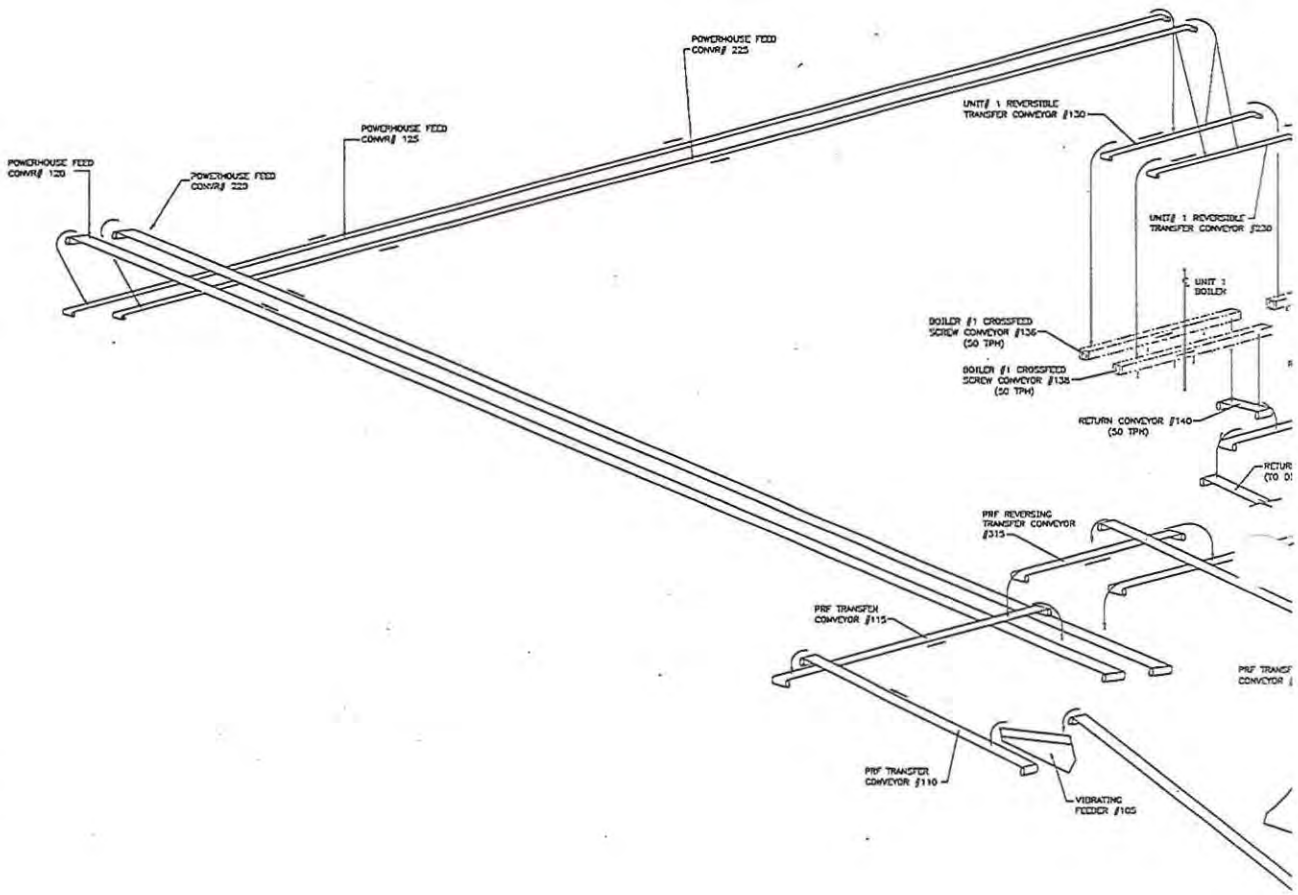

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