SECTION 7.0

STRUCTURAL AND ARCHITECTURAL SCOPE

This section covers the minimum scope and quality standards for the plant structural and architectural facilities.

7.1 MATERIALS

7.1.1 Steel

Design of structural and miscellaneous steel shall be in accordance with the 1989 American Institute of Steel Construction (AISC) Manual of Steel Construction – Allowable Stress Design.

Materials for structural steel and miscellaneous steel shall conform to the following requirements of the American Society for Testing and Materials:

1. Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50
2. M shapes, S shapes, Hp (Bearing Piles), Channels, and Angles: ASTM A36
3. Structural Plates and Bars: ASTM A36

Metal decking shall comply with SDI "Design Manual for Floor Decks and Roof Decks."

Structural steel grating shall be welded and galvanized and shall conform to ASTM A569. Grating shall be banded at edges and openings with bars of the same size as the bearing bars. It is recommended that one size grating be used throughout the Project. Grating for exterior use shall be serrated.

Minimum stair tread width shall be uniform for full length of stairs. Rise and run of stairs shall be in accordance with local building codes, state requirements, the International Building Code (IBC), and OSHA requirements.

High strength bolts, nuts, and washers shall conform to ASTM A325. Galvanize bolts, nuts, and washers when connecting galvanized steel members.

Anchor bolts shall conform to ASTM F1554, Grade 36. Anchor bolt sleeves shall conform to ASTM A501.

Anchor bolts shall be used for all structural and building columns, all major equipment, and all vibrating equipment. Galvanize all anchor bolts exposed to the weather.

Steel pipe for handrail shall conform to ASTM A53, Type E or S, Grade B. Handrails for exterior use shall be galvanized.

All structural welding shall conform to the requirements of AWS D1.1.

Galvanizing, as specified herein, shall conform to the requirements of ASTM A123 or ASTM A153, as applicable.

7.1.2 Concrete

Design of structural concrete shall be in accordance with the American Concrete Institute (ACI) - "Building Code Requirements for Reinforced Concrete," ACI 318.

An independent testing laboratory shall be retained by the Contractor to perform acceptance sampling and testing of the concrete in the field. Sampling and Testing shall be in accordance with ACI 301 and applicable ASTM procedures. Make at least one strength test for each 100 cu yd, or fraction thereof, of each concrete mix placed in any single day. Determine the concrete slump for each strength test sample and whenever consistency of the concrete appears to vary. Determine air content of each strength test sample. Record the ambient temperature and the concrete temperature for each sample.

Minimum concrete strength classes for various structures shall be as follows:

Item	Minimum Ultimate Compressive Strength,(psi) (at 28 Days)
Subgrade leveling slab	2,000
All other construction	4,000

Reinforcing bars shall be deformed bars conforming to ASTM A615, Grade 60. Welded wire fabric shall conform to ASTM A185.

Cement shall be portland cement conforming to ASTM C150, Type I or Type II, or Type V, as necessary to comply with ACI 318 recommendations in Section 4.3 regarding sulfate exposures.

The minimum cement content for 4000 psi mixes shall be 564 lbs per cubic yard and the maximum water cement ratio shall be 0.45 unless noted otherwise. Concrete shall be homogeneous, readily placeable, uniformly workable and finishable, and shall be proportioned to conform to ACI 211.1. Mix proportions shall be selected in accordance with ACI 318.

Provide air entrainment for concrete permanently exposed to the weather. Total air content shall be based on ACI recommendations for the type and size of aggregate used in the concrete.

Aggregates for normal weight concrete shall conform to ASTM C33.

Provide a housekeeping pad under all pumps and heat exchangers. Pad shall extend a minimum of 6 inches above grade or slab, whichever is higher.

Provide a minimum of 1 inch of grout under all equipment, support structures, platform supports, pipe supports and other structural supports that are mounted on concrete foundations or concrete slabs. Apply grout in accordance with grout manufacturer's instructions.

All concrete trucks shall be rinsed out on site. Rinse material shall be properly disposed of as spoils in road base.

7.2 STRUCTURAL LOADING

7.2.1 Dead Loads

Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.

7.2.2 Live Loads

Live loads shall be in accordance with local codes, the 2003 International Building Code (IBC) and the provisions of the Utah Uniform Building Standard Act Rules (R156-56)

7.2.3 Wind Loads

Wind loads shall be in accordance with local codes, the 2003 International Building Code (IBC) and the provisions of the Utah Building Standards Act Rules (R156-56). Basic wind speed shall be 90 miles per hour.

7.2.4 Seismic Loads

Seismic loads shall be in accordance with local codes, the 2003 International Building Code (IBC) and the provisions of the Utah Building Standards Act Rules (R156-56). Seismic acceleration parameters shall be in accordance with the IBC as follows:

SDs = 0.74 g

SD1 = 0.38 g

The soil profile type shall be determined by the Contractor based on the results of a subsurface investigation, which shall be performed by the Contractor.

7.2.5 Thermal Loads

Buildings and structures shall be designed for forces and/or movements resulting from a change in temperature. Induced thermal loads (i.e., thermal loads induced by equipment operating temperatures) shall be considered in design of applicable structural elements.

7.2.6 Crane Loads

Crane loads shall be in accordance with the 1989 AISC Specification for Structural Steel Buildings – Allowable Stress Design (ASD) and Plastic Design and Code of Standard Practice for Steel Buildings and Bridges. Additional requirements for the turbine room crane are listed under Section 7.5, BUILDINGS / STRUCTURES.

7.2.7 Vehicle Loads

Design loading, for areas accessible to trucks, shall be (AASHTO) HS20-44.

Floors in buildings accessible to a forklift truck shall be designed for the forklift truck wheel loads.

7.2.8 Pipe and Equipment Anchor Loads

Supporting structures shall be adequate to resist all pipe and equipment anchor loading under all design conditions, including seismic.

7.3 STRUCTURAL FOUNDATIONS

Type and depth of foundations required shall be as recommended by Contractor's Geotechnical Engineer based on the existing subsurface conditions and the geotechnical studies. The foundation system used shall be piling, drilled shaft, spread footing, or mat as recommended by the subsurface investigation report.

Foundations supporting rotating machinery shall be checked for resonant frequency and isolated from other foundations using expansion joints.

The combustion turbine generator foundations shall be isolated from surrounding building foundation mats and shall be designed such that no adverse dynamic response or settlement occurs. The foundation shall satisfy the settlement, deflection, and dynamic response criteria supplied by the equipment manufacturer.

The steam turbine generator foundation shall be designed for the following:

1. Static loading per Manufacturer's loading diagram.
2. Vertical impact load as specified by Manufacturer.
3. Area live load of 0.5 kip per square foot on all periphery beams at operating floor, 0.3 kip per square foot at intermediate floor level, and 0.3 kip per square foot on grating areas.
4. Torque, vacuum, horizontal impact, thermal and alignment loads per Manufacturer's load diagrams.
5. Deflection shall be limited to values specified by Manufacturer under loading conditions as specified.

Gas turbine foundations and steam turbine foundations shall include foundation imbeds for anchoring and aligning the gas turbine generator. Gas turbine foundations shall include fixators to facilitate alignments.

Electrical transformer foundations shall include fire walls as recommended by NFPA and the Owners Insurance.

Foundations for hydraulic equipment and oil-filled transformers shall include concrete slabs and curbs for containment of the largest spill plus fire water or precipitation from the 10-year recurrence interval.

7.4 ARCHITECTURAL

The architectural design of the buildings, sound attenuation, and all associated facilities shall seek to optimize functional, aesthetic, and economic considerations; and minimize the visual impact on the surrounding area. Safety and construction requirements shall be in accordance with the requirements of applicable state and local codes.

7.4.1 Siding/Panels

Exterior siding shall be steel wall panels. Insulation shall be installed between the exterior surface panel and the interior surface panel. In areas susceptible to damage, an interior liner panel shall be installed to 8' 0" above the walking surface.

Wall panels shall be designed to withstand the specified wind loading with practical/economical support girt spacing.

Exterior face of wall panels shall be finished with an epoxy prime coat and a urethane or polyurethane finish coat.

Interior liner panels shall be ceiling height and finished with siliconized polyester.

Owner to approve exterior and interior color selection.

7.4.2 Roofing

Roofing shall be designed to withstand specified snow loading and wind loading, including appropriate uplift. Roofing will be sloped metal.

Roofing shall be pitched not less than 1-¼ inch per foot and shall drain to a roof drain system. Pitch shall be governed by local codes and standards.

7.4.3 Interior Construction Materials

In general, architectural finishes for each area shall be per the following table:

Room Name	Floor	Wall	Ceiling
Steam Turbine Generator Building	mc	Mwlp	ex
Water Treatment	mc	Mwlp	ex

Equipment Building			
Electrical Equipment Room	mc	cmup/mwlp	ex
CEMS Shelters	mfg Std	mfg Std	mfg Std

Floor Finishes:

cmc – sealed, cast-in-place concrete coated with coating resistant to battery acid attack

mc - sealed, cast-in-place concrete

vct – reinforced vinyl composition tile

cft - unglazed ceramic tile

rcp – special raised composite panel floor

- Specialty coatings shall be applied in areas subject to acid or chemical spills

** Vinyl tile in Control Room shall be static dissipative type.

Wall Finishes:

gbp –painted gypsum board on metal studs

mwlp - metal wall liner panel at pre-engineered building exterior walls

cmup - filled, painted concrete masonry

cwt - glazed ceramic tile over masonry or gypsum board

Ceiling Finishes:

sap – lay-in grid, grid type, suspended acoustical panel (use moisture resistant type in lockers and toilet areas)

ex - exposed to structure

Except where concrete unit masonry partitions are required, ceiling high interior partitions shall be of metal stud and gypsum board construction. Where applicable, metal stud partitions shall be insulated to reduce sound transmission.

Hollow load bearing or non-load bearing lightweight concrete unit masonry or metal stud/gypsum board partitions shall be provided in stairwells and electrical rooms where required by Building Codes.

7.4.4 Platforms

Platforms, other than those within the scope of major equipment suppliers shall be provided by the EPC Contractor. All platforms shall be designed and supplied with handrail and toe-plate in accordance with OSHA standards. Ladders and stairs shall be in accordance with local Building Codes, the IBC, and OSHA standards. See Mechanical Scope, General Requirements, for the types of platforms required.

Provide self-closing, OSHA approved safety gates on all platform ladder openings. Chain type safety gates shall not be used.

Fasten all grating to platform steel using Saddle clips and Nelson studs with nuts.

7.4.5 Stairs

Stair construction shall be open riser stair treads. Stair treads and platforms shall have non-slip nosings.

Cross brace all stringers where the horizontal run exceeds 12 feet to provide lateral stability.

Fasten stair tread to stringer with a minimum of two 3/8-inch bolts.

7.4.6 Handrail

Railings shall be 1-1/2-inch standard weight steel pipe, and posts shall be 1-1/2-inch extra strong steel pipe, with welded joints, and ground smooth. The number of horizontal rails on handrail shall match the existing Block 1 handrail.

7.4.7 Windows, Window Walls, Entrance Doors, and Louvers

Windows and Window Walls – Window and window wall systems shall be anodized finished aluminum unitized framing systems with tinted, heat-treated, factory-fabricated, double pane insulating low "E" glass. Color of anodizing shall be selected to match the plant color system. Windows to areas which have possible explosive equipment failures shall be wire safety type.

1. Louvers – Louvers shall be drainable, fixed-blade, manual or gravity operating, weatherproof-type louvers, and shall include bird screens and be finished in a color to match adjacent wall panels.

2. Exterior Doors

   A. Personnel Doors – Exterior doors shall be flush panel type insulated steel doors in pressed steel frames with weather stripping, weatherproof saddles, closures, and kick armor plates.

   B. Coiling Steel Doors – Coiling steel doors shall be insulated standard type, motor operated, with manual chain-operated override, hood baffle, weather stripping, and bottom seal.

3. Interior Doors – With the exception of acoustical, fire rated, and coiling steel doors, all other interior doors shall be 1-3/4-inch thick, hollow metal flush panel-type in pressed steel frames. Vision panels shall be provided where appropriate. Interior doors to process areas shall have windows with wired safety glass.

7.4.8 Painting

In general, all exterior and interior surfaces, except items furnished in manufacturer's finish or finish coat, shall be painted, including:

1. All structural steel, piping, and miscellaneous steel (except surfaces to be enclosed by concrete).

2. Surfaces of all ferrous metal.

3. All gypsum board. Gypsum board shall be painted in a semi-gloss acrylic enamel latex coating system.

4. All concrete unit masonry. Concrete unit masonry shall be painted in an acrylic latex system, unless a special coating is specified.

Stainless steel and galvanized steel shall not be painted.

Protective Coatings

Component	Surface Prep.	Primer	Finish Coat
Interior Structural Steel Building Framing, including Framing for Hangers and Equipment	SSPC-SP6	Organic Zinc/epoxy, 3 to 4 mils DFT or Galvanized	Acrylic Polyurethane, 3 to 5 mils DFT or Galvanized
Misc. Steel, Interior or Exterior (handrail, stairs, ladders toeplate)	SSPC-SP6	Organic Zinc/epoxy, 3 to 4 mils DFT or Galvanized	Acrylic Polyurethane, 3 to 5 mils DFT or Galvanized
Exterior Structural Supports & Framing for Equipment	SSPC-SP6	Organic Zinc/epoxy, 3 to 4 mils DFT or Galvanized	Acrylic Polyurethane, 3 to 5 mils or Galvanized
Platform, Stair Grating, Handrail, and Ladders Interior and Exterior	Per the American Hot Dip Galvanizers Assoc. recommendations	Hot Dipped Galvanized	
Interior Above Grade Uninsulated Piping (Not requiring color coding)	SSPC-SP6	High Build Epoxy Primer or Galvanized	None.
Interior Above Grade Uninsulated Piping	SSPC-SP6	High Build Epoxy Primer	None

(Requiring color coding)		or Galvanized	
Exterior Above Grade Uninsulated Piping	SSPC-SP6	Inorganic Zinc Rich Primer	Polyurethane, 3 to 5 mills
Exterior and Interior Insulated Piping	None	None	None.
Equipment, Motors, Valves, Instruments, and other manufactured components	Manufacturer's Standard	Manufacturer's Standard	Manufacturer's Standard
Stainless Steel, Galvanized, or Nonferrous pipe or Materials	None	None	None
Stacks and other hot surfaces	SSPC-SP6	Inorganic Zinc rich ethyl silicate, 2 to 3 mils, DFT	Hi-temp silicon, 3 to 5 mils

7.4.8.1 Surface Preparation

The exterior surface of structural and miscellaneous steel, and tanks shall be abrasive blasted in accordance with the Society for Protective Coatings, SSPC-SP6, Gray Commercial Blast, or SSPC-SP10, Near White Blast for submerged items.

Tank interiors to be lined shall receive an abrasive blast in accordance with SSPC-SP5, White Blast, with a 3.0 mils maximum anchor pattern.

Small miscellaneous field fabrications shall be given not less than SSPC-SP3, Power Tool Cleaning.

All masonry surfaces to be coated shall receive a light brush-off blast or an acid etch prior to coating.

Piping shall be field-cleaned to a minimum of SSPC-SP3, Power Tool Cleaning.

7.4.8.2 Prime Protective Coating for Steel

All structural and miscellaneous steel shall be primed within 8 hours after the surface preparation is completed to a full 2.5 mils. The primer shall be as specified in the Protective Coatings Table, this Section. Open web joists may be primed with a red iron oxide primer.

7.4.8.3 Finish Coating

Structural and miscellaneous steel shall be finish coated as specified in the Protective Coatings Table, this Section.

Above grade piping designated to be painted, shall be color coded to coordinate piping service. Provide a color code chart to Owner for approval indicating piping color for each piping system included in the Project.

Before painter's finish work is begun, the surfaces to be painted shall be carefully inspected to assure that they are in proper condition to receive the finish coating. Surfaces, which are in poor condition, so that a proper finish cannot be produced, shall receive such special treatment or additional coats as necessary to produce a smooth, durable, satisfactory finish. Contractor shall supply color samples to Owner for approval.

7.5 BUILDINGS/STRUCTURES

7.5.1 Minimum Requirements

Drawings showing floor plans, equipment arrangements and other building and architectural features shall be submitted by the Contractor for Owner's review, comments and approval. Building framing may be Pre-Engineered or designed of standard rolled shapes.

Include lifting devices such as cranes, hoists, trolleys, and monorails in all buildings and structures at locations above all equipment weighing more than 200 lbs. Capacity of the lifting device shall be at least 15 percent above the maximum load to be lifted. Coordinate locations with the equipment layouts.

Design all building roofs, platforms, and structures for a minimum collateral load of 15 psf, in addition to the Code required and specified live loads. Increase the minimum collateral load in routing corridors for piping, electrical conduit, and cable tray, and determine the design collateral load by consideration of actual weights and by calculations.

Buildings shall be provided as follows:

Building	Min number of external doors / windows	Minimum Size	Special Notes
Steam Turbine Generator Building	Exit doors in accordance with Building Code. Minimum of two roll-up doors.	Per the Site Plan	One of the roll-up doors shall be sized to allow removal of the largest piece of equipment.
Water Treatment Equipment Building	2 roll-up, 2 doors, no windows	Per the Site Plan	
CEMS Shelters	1 door	8-foot x 10-foot (if 1 per GTG) or 10-foot x 12-foot (if 1 per 2 GTGs) Minimum of 1 per 2 GTGs	
Boiler Feed Pumps Building	Per Building Code requirements.	As required for access of equipment	Include monorail for maintenance of pumps and motors.
Other Buildings	Per Building Code requirements.	As required for access of equipment	

7.5.2 Steam Turbine Generator Building

Column Bases shall be designed as pinned.

The turbine room roof design shall utilize horizontal bracing.

Floor and roof live loads shall be as follows:

1. Turbine room roof — 30 psf
2. Operating floor, turbine room area — 500 psf
3. Operating floor, other areas — 250 psf
4. Ground floor — 300 psf plus HS20 loading

Building footprint shall be adequately sized to allow laydown of all turbine generator components during maintenance or refurbishment.

7.5.3 Other Structures

Contractor shall provide sun shade covers for all CO_2 and bulk gas storage systems.

Provide a minimum of 20-foot wide shed roof structure on the north side of the maintenance shop to provide covering for equipment and maintenance materials. Shed roof shall extend the length of the maintenance shop building.

7.5.4 HRSG Equipment Enclosure

Provide steel frame equipment enclosure with weather-tight metal siding and roof deck at the top of the two HRSG Units. Include doors with hardware, ventilation, and interior lighting.

7.5.5 Turbine Room Crane

The Turbine Room Crane shall be capable of handling the heaviest piece of disassembly of the steam turbine. Determine the required crane capacity by consideration of the maximum weight to be lifted during overhaul of the actual equipment furnished. Estimated crane capacities are as follows:

75 - ton minimum capacity main hook

25 - ton minimum auxiliary hook

Operation shall be by remote radio control and by control pendant suspended from trolley. Include a platform with stair or ladder to provide access to the crane bridge service platform from the Turbine Operating Floor.

SECTION 8.0
ELECTRICAL SCOPE

8.1 GENERAL REQUIREMENTS

This section covers the minimum scope and quality standards for the major electrical equipment, systems, and interfaces with other plant systems and facilities and with off-Site facilities. Contractor shall provide all material and labor for the engineering, design, procurement, installation, construction, startup, inspection, and testing of all electrical systems specified herein and necessary for a complete, functional power generating facility, and in conformance with generally accepted utility practices for generating facilities.

The conceptual design is shown on one line diagram SKE-1 that is included in Appendix E. Contractor shall develop a detailed plant design based on Owner's conceptual design. Alternative designs may be acceptable if they meet the functional requirements of this specification. Any changes in plant arrangement or design must be approved by the Owner. Arrangement and design of the auxiliary power system equipment shall provide for unobstructed vertical clearance on the access road between units for bringing in cranes and other heavy equipment for maintenance.

The design and specification of all work shall be in accordance with all applicable laws and regulations of the Federal government and the State of Utah, and applicable local codes and ordinances. A listing of the codes and industry standards to be used in design and construction is found in Section 3.0. All equipment furnished under these specifications shall conform to applicable standards of IEEE, NEMA and ANSI. All materials and devices shall be in accordance with the applicable requirement of the Federal "Occupational Safety and Health Standards". The latest editions of the referenced codes and standards shall apply. Equipment ratings and capacities are generally referenced to 40° C maximum ambient and less than 3300 feet. Contractor shall revise ratings accordingly for equipment and materials where required for Project maximum ambient conditions and elevation.

Other recognized standards may be utilized when required in Contractor's opinion and when not in conflict with the standards listed in Section 3.0. Contractor shall notify and obtain Owner approval prior to any changes.

8.1.1 Plant System Studies

Contractor shall perform a set of system studies to demonstrate the adequacy of the proposed electrical system design, including AC and DC distribution systems, by performing the following studies as a minimum. The design and construction of the electrical systems shall reflect the findings and conclusions of these studies. Prior to starting studies, provide Owner with cases to be analyzed. Owner will identify other cases if required to meet the criteria established in the following. These system studies shall be subject to review and comment by Owner.

1. Load flow and voltage regulation
   A series of studies shall be undertaken over a range of operating conditions, including pre-synchronizing, post-synchronizing, variation in grid voltage, auxiliary transformer failure, etc., to demonstrate that the plant electrical equipment operates within its manufacturer's rating and the voltage at all buses is maintained in the required range. For the studies, cable impedance shall be included and transformer and generator impedance shall include the maximum positive tolerances.

   Transformer impedance shall be determined to optimize the through-fault withstand current of the transformer and the interrupting duty of the switchgear and switchyard breakers and to ensure that the voltage will not fall below allowable limits when the largest motor will be started.

   The studies shall include motor starting studies to show that, when starting any motor, the distribution voltage at all levels does not fall below 90% of motor nameplate rating except for motors designed for lower terminal voltage. This requirement shall apply for all the contingencies given above and include motors of the largest starting current at each voltage level. Motors subject to the low starting voltage will be rated for 80% starting voltage.

   Evaluate generator step-up transformer reactive power flow study to verify that transformer does not reduce generator reactive power flow through all operating conditions. Reactive power flow shall be evaluated in accordance with IEEE C57.116 to meet a power factor of 95% lagging and 95% leading for each unit at the 345 kV side of the generator step-up transformer.

System design shall provide for transmission voltage deviation of plus or minus 5% and short term (one minute or less) voltage excursions of plus 10% to minus 10%. During normal operation system bus voltage shall be within plus or minus 5% of nominal voltage. Auxiliary equipment shall be designed for continuous operation for a plus or minus 10% voltage variation.

2. Fault level

   Studies shall be undertaken to ensure that the prospective fault current is within the rating of the switchgear and cables. For these studies: cable impedance shall be ignored, full motor contribution shall be included, and transformer impedance shall be at the maximum negative tolerance.

3. DC System Studies

   A load profile shall be developed for all DC loads to size the batteries and chargers, and to verify minimum voltages are maintained as specified and required by equipment vendors.

4. Grounding Studies

   Perform grounding system studies using a minimum of a 2 layer model to limit touch and step potentials to safe values as specified. The calculation of the ground resistance shall include the switchyard area and plant. The grounding system shall be designed to provide personnel safety and to provide protection to electrical equipment. The grounding system study shall be in accordance with the requirements of IEEE 80, 81, 81.2, 142, 665 and 1050, NESC and the NEC. Soil resistivity shall be measured as described in IEEE 80.

5. Arc-Flash Study

   Perform arc-flash study for medium voltage switchgear, contactors, 480 volt switchgear, 480 volt motor control centers, and 480 volt distribution panels. Study shall be performed based on IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations. Arc-flash study shall calculate incident energy and boundary areas where no special clothing or personal protective equipment is required. Arc-resistant equipment shall be furnished for medium voltage busses. Incident energy shall be limited to a maximum of 40 cal/sq-cm for all 4160 and 480 volt busses.

6. Protective Relay Coordination Study

   A protective relay coordination study and relay setting report shall be prepared. This study will serve as the basis for relay protection for the plant electrical distribution systems. Relay settings are required for all protective relays furnished by Contractor. Recommended settings for combustion and steam turbine relays will be provided by equipment supplier. Contractor shall provide settings for relays requiring system information. Contractor shall request any information from Owner to provide relay settings. Contractor shall provide a hardbound report including settings, calculations, system data, one lines, and coordination curves. In addition a CD shall be furnished including all documents in the report, relay setting files, relay communication software, instruction manuals, and application manuals where applicable. Contractor shall coordinate with the local utility company to implement any special protection or system requirements.

8.1.2 Interface Requirements

8.1.2.1 Utility System Interface

The interconnection of the plant into the Utility system will be through a 345 kV switchyard extension. The switchyard will be supplied by Others under a separate Contract. The interfaces as described in the following will refer to the Owner's switchyard. The switchyard interface will be at the following points:

1. Generator step up transformer dead end structure (switchyard Contractor will install overhead line to dead end structure and make drops to transformer).
2. Switchyard relaying and metering interface terminal box; SCADA communications junction box, switchyard station service power marshaling box.
3. Grounding consisting of two connections per step up transformer plus one connection per duct bank.

A generator fault on a combustion turbine shall trip only its associated generator excitation and low side generator circuit breaker. This scheme should allow the auxiliary loads to continue receiving the power supply from the switchyard through the corresponding station auxiliary transformer. A fault on a step-up transformer shall trip its high side circuit breakers and associated generator breaker. A fault on the steam turbine generator shall trip its associated high voltage breakers.

Contractor shall coordinate with Owner's switchyard contractor for routing of circuits to the switchyard control building. In addition to the required raceways, Contractor shall provide two spare 4" conduits from administration building to Owner's switchyard.The Contractor shall interface with Utility company and Owner's switchyard contractor for interconnection of the power plant at least but not limited to the following technical areas:

1. Basic System Design
2. Protective Relays of the generation system.
3. Engineering Studies
4. Metering
5. Telemetering
6. Generator synchronizing
7. Reactive Power Requirements
8. RTU Dispatch Control
9. Backup power supply
10. Dead end structure line termination

The Contractor shall include interfaces to an RTU (remote terminal unit) located in the switchyard control building. The interface shall include as a minimum the following isolated metering, control, and status points per unit:

1. Gross megawatts
2. Net megawatts
3. Auxiliary megawatts
4. Station net megawatts
5. Gross megavars
6. Net megavars
7. Auxiliary megavars
8. Generator voltage
9. Upper operating limit

10. Lower operating limit
11. AGC control status
12. Power system stabilizer status
13. Voltage regulator status

Final point list shall be developed during Contract execution, and shall include additional points typical of this type of installation.

Furnish and install plant side revenue metering system consisting of Maxsys 2510 revenue meters for each generator and auxiliary transformer, current transformers, and potential transformers for combustion turbine generator gross (low side for each unit), combustion turbine auxiliary load (each unit) and steam turbine gross (low side). Meters shall be furnished with 5759 firmware, peer to peer networking capability, bi-directional metering capability, DNP 3.0 communications protocol, 4 KYZ outputs, and 4 analog outputs. Meters shall be connected to allow internal calculation of unit and net station power. Meters shall be connected to dedicated revenue quality current and potential transformers. Provisions shall be included to accumulate auxiliary power when the CT units are off line in separate registers or other methodology as approved by Owner. Owner will supply meter catalog number. Hardwired analog, pulse, and communication outputs shall be made to switchyard RTU. Metering to have remote dial up capability.

Provide rack space, 48V 150A-H battery and charger system for the Owner provided DMXplore and Channel bank communications equipment. Furnish conduits and fiber cable between the new 345 kV switchyard and the communications equipment.

Owner will ultimately enter into a power supply agreement in accordance with the Large Generation Interconnection Agreement (LGIA) and associated documents included in Appendix H. Contractor shall include all technical and operational requirements within the plant to design to meet the requirements o f the LGIA and associated documents.

8.1.2.2 Plant Synchronizing and Switching Scheme Interface

Contractor shall design a synchronizing scheme in coordination with the turbine supplier. Combustion turbines will be synchronized across low side generator breakers and the steam turbine will be synchronized across the switchyard breakers. Design shall be based on a single high side breaker connected to a collector bus.

As required to ensure proper synchronization operation, phase matching potential transformers shall be provided to compensate for any phase angle and potential differences (caused by step-up transformer phase-shift) on the derived voltage sources from the switchyard and generator systems. Potential selection relays and selection logic shall be included as part of the synchronizing scheme.

8.1.3 Auxiliary Power Supply Equipment

The auxiliary power supply equipment includes the unit auxiliary transformers, 4160-volt switchgear, 4160-volt motor control centers, 480-volt secondary unit substations, 480-volt motor control centers, 480/277-volt distribution panelboards, and 208/120-volt power panels. All 4160 volt switchgear and 4160 volt motor control centers shall be arc-flash resistant. The auxiliary power equipment shall distribute electrical power to the plant auxiliary equipment. Electrical equipment with the exception of transformers shall be installed in rooms with a controlled environment including redundant air conditioning, except as approved by the Owner. Each class of primary distribution equipment (4160-volt switchgear, 4160-volt MCC, 480-volt switchgear, 480-volt MCC's) shall be of the same type and manufacture (i.e. all 4160-volt switchgear shall be of the same type and manufacture, but not necessarily the same manufacture as the 480-volt switchgear).

Critical loads for each block will be configured in such a manner that critical loads can be easily and quickly isolated from the normal source and transferred to the backup source (emergency diesel generator). Included in the critical loads are the loads to keep the combustion turbines in a ready to start condition, steam turbine critical loads, DC system, HVAC, communications and other loads as selected by Owner. Loads shall be selected up to the capacity limit of the emergency diesel.

Each 4160 and 480 volt bus shall be provided with metering functions to include, 3-phase bus voltage, 3-phase current, kW, kVAR, kWh (meter functions may be provided through protective relay data to DCS). Summary metering shall be configured to provide total kW, kVAR, kWh for the station and the auxiliary power system. The station service power shall be supplied from the utility system during plant startup, shut down, and maintenance periods. Power shall be supplied from the generated power during normal operation. Primary control for medium and low voltage switchgear, mains, ties, and feeders shall be from the distributed control system. Backup control shall be provided near the switchgear to allow buses to be energized if the DCS is out of service. DCS shall display feeder and bus metering information in addition to switchyard voltage.

The quantity and size of 480 volt panel boards shall be selected such that the capacity is adequate for total running load under all operating conditions, plus a 20% design allowance, plus 10% allowance for future use. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected load. Each distribution panel board shall include the feeder breakers required to supply the connected load, plus two three-pole and two single-pole feeder breakers for future use.

Welding receptacles shall be provided for portable 480 volt, 3-phase welding equipment. Sixteen receptacles will be placed in strategic locations as directed by the Owner.

All 208 volt loads and all single-phase 120 volt loads shall be supplied from the 208/120-volt power panels. The continuous current rating of the main bus and the 480-208/120-volt transformer shall be as required plus a 20 percent design allowance. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected load. Distribution transformers shall be dry type, U.L. listed, class H insulation (based on a 115 degrees C rise) with 4 – 2½ % FCBN and 2 –2 ½ % FCAN taps in primary winding with suitable enclosure. Motor space heaters, equipment space heaters, equipment lights and receptacles and equipment miscellaneous power feeds shall be from power panels. Each power panel shall include the feeder breakers required to supply the connected load, plus 6 single-pole feeder breakers for future use.

8.1.4 Classification of Hazardous Areas

Areas where flammable and combustible liquids and gases are handled and stored shall be classified for the purpose of determining the minimum criteria for design and installation of electrical equipment to minimize the possibility of ignition. The criteria for determining the appropriate classification are specified in Article 500 of the National Electric Code (NFPA/ANSI C1). The application of these criteria to specific areas at generating stations is provided in Article 127 of the National Electrical Safety Code (ANSI C2) and applicable NFPA standards.

8.1.5 Lighting

A lighting system shall be furnished for all structures and new equipment. The lighting system shall provide personnel with illumination for plant operation under normal conditions, means of egress under emergency conditions, and emergency lighting to perform manual operations during a power outage of the normal power source. Provide aviation lighting system for stacks, if required . The power supply for the lighting system shall be from 120/208 or 277/480 volt, 3-phase, 4-wire lighting panelboards. Emergency lighting shall be powered from a 120 volt AC normal source with local battery backup.

The lighting system shall be designed in accordance with the Illuminating Engineering Society (IES) to provide illumination levels recommended by the following standards and organizations:

1. ANSI IIES RP-7, 1979, Industrial Lighting.
2. ANSI IIES RP-8, 1977, Roadway Lighting.
3. Federal Aviation Administration (FAA).
4. Occupational Safety and Health Act (OSHA).

In addition to the above, the lighting design shall meet all local codes and regulations. Lighting sources and fixture selections shall be based on the applicability of the luminaries for the area under consideration.

Four types of lamps shall be used for the light sources in the lighting system including fluorescent, high-pressure sodium, metal halide, and incandescent. Generally, fluorescent lamps shall be used in indoor, low-bay enclosed areas; high-pressure sodium lamps shall be used outdoors, metal halide in high-bay enclosed areas, and incandescent lamps shall be used for emergency lighting. Exterior lighting shall include all roadways, HRSG platforms, combustion turbine platforms, CEMS equipment platform areas, and evaporation pond sump. Lighting levels shall be designed to at least the following minimum foot-candle levels:

Platforms, stairs, & walkways	10
Maintenance areas	50
Toilets and locker rooms	40
Warehouses/mechanical rooms	20-30
Water treatment	30
General outside areas	1
Roadway and parking areas	1

Electrical rooms	50

In general outside areas shall be controlled by photocell. Outside areas such as HRSG platforms shall have auto/manual stations to selectively turn-off lights when plant is not operating.

8.1.6 Telephone and Data Systems

Contractor shall expand the existing telephone/data network to include the Block 2 equipment. As a minimum voice/data lines shall to installed to the areas tabulated below. The telephone / data system design including all equipment shall be approved by the Owner. Provide dedicated raceway system from the control room building to the plant terminal point for telephone cable.

Contractor shall include a raceway system, wiring, jacks, and switches as required for the telephone and communications system indicated below. Listing is per building when multiple buildings are included:

Facility	Voice	Data	Analog
Admin Building	4	4	2
Boiler Feed Pump Enclosure	1	1	1
Chemical Treatment Building	1	1	1
Power Distribution Building	1	1	2
CEMS	1 Each	1 Each	1 Each
CT Electrical building	1 Each	1 Each	2 Each
ST& CT Excitation Building	1	1	2
Gas Regulating station		1 (fiber)	2

Final locations will be determined by Owner during detailed design.

Provide data ports with interconnecting Category 6 wiring for 100 mbps plant network at locations near the phone outlets. Data ports in other buildings remote from the Control/Administration building will be connected through fiber optic cable unless otherwise approved.

8.1.7 Construction Power

Contractor shall contact local utility and make arrangements for construction power services. Contractor shall pay all fees and operating costs associated with the installation, operation, and maintenance of the service including removal at project completion. Construction power shall be available through the duration of the project up to commercial operation unless approved by Owner. Owner will furnish power for commissioning and startup through back-feed of the auxiliary transformers. This power source will not be available for construction.

8.1.8 Freeze Protection

A freeze protection system shall be provided for piping, instrument impulse lines (integral tubing bundles), gauges, pressure switches, and other devices subject to freezing. See Division 5 and 9 for additional requirements. All transmitters, remote gauges and switches located outdoors shall be located in a heated instrument enclosure complete with a thermostat and space heater which will automatically turn on when the ambient temperature falls below 40 F. The enclosures shall be designed such that the heater cable circuit for the integral tubing bundle connecting the instrument to the process is terminated inside the enclosure.

On pipes that operate below 300°F, parallel circuit type heating cable shall be directly applied to the pipe. These heating cable circuits can be assembled and installed in the field using the appropriate connection kits.

For pipes which operate at 300°F and above, parallel circuit-type heating cable shall be sandwiched between layers of insulation or heat tracing of suitable temperature rating shall be used. These heating cable circuits can be assembled and installed in the field using appropriate connector kits.

Power distribution panelboards, each fed from 480-120/208 volt transformers shall furnish power to the freeze protection circuits. Power to the freeze protection circuits shall be controlled by ambient thermostats through a central control panel which shall provide control and alarm/monitoring functions for the freeze protection system. In addition, thermostats that sense actual pipe temperature may be required to prevent overheating of critical process or chemical piping. Remote alarms for the overall system and local monitoring of each freeze protection circuit shall be provided.

8.1.9 Cathodic Protection System

Cathodic protection and other corrosion control measures shall be provided to protect metal tank bottom and underground piping and shall be designed and installed according to soil survey results. A study shall be prepared by a corrosion control specialist (member of NACE) to provide recommendations as to the requirements for, and methods of, preventing corrosion of metallic elements due to galvanic action. This study shall be submitted for review by the Owner. The study shall include a conceptual design, including comparison of active versus passive corrosion control methods, and a bill of material for implementation of any recommended corrosion control system.

8.1.10 Lightning Protection

Lightning protection system shall be provided for building structures, transformers, the GT packages (including HRSG and stacks (regardless of stack thickness), the air-cooled condenser, and tanks.

Lightning protection for the building structures shall consist of air terminals installed at the highest points. The air terminals shall be connected together with copper cable and connected to the plant ground grid with copper down conductors. Protection system will be certified with a Master Label.

8.2 ELECTRICAL PROTECTIVE SYSTEMS

This Contract shall furnish and install an coordinated protective relay system to detect faults and trip the appropriate equipment. Owner will review and approve all protective relay equipment, logic, nomenclature and settings to verify consistency with the specifications and Owner's standards. Contractor will coordinate with switchyard supplier to ensure a proper interface.

In general protective relays are to be based on the Schweitzer relay products unless specifically approved by Owner. Any grouping of relays shall be provided with an SEL-2030 for remote modem access. Contractor to include communication lines to allow remote dial up capability. All protective relays shall be time synchronized using a station IRIG-B time signal. All relay currents, potentials, and trips shall be wired through test switches. When required relay outputs shall trip ElectroSwitch type LOR lockout relays with a minimum of 10 decks. Owner shall provide assignment of relay output contacts. All current, potential, and lockout trip contacts shall be wired through clear cover test switches.

8.2.1 Generator Protective Relays

The generator protection system shall be based on redundant SEL-300G multifunction relays. Relays shall include the following protective functions: 21 backup impedance; 24 volts/hertz; 32 Multi-step reverse power; 27TN/59N 100% stator ground fault; 46 Phase unbalance; 50/27 inadvertent energization; 50BF breaker failure (combustion turbines); 59 over voltage elements; 59N bus ground fault; 60 loss of potential detection; 78 out-of-step protection; 87 differential protection. In addition to protective functions relay shall have extensive metering capability, oscillography, self-diagnostics, and communication capability.

Each SEL-300G will be provided a lockout relay for turbine tripping and a lockout relay fro generator tripping. Tripping, blocking, and initiate logic shall be consistent with Owner's operating requirements and coordinated with the switchyard protection.

8.2.2 Generator Step-up Transformer Relays

The primary protection shall be an SEL-387E that only includes the transformer windings in the protective zone. Relay shall trip dedicated lockout relay. Backup relaying shall be dual SEL-387's connected in unit differential configuration. Backup relays shall trip dedicated lockout relays. The protection zone shall include the 345 kV breaker, generator and auxiliary transformer tap (steam turbine does not have auxiliary transformer.) Dual sudden pressure contacts and dual neutral current transformers shall be provided as inputs to the protective relays.

8.2.3 Unit Auxiliary Transformer Relays

Protection for auxiliary transformers shall include an SEL-387E with a protective zone including the auxiliary transformer and switchgear main breaker. Provide lockout relay for status, blocking, and tripping functions.

8.2.4 Medium Voltage Switchgear and Motor Controllers

Provide SEL-351A multifunction protective relays for mains, ties, and non-motor feeder breakers. SEL-701 shall be used for protection for motor feeders. Relays will be configured to detect faults or abnormal operating conditions and trip appropriate breaker or alarm operator and coordinated with other protective devices. Any trip operations will include lockout functions to block closing of breakers without operator intervention.

8.3 SWITCHYARD

Others will design and install the switchyard and equipment from the high side of the step-up transformers to the switchyard except as specified. Contractor shall coordinate design between Contractor and Switchyard Contractor to determine placement of dead end structures, transformers, protective relay settings, interface junction box, RTU communication connections, power feeds and associated details.

This Contract shall provide two separate 480 volt feeds (200A each) to the substation to provide redundant AC auxiliary power sources for the substation. Contractor shall also provide two, 125 VDC, 100A each and one 1 kVA 120 volt UPS supply to the switchyard control building interface cabinet by the Switchyard Contractor.

8.3.1 Deadend Structures

EPC Contractor shall provide one dead-end structure for each GSU. Dead end structure shall have a conductor height of 45 feet, a shield wire height of 20 feet, mast height of 20 feet, phase spacing of 20 feet and a line angle from 0 to 20 degrees. Design conditions shall be NESC heavy loading. The structure shall be designed using the ultimate stress method. The following are the maximum loads:

Conductor Loading - 3000 lb per conductor
Shield Wire Loading – 2500 lb per wire

EPC Contractor shall provide engineering, procurement, and installation of GSU switches and dead end structures including all supporting systems. These systems include but are not limited to all low and high voltage cable, conductor, and connectors; raceway; foundations; grounding; and monitoring, controls, and protection. All high-voltage systems shall be coordinated with plant and switchyard design and installation. Owner will approve final design and arrangement of dead end structure.

8.4 GENERATOR STEPUP TRANSFORMERS

This section covers power transformer equipment, material, and accessories. The power transformers furnished shall have all standard and normally supplied accessories ready for installation, connection, and immediate service. The following requirements are to be used in conjunction with the applicable sections of the Owner's specifications for transformers 'Material Specification ZS 001-2004, Substation Equipment – Power Transformer All Ratings' included in Appendix F.

Transformers shall be generator unit step-up transformers (GSU), shall be 345 kV nominal secondary, and generator rated voltage nominal primary, and shall be rated a minimum 5% over generator capability throughout the full ambient operating range with a temperature rise limited to 65°C. The method of cooling shall be ONAN/ONAF/ONAF. Step up transformers for the combustion turbines shall be designed for a minimum guaranteed efficiency of 99.7% and the steam turbine 99.75% at the top ONAF rating.

On initial selection of transformer supplier, Contractor shall provide Owner with the guaranteed load and no load losses for the step-up transformers at the top ONAF rating. In the event the tested losses are greater than the guaranteed losses, Contractor shall reduce the contract price by the sum of $4,000/ kW for no load losses above the guaranteed value and $1,700 / kW for the load losses above the guaranteed value. The no load and load loss evaluation will be performed independently of each other. In the event losses are less than the guarantee value, the Contract Price shall be increased by the sum of $2,000 / kW for no load loss differential plus $850 / kW for the load loss differential.

Transformer high voltage winding BIL shall be a minimum of 1050 kV with 350 kV neutral. High voltage bushing shall have minimum BIL of 1175 kV. Low voltage winding shall have a minimum BIL of 150 kV. Transformer size, impedance and high side tap shall be selected to allow full range of generator reactive capability at the system nominal voltage. Transformer impedance shall be approximately 6% on an ONAN base and 10% at maximum rating. In addition, transformer impedance shall be selected to limit fault current below generator breaker interrupting level, and allow starting of largest plant motor without exceeding NEMA starting criteria.

All equipment shall conform to the applicable standards of ANSI, NEMA, and IEEE and shall be in accordance with the applicable requirements of OSHA standards. The latest published edition of referenced standards shall apply.

The power transformers shall be designed, fabricated, and tested in accordance with ANSI C57 series, C62, NEMA TR 1, and these Specifications.

Transformers shall be provided with oil containment and drainage to the plant oil water separator. Drain lines shall be provided with normally closed manual drain valves.

Transformers shall be provided as a minimum with the following accessories and capabilities:

1. 4 (four) full capacity 21/2% taps, 2 (two) above and 2 (two) below nominal voltage rating for manual "no-load" operation.
2. Standard angular displacement of voltages.
3. Sound level not to exceed 85 dBA at 3 feet at top ONAF rating (or less if required to meet project sound limitations).
4. Continuous over excitation capability of 110% at full load and 125% for 30 seconds.
5. Manholes located in cover.
6. Lockable tap changer handle accessible from ground level.
7. Short circuit capability with only transformer impedance limiting fault current.
8. Accessible core ground bushing and well for core ground.
9. Detachable radiators with lifting eyes and upper and lower isolation valves.
10. Upper and lower filter connections with sample valves.
11. Qualitrol temperature monitor with a minimum of 8 output contacts, diagnostic alarm, communications capability, and analog outputs.
12. Oil temperature and level gauges.
13. Conservator or sealed tank with inert-gas pressure oil preservation system.
14. Pressure relief device with a semaphore visible from ground level.
15. NEMA 3R control cabinet with latchable doors.
16. Adequate number of current transformers with relay accuracy of C800 and metering accuracy of 0.3B1.8 (or as required by interconnect standards) for plant metering and relaying including any relaying interface with substation. Current transformers shall have a minimum thermal rating factor of 2.0. A minimum of three current transformers on high side with at least one with metering accuracy and two on the low side.
17. Dual neutral current transformers.
18. Station Class surge arresters (internal surge protection not acceptable) with an MCOV of not less than 110% of line to ground voltage.
19. Discharge counters.

20. Sudden pressure relay device with dual outputs.
21. Fall protection device mounting provisions.
22. Serveron on-line gas analysis monitor with communications capability to the plant DCS, alarm and configurable analog outputs.
23. Copper windings with EHV-Weidmann insulation and materials suitable for 120° C continuous operation.
24. Local annunciator with common alarm or adequate alarms in DCS to quickly identify alarm source.
25. Maximum core flux density of 1.7 Tesla at no load and 100% rated tap voltage.
26. One spare high and low voltage bushing.
27. High temperature gasket material (Viton).

Factory Tests:

1. Notify Owner not less than two weeks prior to the starting date of the factory tests to permit observers to be present during the factory tests.
2. Procedures for factory tests shall conform to ANSI C57.12.90, unless otherwise specified. Except where a specific test method is specified, the factory test report shall state the test method used. Perform the following factory tests on each transformer unless otherwise stated:
   A. Winding ratio on rated voltage connections and on all tap positions.
   B. Winding polarity and phase relation on the rated voltage connections.
   C. Excitation loss at 100% and 110% of rated voltages on the rated voltage connections.
   D. Excitation current at rated voltages, and at 110% rated voltages, on the rated voltage connections.
   E. Impedance and load loss at the maximum 65°C rise rating.
   F. Temperature rise at the maximum 65°C rise rating for the transformer supplied under this contract. Records of temperature tests performed on duplicate or essentially transformers will not be acceptable.
   G. Temperature indicator accuracy test.
   H. Applied potential test.
   I. Induced potential test with the transformer connected at rated voltage, with the transformer's own bushings in place, accompanied by partial discharge monitoring (to conform to ANSI C57.12.90) with tansformers own bushings in place.

J. Switching surge tests on the high-voltage winding, with the transformer's own bushings in place.

K. Test all control wiring for continuity, grounds, and correct connections; and test operation of all relays, indicators, switches, lights, and interlocks.

L. Resistance measurements of all windings on the rated voltage connection and all load tap connections. Test results shall be reported in ohms at 75°C

M. Doble insulation power factor tests conforming to Method II in Table 4 of Article 10.10 of ANSI C57.12.90. The power factor shall be equal to or less than 0.5% at 20°C.

3. Perform the manufacturer's standard tests on each surge arrester.

8.5 PLANT AUXILIARY TRANSFORMERS

Transformer shall be suitable for operation throughout the full ambient temperature operating range. The method of cooling shall be ONAN/ONAF. Transformers shall have a minimum efficiency of 99.5% at the top rating. Transformer spare capacity at the top ONAF rating may drop below 20% when one auxiliary transformer is out of service. The following requirements are to be used in conjunction with the applicable sections of the Owner's specifications for transformers 'Material Specification ZS 001-2004, Substation Equipment – Power Transformer All Ratings' included in Appendix F.

On initial selection of transformer supplier, Contractor shall provide Owner with the guaranteed load and no load losses for the auxiliary transformers at the top ONAF rating. In the event the tested losses are greater than the guaranteed losses, Contractor shall reduce the contract price by the sum of $4,000/ kW for no load losses above the guaranteed value and $1,700 / kW for the load losses above the guaranteed value. The no load and load loss evaluation will be performed independently of each other. In the event losses are less than the guarantee value, the Contract Price shall be increased by the sum of $2,000 / kW for no load loss differential plus $850 / kW for the load loss differential.

The continuous rating of the unit auxiliary transformers shall be as required to supply electrical power to the total plant (two combustion turbines and one steam turbine) auxiliary load under all operating conditions but not to exceed 4160 volt switchgear capability. Transformers shall be 100% redundant. The transformer impedance shall be selected to provide adequate voltage regulation and motor starting capability under all operating conditions.

All equipment shall conform to the applicable standards of ANSI, NEMA, and IEEE, and shall be in accordance with the applicable requirements of OSHA standards. The latest published edition of referenced standards shall apply.

The power transformers shall be designed, fabricated, and tested in accordance with ANSI C57.12 series,C62, NEMA TR 1, and these Specifications.

Transformers shall be provided as a minimum with the following accessories and capabilities:

1. 4 (four) full capacity 21/2% taps, 2 (two) above and 2 (two) below nominal voltage rating for manual "no-load" operation.
2. Standard angular displacement of voltages.
3. Sound level not to exceed 85 dBA at 3 feet at the top ONAF rating.
4. Continuous over excitation capability of 110% at full load and 125% for 30 seconds.
5. Manholes located in cover.
6. Lockable tap changer handle accessible from ground level.
7. Short circuit capability with only transformer impedance limiting fault current.
8. Accessible core ground bushing and well for core ground.
9. Detachable radiators with lifting eyes and upper and lower isolation valves.
10. Upper and lower filter connections with sample valves.
11. Qualitrol temperature monitor with a minimum of 8 output contacts, diagnostic alarm, communications capability, and analog outputs.
12. Oil temperature and level gauges.
13. Pressure relief device with a semaphore visible from ground level.
14. Control cabinet with latchable doors.
15. Adequate number of current transformers with relay accuracy of C800 and metering accuracy of 0.3B1.8 (or as required by interconnect standards) for plant metering and relaying. At least one set of CT's on primary shall have metering accuracy. Current transformers shall have a minimum thermal rating factor of 2.0.

16. Sudden pressure relay device.
17. Serveron on-line gas analysis monitor with communications capability to the plant DCS, alarm and configurable analog outputs.
18. Copper windings with EHV-Weidmann insulation and materials suitable for 120° C continuous operation.
19. Maximum core flux density of 1.7 Tesla at no load and 100% rated tap voltage.
20. Fall protection device mounting provisions.
21. Grounding resistor.
22. Local annunciator with common alarm.
23. High temperature gasket material (Viton).

Factory Tests:

1. Notify Owner not less than two weeks prior to the starting date of the factory tests to permit observers to be present during the factory tests.
2. Procedures for factory tests shall conform to ANSI C57.12.90, unless otherwise specified. Except where a specific test method is specified, the factory test report shall state the test method used. Perform the following factory tests on each transformer unless otherwise stated:
   A. Winding ratio on rated voltage connections and on all tap positions.
   B. Winding polarity and phase relation on the rated voltage connections.
   C. Excitation loss at 100% and 110% of rated voltages on the rated voltage connections.
   D. Excitation current at rated voltages, and at 110% rated voltages, on the rated voltage connections.
   E. Impedance and load loss at the maximum 65°C rating.
   F. Temperature rise at the maximum 65°C rating for the transformer supplied under this contract. Records of temperature tests performed on duplicate or essentially transformers will not be acceptable.
   G. Temperature indicator accuracy test.
   H. Applied potential test.
   I. Induced potential test with the transformer connected at rated voltage, with the transformer's own bushings in place, accompanied by partial discharge monitoring (to conform to ANSI C57.12.90).
   J. Lightning impulse tests on all winding terminals, with the transformer's own bushings in place.

K. Switching surge tests on the high-voltage winding, with the transformer's own bushings in place.

L. Test all control wiring for continuity, grounds, and correct connections; and test operation of all relays, indicators, switches, lights, and interlocks.

M. Resistance measurements of all windings on the rated voltage connection and all load tap connections. Test results shall be reported in ohms at 75°C

N. Doble insulation power factor tests conforming to Method II in Table 4 of Article 10.10 of ANSI C57.12.90. The power factor shall be equal to or less than 0.5% at 20°C.

3. Perform the manufacturer's standard tests on each surge arrester.

8.6 4160 VOLT METAL-CLAD SWITCHGEAR

8.6.1 General

This section covers the furnishing of 4160 volt vacuum metal-clad indoor switchgear equipment, material, and accessories. Equipment shall be provided in accordance the conceptual one-line diagram. Switchgear will have continuous ratings as required and short circuit duty of 350 MVA. Switchgear shall be arc-resistant. Switchgear will be of the same type and manufacture.

The continuous current rating, short-circuit interrupting capability, and short time current carrying capability of the 4160 volt switchgear and 4160 volt motor control center shall be coordinated with the ratings of the unit auxiliary transformer and the characteristics of the connected loads. All motors rated 4000 volts and all 480 volt secondary unit substations shall be supplied directly from the 4160 volt switchgear or 4160 volt motor control center. The 4160 volt switchgear shall be furnished with potential transformers and current transformers as required for protective relaying, metering, and control. Provide surge arresters on mains and feeder breakers.

Switchgear main bus shall be fully insulated copper. Control power shall be 125 VDC with mains, tie, and feeders controlled from the plant DCS.

Relays will be configured to detect faults or abnormal operating conditions and trip appropriate breaker or alarm operator and coordinated with other protective devices.

Any trip operations will include lockout functions to block closing of breakers without operator intervention. Motor feeders 2500 hp or larger shall be provided with differential protection.

8.7 4160 VOLT MOTOR CONTROL CENTERS

8.7.1 General

These specifications cover 4160 volt, general purpose, indoor motor control centers. The continuous current rating, short-circuit interrupting capability, and short time current carrying capability of the 4160 volt motor control center shall be coordinated with the ratings of the unit auxiliary and the characteristics of the connected loads. Motor control centers shall be arc-resistant.

The motor control centers shall be designed and fabricated with all normally supplied accessories for use on a 4160 volt, 3-phase, 60-hertz, 60 kV BIL, resistance grounded system, and shall be coordinated to protect motors over the complete range of overload and fault conditions. Construction of Motor Control Centers shall allow either one-high or two-high arrangements. Lifting apparatus shall be provided for the two-high arrangements. Provisions shall be made so that the Motor Control Centers can be extended to include additional sections in the future.

8.7.1.1 Codes and Standards

All motor starters and motor control center components shall be designed and fabricated to conform to the requirements of NEMA standards for Class E-2 Industrial Control Equipment and to the requirements of applicable IEEE and ANSI standards. All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards". The latest edition of these codes and standards shall be applied to the manufacture of the equipment

8.8 480 VOLT SECONDARY UNIT SUBSTATIONS

8.8.1 General

The equipment shall include coordinated assemblies of incoming line, transformer, and outgoing feeder sections with all auxiliary and transition compartments necessary to provide unit substations ready for installation, connection, and immediate service.

Each power transformer included with each secondary unit substation shall be rated to supply the total 480 volt auxiliary load plus 30 percent under all operating conditions and 110% of the auxiliary load when the tie breaker is closed and one transformer is out of service. The transformer impedance shall be selected to provide adequate voltage regulation and motor starting capability under all operating conditions. The continuous current ratings and interrupting ratings of the main breakers, tie breakers, feeder breakers, and main bus shall be coordinated with the ratings of the power transformers and the connected loads. Breakers shall be drawout air magnetic units. The secondary unit substations shall include feeder breakers required to supply the connected load, plus one additional equipped space for future use on each bus.

Overload and fault protection for loads connected to the 480 volt secondary unit substations shall be provided by solid-state trip devices which are an integral part of the drawout type air circuit breakers or separately mounted panel devices. Integral trip devices shall include long time, short time, instantaneous, and ground functions as required for a coordinated system. Trip units shall display metering information. If required, auxiliary power shall be provided for trip unit display at low loads.

General arrangement of unit substation shall be as indicated on the conceptual one-line diagram. This Contract shall provide substations of quantity and sizes to support the plant loads. One spare breaker of each frame rating (except for mains) shall be included for future use. Main and tie breakers shall have same rating and be electrically operated. MCC feeder breakers shall be manually operated.

Transformers for 480-volt secondary substations may be oil filled or cast coil for outdoor applications, or vacuum pressure impregnated (VPI) dry type for indoor applications. If dry type, they shall be indoor close coupled to 480-volt switchgear. Oil transformers shall have a maximum of 65° C rise, cast coil 80°C rise, and VPI 115°C rise. Oil filled units shall have high side BIL of 60 kV and low side BIL of 30 kV, ventilated dry type shall have BIL of 45 and 10 kV respectively, and cast coil 75 and 30 kV respectively. Transformers shall be low loss units and have a minimum efficiency of 99%. Transformers shall have the following accessories:

1. Externally operated no load tap changer.
2. Lower drain valve and liquid sampling device (for oil type).
3. Dial-type thermometer with contacts for cooling control and high-temperature

alarm.

4. Magnetic liquid level gauge with alarm contact for low level (for oil type).
5. Pressure/vacuum gauge (for oil type).
6. Lifting lugs and jacking pads.
7. Pressure relief device (for oil type).
8. Two ground pads, on diagonally opposite corners.
9. All other standard accessories.

8.8.1.1 Codes and Standards

Unit substation components furnished under these specifications shall be in accordance with the requirements of applicable IEEE, NEMA and ANSI standards. All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards". The latest edition of these codes and standards shall be applied to the manufacture of the equipment

8.9 480V MOTOR CONTROL CENTERS

8.9.1 General

The Contractor shall furnish and install motor control center equipment, materials, and accessories as specified herein. The motor control centers shall be designed and constructed for use on a 480 volt, 3-phase, 60-hertz, 3-wire, solidly grounded system. Except as specified otherwise, all equipment shall be designed for service with an ambient temperature of 40°C.

All equipment furnished under these Specifications shall conform to applicable standards of IEEE, ANSI, and NEMA. Motor control centers shall conform to UL 845, NEMA ICS1, NEMA ICS2, NEMA ICS4, and NEMA ICS6. All materials and devices shall be in accordance with the applicable requirements of OSHA standards. The latest edition of these codes and standards shall be applied to the manufacture of the equipment.

The continuous current rating of the motor control center main bus shall be as required to supply the total running load under all operating conditions, plus a 20 percent design allowance. The bus bracing and the interrupting ratings and continuous current ratings of the combination starters and feeder breakers shall be based on the available fault current and the characteristics of the connected loads. Each motor control center shall include the combination starters and feeder breakers required to supply the connected load, plus 10% spare units for each type size 3 and smaller. Motor control centers main breakers shall be protected by an adjustable long-time and short-time solid state trip device element for phase protection.

Each magnetic starter within an MCC which supplies power to a motor shall be equipped with a magnetic-only molded case circuit breaker and a microprocessor based overload system. Starters shall be supplied with control power transformers.

Certain loads will be fed from MCC feeder circuit breakers. The breakers shall be thermal magnetic molded case breakers sized to protect supply cable and individual loads.

All starter units and feeder tap units shall be readily interchangeable with units of the same type and size. At least one spare starter unit of each type and size used in that MCC shall be provided for future use in each motor control center. MCC's shall have provisions and space to expand at least one vertical section.

All units, except Size 5 starter units and 400 ampere frame or larger feeder tap units, shall be automatically disconnected and connected to the bus as the units are removed or replaced in the motor control centers. Size 5 starter units and 400 ampere frame or larger feeder tap units shall have fixed mounting within the motor control centers.

8.9.2 Circuit Breakers

Each combination starter unit and each feeder tap unit shall include one 3-pole, single-throw, 600 volt, molded case air circuit breaker with the appropriate amperes symmetrical interrupting rating at 480 volts. All breakers shall be manually operated with quick-made, quick-break, trip-free mechanisms of the toggle type. The breakers shall be equipped with suitable arc quenching devices. Main current carrying contacts shall be silver-plated and shall be capable of carrying their rated current without exceeding the Underwriters' Laboratories specified temperature rise. All circuit breakers shall be of the same manufacture.

Manual operating handles shall be furnished on the access doors of starter units and feeder tap units to operate the circuit breakers. Provisions shall be made for padlocking each handle in the open position. Each operating handle shall indicate when the breaker has tripped automatically.

The access doors shall be interlocked with the operating handles to prevent opening the doors normally when the circuit breakers are in the closed position. Provisions shall be made for overriding this interlock.

8.9.3 Combination Starter Units

All combination magnetic full voltage starter units shall include disconnecting and branch circuit over-current protective devices; 480 to 120 volt dry-type control transformers; 480 volt, 3-phase, 60 hertz contactors with microprocessor based overload relays. Control transformer leads, starter overload relay contacts, contactor operating coils, and starter auxiliary contacts shall be wired to marked unit terminal blocks.

Disconnected and branch circuit over-current protection devices shall be magnetic instantaneous trip-only type circuit breakers as previously specified under Circuit Breakers.

8.10 GENERATOR TERMINAL EQUIPMENT/ISOLATED PHASE BUS DUCT

The generator terminal equipment includes the isolated phase bus duct, the generator circuit breakers, the generator transformer, and associated auxiliary equipment. The generator terminal equipment shall provide the interface between the steam turbine generator, combustion turbine generator, and the generator step-up transformers and neutral connections of steam turbine generator. Bus duct shall be selected with suitable continuous, momentary, and BIL ratings for this application and consistent with the applicable standards and considering operating and environmental conditions. Bus shall be provided with pressurized air system or heaters to prevent condensation. Bus shall include appropriate seals for connection to hydrogen cooled generators. System shall include adequate gauges, alarms, and controls for automatic operation.

8.10.1 GT Generator Bus Duct/Auxiliary Power Connections

Generator bus duct shall connect generator line terminal unit to the generator breaker and then to the generator step-up transformer with taps to the auxiliary transformers as depicted on the conceptual single-line drawing. Bus duct shall be self cooled with suitable continuous, momentary, and BIL ratings for this application and consistent with the applicable standards and considering operating and environmental conditions. The bus shall be a low loss design. The bus shall include seals at the generator terminals.

Tap bus shall be provided for connection to the auxiliary transformers. Tap bus shall have suitable momentary and continuous ratings.

8.10.2 Low Side Generator Breakers

A generator breaker shall be provided between the combustion turbine and generator step-up transformer. Each generator circuit breaker shall have a continuous current rating at least 125% of generator rating to transmit the generator output under all normally expected loading conditions. Each breaker shall have a short-circuit interrupting capability and short-time current carrying capability which is equal to or greater than the fault current available under any operating conditions. The potential transformers and current transformers shall be furnished as required for protective relaying, metering, and synchronizing of the generator to the grid.

The surge protection equipment shall include surge arresters and capacitors. The surge protection equipment shall be coordinated with the characteristics of each generator to provide protection for each generator insulation system. Generator breaker shall be provided with dual tripping coils, transformer side surge protection, generator side surge capacitor, isolation switch, grounding switch and generator side grounding switch. The generator breaker shall include all material required for termination of the isolated phase bus duct. Breaker shall be provided with adequate number of current and potential transformers to implement protective relaying as specified or required. At least one PT shall be a broken delta configuration with ferroresonant loading resistor.

Access platforms shall be provided for the normal maintenance and operation of the units.

8.10.3 ST Generator Bus Duct

Generator bus duct shall connect the steam turbine generator directly to its step-up transformer. Provide PT and surge cubicle, and steam turbine bushing terminal enclosure. The isolated phase bus duct and tap bus shall have a continuous current rating as required under all normally expected loading and ambient conditions and suitable momentary ratings. The bus shall include seals at the generator terminals.

All medium voltage, isolated phase bus duct and accessories shall be designed, fabricated, and tested to the latest applicable standards of NEMA, IEEE, and ANSI. The latest editions of these codes and standards shall apply.

8.11 NON-SEGREGATED PHASE BUS DUCT

8.11.1 General

Bus duct shall have continuous and short circuit ratings equal or exceeding all equipment connected to the bus. Bus shall be non-ventilated and include all hot-dipped after fabrication support structures. Flexible connections shall be provided at each termination point to allow for differential settlement. Appropriate sealing method shall be provided for wall penetrations.

8.11.2 Bus Enclosures

Bus enclosures, fitting enclosures, and termination enclosures shall be ventilated-type for indoor locations and totally enclosed non-ventilated type for outdoor locations. Enclosures shall be fabricated from heavy gauge steel or aluminum with removable covers for access to splice points of heaters. All covers or access points shall be gasketed. Welded or riveted connection means shall be used for non-removable construction. Top covers shall be solid, removable, and gasketed. Removable bottom covers shall be provided where required for splice access. Bottom pan shall have filtered breathers for outdoor section. All steel framing and panels shall be chemically cleaned and phosphatized prior to painting. All outdoor and indoor sections shall be painted. Bus enclosure shall be such that mating parts with termination boxes, elbows, wall seal sections, and tees shall fit properly without warping, gaping, or distortion of the enclosure or accessories. Connections between joining sections of enclosures or accessories shall be bonded by the enclosure design or by jumpers to ensure electrical continuity of the enclosure. The enclosure shall be designed to be hung from overhead (indoors) or supported from below (outdoors). The bus duct manufacturer shall supply all support hardware, hangers, and pedestals.

8.11.3 Bus Conductors

Bus conductors shall be multiple flat bar copper with silver plating at connections with flame-retardant, track-resistant insulation, mounted on insulated supports. Bar size and quantity per phase shall be such that the continuous current rating specified shall not cause bar temperature rise exceeding 65°C above a 40°C ambient. Bars shall be insulated with "Noryl" sleeving or dipped with a fluidized bed epoxy coating. Bars shall be mounted within the housing with flame retardant, molded, reinforced fiberglass supports. Bars shall be braced to withstand the available fault currents specified. Splice points shall use bolted connections that are accessible after installation for inspection. Splices shall be fully insulated after installation with flame retardant PVC boots or flame retardant insulating tape and jacketing tape.

8.12 BATTERY/UPS SYSTEM

This section covers furnishing a generating station unit battery complete with charging system. Additionally, this section covers the furnishing of power conversion switching and distribution equipment for continuous supply of electric power to critical AC loads.

8.12.1 Codes and Standards

All equipment furnished under these specifications shall conform to applicable standards of IEEE, ANSI, and NEMA. All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards." The latest edition of each code and standard shall apply.

8.12.2 Design and Construction

Each battery cell shall be wet cell, lead-acid pasted plate-type with lead-calcium alloy plate grids or sealed type with 20-year expected life. Cell containers shall be sealed, clear, shock absorbing, heat resistant plastic, with electrolyte high and low-level markers and spray-proof vents. Batteries shall be manufactured for full float service with a high discharge rate, low deterioration rate, and low maintenance. Batteries shall be supplied complete with all accessories (e.g. battery rack, inter-cell connectors). Racks shall be a 2 step configuration. Battery shall be installed in protected room ventilated with conditioned air. Battery shall have a final discharge voltage of 1.75 volts per cell and a design temperature of 30° C.

The DC power supply equipment shall include one battery (number of cells as required) of required voltage to provide 125-volt DC power for plant switchgear control power, protective relaying, steam turbine loads, and to the essential service AC system; two redundant ferro-resonant battery chargers for each battery; DC switchboard, and DC panelboards as required. The equipment shall supply DC power in emergencies to protect power plant equipment (UPS) and to ensure the safety of operating personnel. The equipment shall provide power to trip circuit breakers, to energize emergency bearing oil pumps, emergency lighting, continuous AC power supply equipment, and critical control and protection systems.

Each CTG is supplied with its own dedicated DC power system for combustion turbine DC loads.

The DC switchboard and panelboards shall have a main bus current rating as required to supply the connected load. Battery leads to switchboard shall be run in individual raceways for each pole. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected loads or the battery chargers. Each panelboard shall include the feeder breakers required to supply the connected loads plus six two-pole feeder breakers for future use. Switchboard shall include bus voltmeter, battery ammeter with shunt, ground detection and alarm, and low voltage alarm.

8.12.3 Rating

The Contractor, in accordance with IEEE 485 and these Specifications, shall determine the capacity of each battery. With the actual discharge capacity of the battery at 80% of rated discharge capacity, with the battery initially fully charged at the floating voltage specified, and with the battery chargers disconnected, the battery shall be capable of supplying the duty cycle specified. The ambient temperature during the duty cycle shall be 30° C. An aging factor of 25% and design margin of 20% shall be used. Contractor shall submit battery calculations for approval.

8.12.4 Duty Cycle

The batteries shall be sized to safely shut down the plant under emergency conditions without a source of auxiliary power or station service power. The station battery shall also have adequate capacity to supply emergency lighting, continuous AC power supply equipment, and critical control and protection systems for a period of three-hours following an emergency shutdown.

8.12.5 Battery Charger Requirements

Each battery charger-eliminator furnished shall be self-regulating, natural cooled, solid-state silicon controlled full wave rectifier type designed for single and parallel operation with the batteries specified under these Specifications. The parallel operation features of the battery chargers shall include cross-compensation providing for equal sharing of the charger loads. Chargers shall be able to provide the DC load requirements in the event that batteries are disconnected.

The chargers will be served from a 480 volt, 3-phase, 60 hertz system.

The battery chargers shall maintain output voltage within plus or minus ½% from no load to full load, with an input power supply deviation in voltage level of plus or minus 10% and an input power supply deviation in frequency of plus or minus 5%.
Solid-state electronic circuits shall have AC and DC transient voltage protection and shall be designed to recharge a totally discharged battery without overloading and without causing interrupting operation of AC or DC circuit breakers.

Redundant chargers shall be provided for each battery. Charger shall be a full capacity charger. Each charger shall have the capacity to recharge the battery in 8 hours following complete discharge. Battery chargers shall also have a equalizing charge mode. Battery chargers will be self-regulating after charging levels are manually selected. Battery chargers shall be manufactured in NEMA 1 enclosures suitable for placement in an indoor, environmentally controlled atmosphere. The battery chargers shall require only front access, and will allow either top or bottom conduit/cable entry.

8.12.6 UPS Equipment Requirements

The continuous AC power supply equipment includes a voltage regulator, inverter, static transfer switch, a manual bypass switch, and distribution panelboard. The equipment shall provide 120-volt AC power to essential plant control, safety, and information systems.

The equipment shall supply all plant essential loads that would be affected by a loss of power of more than 1/4 cycle and excessive voltage and frequency deviations. The equipment shall be rated so that one inverter can supply the total plant essential loads plus 10% for future expansion. The distribution panelboard shall have a main bus current rating as required to supply the connected loads plus six single-pole switches for future use. The ratings of the fuses shall be coordinated with the characteristics of the loads and the capabilities of the inverter. In addition to the plant loads furnished by this Contract, Contractor shall include critical AC loads for the combustion and steam turbine including HMI's, hydrogen control panel, fuel gas regulator station, communication equipment, SCADA RTU's, and other critical loads determined during design.

The following equipment shall be designed and assembled to provide 120 volt, single-phase, 60 hertz power to a 2-wire uninterruptible AC power system;

1	Static Inverter
1	Full Capacity Static Switch
1	120 Volt AC Distribution Panelboard
1	Manual Bypass Switch
1	Voltage Regulating Transformer

All equipment, enclosures, and accessories shall be designed, arranged, assembled, and connected in accordance with the requirements of these Specifications.

8.12.6.1 Static Inverter

The static inverter shall be solid-state type employing silicon controlled rectifiers and other required solid-state devices to convert direct current power to essentially sinusoidal alternating current power, and shall conform to the following characteristics and requirements:

Voltage	
Output	120 volts, single-phase, 60 hertz
Input (battery)	105 to 140 volts DC
Harmonic Distortion	Not more than 5%, 0 to 100% load
Voltage Regulation	Not more than plus or minus 2% at 0 to 100% percent load, 1 .0 to 0.8 power factor, 105 to 140 volts DC Input
Output, Self-Regulated	Automatic, not more than plus or minus 0.5% 0 to 100% load
Efficiency	Not less than 80% at rated load and 1.0 power factor
Duty	Continuous
Cooling	Natural convection or forced air cooling
Ambient Temperature	0-50°C maximum, 35°C normal
Minimum SCR De-rating	50% from peak voltage and peak current ratings

8.12.6.2 Inverter Capacity

The static inverter shall have the following minimum capabilities:

Continuous Full Load Rating	The inverter shall be sized to supply power for 110% of the Plant's critical 120-volt AC loads with 125% overload capability for 10 minutes.
Step Load Pickup	Upon transfer of full load, the inverter output voltage shall not drop below 75% of nominal voltage during the first half cycle after transfer and 90% of nominal voltage subsequently.
Fuse Clearing	Upon a fault in any branch circuit lateral feeder, the inverter shall have the capacity to carry a load equal to one-half of its full load rating and clear a 30-ampere, fast-acting fuse in 4 milliseconds (1 /4 cycle) or less. This requirement shall be met if the static switch fails to transfer from the inverter to the alternate source.

8.12.6.3 Static Transfer Switch

The static transfer switch shall use silicon-controlled rectifiers and other static devices required to automatically transfer loads from the "Normal" source to the "Alternate" source. The static transfer switch shall conform to the following requirements:

Capacity, continuous	Equal to the continuous full load capacity of the inverter
Capacity, peak	1,000 percent of continuous rating for 5 cycles
Voltage	120 volts, single-phase
Frequency	60 hertz
Transfer time sensing,	Including 1/4 cycle maximum. Transition shall be "make before break." Voltage failure shall be sensed on the output of the static switch. Failure shall cause the static switch to transfer. The static switch shall also transfer on over-current prior to the inverter reaching a current limit mode.
Voltage transfer to "Alternate" source	Automatic transfer to alternate source When output voltage of inverter deviates plus or minus 10 percent from nominal
Over-current transfer to "Alternate" source	Continuously adjustable from inverter Continuous rating to inverter current limit rating

Retransfer to "Normal"	Return to normal shall be automatic for all source externally caused transfers such as overload or clearing of a branch circuit fuse, but shall be manual for all internally caused transfers such as inverter, filter, or normal patch failure.
Overload	125 percent for 2 minutes
Line voltage transient	170-volt peak above normal line voltage tolerance
Ambient temperature	0-50°C maximum, 35°C normal
Cooling	Natural convection or forced air cooling
Duty rating	125% Continuous

The static switch shall be provided with protective fuses in both "Normal" and "Alternate" power sources. The static transfer switch shall be furnished mounted in enclosures described later in these Specifications.

8.12.6.4 Manual Bypass Switch

A manual bypass switch shall be used to isolate a static switch from its load and alternate power supply and to take it out of service without power interruption to the load. In so doing, it will connect the load bus to the alternate source. It shall have make-before-break contacts, so that power supply to the loads is continuous during switch operations. It shall be rated 600 volts, single-phase, 60-hertz, and shall have a continuous rating 125% of output rating.

8.12.7 Distribution Panelboards

Panelboards for distribution of continuous AC power to essential loads shall be dead-front type panelboards rated 120 volts AC. The hinged panelboard front shall cover the fuses and wiring gutter, but not the switch handles. The enclosure door shall cover the hinged front and switch handles.

Each panelboard shall be constructed for a 2-wire, single-phase distribution with a solid neutral bar. Phase and neutral bars shall be copper. Rating of the main lugs shall be equal to the rated continuous full-load current of the inverter.

Each panelboard shall have sufficient quantity single-pole, branch circuit protective devices to serve all loads plus 25% spare. Circuit protective device sizes required will be determined by Contractor.

Circuit identification labels or tags shall be provided on the panelboard front.

8.12.8 Construction Details

Details of construction shall conform to the requirements of the following paragraphs.

Enclosures shall be ventilated switchboard type, fabricated from not less than 14 USS gage sheet steel. Enclosures shall be designed to permit easy access to all components for maintenance or replacement. The enclosures shall be reinforced with formed steel members as required to form a rigid self-supporting structure. Doors shall have thee-point latches.

Adequate ventilating louvers and openings and enclosure top panels shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings.

If the equipment supplied requires forced air cooling, the cooling system furnished shall meet the following requirements.

1. Reserve cooling equipment shall be furnished for each switchboard assembly. Reserve fan capacity shall be equal to 100% of cooling fan requirements for full-load operation at the specified maximum ambient temperature.
2. Completely independent duplicate wiring and control systems shall be provided for the normal cooling fan system and the reserve cooling fan system.
3. Each cooling fan shall normally run continuously and shall be powered from the output of the inverter. Each cooling fan supply circuit shall be separately fused.
4. Each cooling fan shall be equipped with an airflow switch having an alarm contact that closes upon failure of airflow.

8.13 EMERGENCY DIESEL GENERATOR

8.13.1 General

Furnish and install an outdoor self-contained integrally assembled low-emission emergency diesel generator system to automatically start and energize critical busses in the event of loss of station power. Critical loads include loads to keep combustion turbine in the ready to start condition, battery chargers, turning gear, seal oil pumps, lube oil pumps, emergency lighting, and other loads as developed during the design phase.

8.13.2 Design and Operation

Unit shall be designed for No. 2 fuel oil with an integral day tank for 18 hours operation before filling. Heaters shall be provided to maintain water temperature to allow unit to be brought to full load within 30 seconds of starting. Provide day tank fuel oil heaters if required due to low ambient temperatures. Provide local panel for control and monitoring of unit. Unit shall be capable of remote control from the plant distributed control system. Unit shall be capable of automatic starting and synchronizing to hot or dead bus. Include any required fire protection equipment.

8.14 ELECTRIC MOTORS

Except for valve motor operators (specified elsewhere), these motor specifications are applicable to all electric motors furnished under these Specifications. Special requirements for individual motors and specifications for special application motors are included in the equipment technical sections, as required. All motors shall be Premium Efficiency.

All motors shall conform to applicable standards of ANSI, IEEE, NEMA, and AFBMA, except where modified or supplemented by these specifications. All equipment and materials shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards." The latest edition of these codes and standards shall apply.

The motor nameplate horsepower multiplied by the motor nameplate service factor shall be at least 15% greater than the driven equipment operating range maximum brake horsepower. Motor ratings shall be based on site maximum design ambient temperature.

Any motors used in variable frequency applications , such as air-cooled condenser fans, shall be rated for the application and type of drive.

Motors shall be designed for full voltage starting and frequent starting where required, and shall be suitable for continuous duty in the specified ambient. Intermittent duty motors may be furnished where recognized and defined as standard by the equipment codes and standards. Motors shall be sized for the altitude and temperature range at which the equipment will be installed.

Except as specified otherwise in the individual paragraphs or technical sections, the torque characteristics of all induction motors at any voltage from 90% rated voltage to 110% rated voltage shall be as required to accelerate the inertia loads of the motor and driven equipment to full speed without damage to the motor or the equipment.

8.14.1 4000 and 460 Volt Integral Horsepower Motors

Motors ¾- hp to 200-hp shall be rated 460-volt, 3-phase, 60-hertz. Motors 250-hp and greater shall be rated 4000 volt, 3-phase, 60-hertz. Design and construction of each 460-volt integral horsepower motor shall be coordinated with the driven equipment requirements and shall be as specified herein. Any exceptions shall be approved by Owner.

The following nameplate data shall be included:

1. Starting limitations, if any.
2. AFBMA bearing identification number for motors furnished with rolling element bearings.

For motors designed for service in hazardous areas:

1. Location class and group design.
2. Maximum operating temperature value or operating temperature code number.
3. All other motor data such as horsepower, FLA, service factor and related items.
4. All motor nameplates and attachment pins shall be corrosion-resistant metal.

All motors shall be self-ventilated unless required otherwise.

Enclosure parts for all motors (e.g., frames, bearing brackets, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable. All open-type motors and the fan covers of totally enclosed fan-cooled motors shall meet NEMA MG 1 requirements for a fully guarded machine.

Totally enclosed motors shall be furnished with drain holes and rotating shaft seals. Drain holes shall be provided with Crouse-Hinds Type ECD "Universal" combination water drain-breather plugs, or approved equal. Motors for outdoor service shall have all exposed metal surfaces protected with a corrosion-resistant polyester paint or coating.

In addition to the preceding requirements for outdoor service motors, totally enclosed motors with NEMA waterproof features shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. Bolts, nuts, screws, and other hardware items shall be corrosion-resistant or heavy cadmium-plated metal. A rotating labyrinth shaft seal shall be furnished on the shaft extension end of the motor.

Motors specified for Class I, Group D locations shall be UL approved and labeled.

Except as specified in the following paragraph, all insulated windings shall have Class F Non-hygroscopic insulation systems limited to class B rise. Motors larger than 200 hp shall be provided with sealed insulation systems and be abrasion resistant for any open motors.

All insulated winding conductors shall be copper. The winding temperature rise for all motors, when operating at the nameplate horsepower multiplied by the service factor shall not exceed 80°C. Motors larger than 200 hp shall have 2 embedded RTD's per phase.

All motors furnished in NEMA 180 Frame Series or larger shall have space heaters. Space heaters shall be rated a 120 volts, single-phase, 60 hertz. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle. The space heaters shall not cause winding temperatures to exceed rated limiting values, nor cause thermal protective device "over temperature" indication when the motor is not energized.

Terminal housings for totally enclosed motors shall be cast iron. Terminal housings for all other motors shall be cast iron, pressed steel, or fabricated steel. Housings shall be diagonally or longitudinally split with a gasket between the split halves of the housing. Each housing shall have a threaded opening to provide a watertight, rigid connection with the conduit, and shall be designed for rotation in 90-degree increments, or have other provisions to receive conduit from any of four directions

All leads shall be wired into the motor terminal housing. All leads and their terminals shall be permanently marked in accordance with the requirements of NEMA MG 1, Part 2. Cable-type leads shall be provided with compression-type terminal connectors. Motors 2500 hp and larger shall be provided with surge protection and current transformers for motor differential protection.

Each motor shall be furnished with a grounding connector attached to the motor frame inside the motor terminal housing. The grounding connector may be a lug or terminal or other acceptable grounding connector. Motors larger than 200 hp shall have grounding pad on frame for connection to plant ground grid.

Antifriction radial and thrust bearings shall be designed and fabricated in accordance with AFBMA standards to have a minimum: L_{10} rating life of not less than 130,000 hours for direct coupled service, and not less than 42,500 hours for belt or chain connected service. Grease lubricated radial bearings shall be double-shielded.

Oil ring lubricated-type sleeve bearings shall be provided with oil level sight glasses marked for required oil level at motor running and motor standstill. The oil ring shall be one-piece construction; split-type construction will not be acceptable. Stationary labyrinth seals shall be bronze material.

Sleeve bearings, end bells, and bearing housings for horizontal motors shall be split-type when available for the frame and the enclosure specified. Air gap measurement holes or other acceptable means will be provided in each motor end enclosure for checking air gap of sleeve bearing motors.

Sleeve bearings on horizontal motors shall be designed and located centrally, with respect to the running magnetic center, to prevent the rotor axial thrust from being continuously applied against either end of the bearings. The motors shall be capable of withstanding without abnormal damage the axial thrusts that are developed when the motor is energized.

Motors furnished with spherical roller thrust bearings shall also be furnished with deep groove radial guide bearings. One guide bearing shall be locked to the shaft so that the guide bearing will take upward thrust and to assure that the thrust bearing is always loaded. If spring loading is furnished, the guide bearing shall not be preloaded during normal operation.

Thrust bearings for vertical motors shall be capable of operating for extended periods of time at any of the thrust loading imposed by the specific piece of driven equipment during starting and normal operation without damage to the bearing, the motor frame, or other motor parts.

Stacked antifriction bearings will not be acceptable, except as vertical thrust bearings in frame sizes up through NEMA 360 Series open-type enclosures and up through NEMA 680 Series open-type enclosures. Where stacked bearings are furnished, matched pair precision tolerance bearings with flush ground sides shall be provided. Bearing seats on the shaft and in the bearing housing shall have accuracy equal to that of the bearing.

Grease lubricated bearings shall be self-lubrication and re-greaseable. Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor.

Bearing lubricants shall contain a corrosion inhibitor. The Contractor shall furnish all lubrication information required to assure proper equipment startup and subsequent bearing maintenance. All induction motors shall have squirrel-cage rotors.

Where shipment permits, motor output shafts shall be complete with motor half-coupling mounted, connected to the driven equipment, and adjusted ready for operation. Where motor size prevents shipment with motor connected to driven equipment, the motor half-coupling shall be factory-mounted for field connection to the driven equipment.

Motors shall have torque and locked rotor current in accordance with NEMA MG 1, Part 12 and sufficient to meet starting requirements of loads.

The maximum motor sound level shall be 85 dBA.

8.14.2 Fractional Horsepower Motors

Motors rated less than ¾-hp shall be rated 115-volt, single-phase, 60-hertz except for valve or damper operators. Motor rating, service factor, and nameplate data shall conform to the requirements of NEMA MG 1 standards.

Motor nameplate horsepower ratings shall not be exceeded when the equipment is operating within the limits of the design conditions specified. The motor loading shall not exceed the motor service factor rating on startup conditions or at the equipment maximum load point.

All motors shall be self-ventilated. Fully guarded enclosures shall be furnished on all motor enclosure types having accessible moving parts other than shafts. All insulated winding conductors shall be copper. Shafts of motors shall be furnished with corrosion-resistant treatment or shall be of corrosion-resistant metal.

Capacitors, as required, shall be furnished in removable metal enclosures mounted on the motor frame. Lock washers shall be provided under the heads of the enclosure hold-down bolts.

Manual reset thermal protection, for both stalled rotor and overload protection, shall be furnished on all motors where available unless specified otherwise in the individual technical sections. All motors shall be completely assembled with the driven equipment, lubricated, and ready for operation.

8.15 RACEWAY

This section covers furnishing and field installation of a complete raceway system in accordance with these specifications.

The raceway system is defined to include conduit, flexible conduit, continuous rigid cable supports called "cable tray" herein, underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

The design and specifications for the raceway system used in supporting and protecting electrical cable shall be in accordance with the provisions of the NEC. Fire stops shall be provided wherever raceways penetrate floors or fire rated walls.

Individual raceway systems shall be established for the following services:

1. 4160 volt power.
2. 480 volt and 125 Vdc power.
3. 600 volt control cable.
4. Special electrical noise-sensitive circuits or instrumentation cable.
5. Lighting
6. Fiber optical

Lighting branch circuits, telephone circuits, fiber optic cables, and intercommunication circuits shall be routed in separate conduit systems. Lighting circuits shall be routed in electrical metallic tubing (EMT) for indoor concealed areas, rigid conduit for hazardous exposed and outdoor areas, and polyethylene (PVC) tubing or Schedule 40 PVC conduit for underground.

Hot dipped galvanized conduit (after fabrication) shall be used for above ground power control wiring. Fiberglass or aluminum tray and conduit shall be used for corrosive areas.

Rigid galvanized steel conduit shall be used for routing individual circuits from the cable tray system to individual devices and pieces of equipment. Liquid-tight flexible conduits shall be used on all motor connections and all other connections subject to vibration.

All underground duct banks shall consist of Schedule 40 PVC conduit encased in concrete. Duct banks shall be reinforced at road crossings and areas subject to heavy loads. Duct banks shall have red dye incorporated in the top two inches of concrete. Galvanized steel conduit shall also be installed for digital and analog low level circuits to provide noise immunity from adjacent power circuits if required. Risers shall be concrete encased conduit. Spare ducts shall be provided in each duct bank run equal to 20% of the total number of ducts with the size of the spare ducts equal to the largest size duct in the duct bank. Duct banks shall be sloped to provide proper drainage.

Duct banks shall be assembled using non-magnetic saddles, spacers and separators as recommended by the duct manufacturer. Separators shall provide 3 inches minimum concrete between the outer surfaces of the conduits.

Duct bank routes shall be identified at 100 feet (minimum) intervals by means of a 4 inches x 4 inches concrete marker set flush with grade and with the letter "E" and an arrow cast in the top. Markers should be approximately 3 feet in length and shall be placed at the side of the duct bank to prevent puncturing of ducts if marker is run over by a vehicle.

Reinforced concrete manholes shall be provided, where required, so that cable may be installed without exceeding allowable pulling tensions and cable side wall pressures. Each manhole shall have the following provisions:

1. Provisions for attachment of cable pulling devices.
2. Provisions for racking of cables.
3. Manhole covers of sufficient size to loop feed the largest diameter cable through the manhole without splicing.
4. Sealed bottoms and sumps.

The installation specifications included in this article apply to all raceway system components.

8.15.1 Routing of Above Grade Raceway and Conduit

The Contractor shall route raceway and conduit and shall coordinate conduit locations with other equipment and structures. Raceway and conduit shall be routed so that, except where they are being lowered to enter equipment, the lowest part of the raceway or conduit, including its associated supports and appurtenances, is at least 6'-8" above the closest floor or walking surface beneath it. Raceway and conduit may be routed a reasonable distance away from the supporting wall, ceiling, or structural member so long as the specified support is provided, interference with other equipment and structures is avoided, and the routing is acceptable to the Owner. Raceway and conduit, including their associated supports and appurtenances, which must be routed closer than 6'-8" above the closest walking surface beneath it, shall be routed as close as possible to surfaces of walls, columns, and the equipment served. Conduit supports shall be spaced no longer than 10 feet. All junction, terminal, and pull boxes shall have construction suitable for the environment and area classification. Expansion couplings are required for every 100 foot.

All raceway and conduit shall be installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance. All raceway and conduit shall be installed perpendicular or parallel to the major equipment, building structure, and floor levels, except in special cases consented to by the Owner.

8.15.2 Electrical Cable Tray System

An electrical cable tray system shall be furnished and installed in accordance with these Specifications. The electrical cable tray shall be in accordance with the requirements of NEMA VE 1 except that, in case of conflict between the requirements of these Specifications and the requirements of NEMA VE1, the requirements of the latter shall govern to the extent of such conflict. Tray shall be installed in a continuous system. In addition to and concurrent with the load specified in this section, the tray shall be designed to withstand a concentrated load of 200 pounds at the mid-span, at the center of the rung or on either side rail.

Cable trays shall be of ladder-type construction with a rung spacing of 6 to 9 inches, nominal depths of 4 to 6 inches, and various widths as required. Cable trays shall be supported in accordance with NEMA VE-1 standards.

Cable trays and fittings shall be the standardized products of a single manufacturer designed to permit easy assembly in the field. The parts shall consist of the manufacturer's standard straight sections, crosses, tees, reducers, flat and riser elbows, as required to suit the layout. Coupling between the members shall be manufacturer's standard. All fittings shall be designed and constructed so that (1) the assembled system will be free of sharp edges or projections on surfaces which contact the cables, and (2) the cables will not be bent, either during installation or in the final position to radii less than allowable for each respective size and type. Dropout fittings shall be provided where required to maintain the minimum cable-bending radius. Where warranted, Contractor may use tray dividers for different class cables. The fill of each of the respective sections shall not exceed NEC limits.

Solid bottom trays shall be provided for all special noise-sensitive circuits and analog instrumentation circuits. Instrumentation trays shall be of steel solid bottom trough tray, galvanized after fabrication. All instrumentation trays shall have complete coverage with solid tray covers. Standard ladder type tray without tray covers may be utilized for instrumentation circuits if this installation method and separation criteria is acceptable to equipment vendors. In any case, shielded, twisted pairs shall be utilized for all low level signals.

All trays shall be of steel or aluminum construction, width and depth as required for application. All trays shall be designed with a safety factor of 2.0. Cable tray shall be labeled with the tray type and node designations shown on the Contractor's drawings. Labels shall be of the adhesive type and shall be applied to both sides of each tray at the locations shown on the Contractor's Drawings. Letters and numbers on the labels shall be minimum of two inches in height and shall be colored as follows:

Power Tray: Black characters on red background
Control Tray: Black characters on yellow background
Instrumentation Tray: Black characters on green background

8.15.3 Covers

Except as specified otherwise herein, all indoor vertical trough and ladder-type trays shall be furnished with ventilated covers to provide mechanical protection to cables which are exposed to traffic. All indoor horizontal trays located under grating floor or insulated pipe shall be furnished with covers which, on trough and ladder-type trays, extend at least two feet beyond that part of the trays directly exposed beneath the grating floor or insulated pipe. Indoors, covers may be omitted on those lower trays of stacked trough and ladder-type trays where a covered tray at a higher elevation in the stack provides complete vertical shielding to the lower tray. The top level of outdoor tray runs shall be furnished with covers. Trays which are specified to have solid bottoms shall also have solid covers throughout including all horizontal runs, all fittings, and all vertical runs.

8.15.4 Tray Supports

Tray supports shall be furnished and installed in accordance with these Specifications. The Contractor shall be responsible for designing the cable tray support system within the allowable limits specified by the manufacturer of the support hardware.

Each support shall be capable of supporting the uniform weight of the trays, plus their nominal uniform cable loads, plus a 200-pound concentrated load without exceeding the allowable limit of any element of the support system. The safety factor of support hardware shall not be considered in determining the suitability of any element, except that the safety factor shall not be less than 2.0 for any support element.

Hanger rods shall not be smaller than 1/2-inch diameter electro-galvanized threaded steel rods.

8.15.5 Material

Underground duct system materials furnished under these Specifications shall be new and undamaged and shall conform to the following requirements:

Duct	Polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.
Couplings	Plastic, for use with duct previously specified and "Duct-to-steel" adapters as required, including joint cement.
Spacers	Plastic high impact, interlocking, base and intermediate type
Factory bends and sweeps	Schedule 40 PVC, 36 inch minimum radius
End bells	Plastic
Plugs	Plastic, high impact, tapered to fit end bell provided
Duct binder	Hemp or sisal twine coupling
Riser termination	Rigid hot-dip galvanized mild steel coupling
Riser bends	Rigid steel conduit elbows, factory or field made, 36-inch minimum radius, 90 degree, entirely concrete encased below grade; hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6; the conduit interior and exterior surfaces having a continuous zinc coating with an overcoat of transparent enamel or transparent lacquer.

8.16 CONDUCTORS

In general, conductors shall be insulated on the basis of a normal maximum conductor temperature of 90°C in 40°C ambient air with a maximum emergency overload temperature of 130°C and a short-circuit temperature of 250°C for medium voltage cables and 75°C for 600 volt cables. Power conductor size and ampacity shall be coordinated with circuit protection devices. Conductor minimum size shall be the largest conductor of the following:

1. Applicable standards
2. Maximum ambient temperature
3. 125 % of connected load
4. For bus feeders 100 % of connected load plus 25 % of running load.
5. 90% minimum motor terminal voltage on starting (except if motor is designed for lower terminal voltage)
6. Voltage drop from no load to full load for switchgear and MCC's excluding transformer drop per NEC.
7. Computerized thermal model of cable position in duct bank (85°F average soil temperature).
8. Cable temperature rise due to short circuit.
9. Worst environmental condition when routed through multiple areas.

Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of this section of these Specifications. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in these Specifications.

Installation shall be defined to include placement, splicing, terminating conductors; coiling and taping of spare conductors; identification, testing, and verification of each circuit, cable, and conductor. Installation of cable in trays shall also include removal and replacement of cable tray covers. Installation shall be in accordance with manufacturer's requirements. Manufacturer's pulling or side wall tension shall never be exceeded. Contractor shall submit recorded cable tension reports. Cable shall be supported by conduits or tray for any cable routed over tray side wall. Any bottom exit cables shall be shall have suitable fittings. Cable in vertical tray risers shall be supported every 2 feet or less to prevent stress on cable.

Terminating a conductor shall include installing cable termination kits for shielded cable, attaching the conductor at its designated location, and insulating the entire connection where specified or required by the application.

8.16.1 Cable Specifications

The cable furnished shall be flame retardant construction meeting IEEE 1202 and UL 1581 and manufactured in accordance with the applicable ICEA standards and suitable for wet or dry locations. All cable installed in trays shall be rated for tray use. All cable shall have surface printing showing manufacture's name, insulation type, jacket type, conductor size, conductor type, voltage rating, and numbered footage markers. Control and instrument cables shall be terminated with ring tongue connectors. Compression type terminals may be utilized if this is the manufacturer's only offering. Special construction cables as required to meet equipment supplier requirements (turbine-generator) shall meet the following requirements to the extent possible in addition to meeting supplier requirements. Control, metering, and relaying cables routed to the switchyard shall have construction as follows except cable is to be shielded

The cable furnished shall conform to the cable descriptions included below:

CABLE TYPE	DESCRIPTION
Medium Voltage Power	25,000 and 5,000 volts, single-conductor and three conductor with ground, Class B stranded copper, ethylene propylene rubber (EPR) 133% insulation, conductor, insulation and tape shield; and chlorosulfonated polyethylene (CSP), polyvinyl chloride (PVC), or chlorinated polyethylene (CPE) jacketed. Where specified by OEM unshielded cables are to be used.
Low Voltage Power	600 volts, single-conductor, Class B stranded copper; EPR or XLP insulated; CPS, PVC, or CPE jacketed.
Low Voltage Power	600 volts, three-conductor; concentric lay, stranded copper with a ground wire in the interstices; FRXLPE or FREPR insulation; CSP, PVC, or CPE jacketed overall.
Control	Control cable, 600 volt, multiple-conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple-conductor, XLP insulation; CSP,

	PVC, or CPE jacketed overall.
Thermocouple	Thermocouple extension cable, one, four, six, and eight twisted pairs, solid alloy conductor with the same material as the thermocouples, with shield over each pair (except for one-pair construction) and with an overall shield, 16 AWG single pair; 20 AWG multi pair; FRXLPE or FREPR insulation; aluminum mylar tape shield with drain wire; CSP or CPE jacketed overall.
High Temperature Thermocouple	High temperature thermocouple extension cable, single-twisted pair thermocouple extension cable; solid alloy conductor with the same material as the thermocouples; 20 AWG; with normal maximum operating temperature of 200° C; Teflon insulation; aluminum mylar tape shield with drain wire; Teflon jacketed overall.
Instrumentation	Instrumentation cable, 300 V minimum, flame retardant single-and multiple-twisted pairs and triads, shielded instrument cable with individually shielded pairs, overall shield, and overall jacket; FRXLPE or FREPR insulation; CSP, PVC, or CPE jacketed overall. (Single pair or triad 16AWG, multi-pair or triad 18AWG).
High Temperature Instrumentation	Same as instrumentation able above 200°C Teflon insulation and jacket.
High Temperature Fixture Wire	High temperature control and fixture wire, single-conductor control cable; stranded copper; 12 AWG; stranded copper, with normal maximum operating temperature of 200°C; silicone rubber insulation; braided glass jacket.
Lighting & Receptacles	Lighting circuit runs totally enclosed in conduit, NEC Type RHH-RHW-USE with XLPE insulation for use in outdoor or unheated areas.

8.17 GROUNDING

This section covers the furnishing and installation of grounding materials complete as specified herein.

The station grounding system shall be an interconnected continuous network of bare copper conductor and copper-clad ground rods (ground wells maybe used instead of ground rods if dictated by the soil analysis). The system shall be designed to protect plant personnel and equipment from the hazards that can occur during power system faults and lightning strikes. Contractor shall perform ground resistivity testing prior to final design to determine ground analysis parameters. Ground system design will include switchyard and incoming lines in the development of the ground model. The grounding system shall be designed to ANSI/IEEE standard 80, 142, and 665 and NEC Sec. 96A.

The station grounding grid shall be designed for adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained but no grater than 50 feet.. Ground cable shall be sized for a fault duration of 0.5 seconds. The ground system shall be designed to have a resistance to ground of 1 ohms or less. The minimum ground grid conductor size shall be 4/0. Upon completion of ground system installation, perform ground system testing to verify design. Detailed design shall conform to Owner's requirements as covered in Appendix H.

Bare conductors to be installed below grade shall be spaced in a grid pattern. Each junction of the grid or other connections will be bonded together by an exothermal welding process.

If required to maintain step and touch potentials, areas not covered with asphalt shall be covered with a minimum of 4' (more if required for step and touch potentials) of suitable crushed rock if not all ready required as part of the site development.

Grounding stingers shall be connected to the building steel, fences, and equipment. Equipment grounds shall conform to the following general guidelines:

1. Grounds shall conform to the NEC and NESC.
2. Major items such as generators, switchgear, secondary unit substations, motor control centers, relay panels, medium voltage motors, and control panels shall have integral ground buses, which shall be connected to the station ground grid.
3. Electronic panels and equipment shall be grounded utilizing an insulated ground wire connected in accordance with the manufacturer's recommendations. In some situations, a separate small grid and ground rod, isolated from the main ground, may be required by the vendor. Where practical, electronics ground loops shall be avoided. Where this is not practical, isolation transformers shall be furnished.
4. Ground conductors will be sized in accordance with the NEC.
5. All single conductor ground wires installed in conduit shall be insulated. Ground conductors included in a multi-conductor power cable may be uninsulated.
6. Grid extended to 4 feet on the inside and outside of the fence line with connections to any access gates. Fence to be grounded at points no greater than 40 feet with ground rods driven at that point. Risers shall be #4 connected to fence fabric.
7. All electrical raceways to be grounded to main grid system.

Remote buildings and outlying areas with electrical equipment shall be grounded by establishing local sub-grade ground grids and equipment grounding systems in a manner similar to the plant area. Remote grids shall be interconnected with the station ground grid to reduce the hazard of transferring large fault potentials to the remote area through interconnecting instrumentation and communication cable shields.

8.17.1 Ground Grid Design

The final conductor sizing, grid configuration, grid depth, grid spacing, and quantities of conductor for the grid is to be determined during detailed design. Ground resistance shall be equal or less than one (1) ohm as confirmed through final ground grid design and testing (as defined above). Site specific soil resistivity studies are required to firm up this design. Specialized ground system software will be utilized for the final design.

Materials

All grounding materials required shall be furnished new and undamaged in accordance with the following requirements:

Rods	¾ inch 10-foot copper-clad standard type. The copper cladding shall be electrolytically bonded to the steel rod or bonded by a molten welding process. Cold rolled copper cladding is not acceptable. Ground rods shall be as manufactured by Blackburn, Weaver, or Owner-approved equal.
Cable	
Bare	Soft drawn copper, Class B stranding, ASTM BB
Insulated	Soft drawn copper, Class B stranding with green colored polyvinyl chloride insulation, UL 83, Type TW, THW, or THHN.
Wire Mesh	Copper-clad, 6 AWG, 6 inch by 6 inch mesh spacing, copper weld or Owner-approved equal.
Bus and Bars	Soft copper, cross section not less than 1/8 inch thick by 1 inch wide, ASTM 8187.
Exothermal I Welds	Molds, cartridges, materials, and accessories as recommended by the manufacturer of the molds for the items to be welded. Cadweld heavy duty or Owner-approved equal. Molds and powder shall be furnished by the same manufacturer.
Flush ground plates	Cadweld B-162 Series, B-164 Series, or Owner-approved equal ground plates with NEMA hole spacing.

All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be of copper.

8.18 PLANT SECURITY SYSTEM

Contractor shall install raceway, power cable, and fiber optic cable to each of the plant fence corners, main entrance gate, and contractor turnstile gate. The cables shall be routed to an area designated by Owner in the control room for connection to Owner furnished security system

8.19 ELECTRICAL TESTING

Contractor shall perform detailed testing for all equipment , materials, and systems furnished under this Contract. Equipment shall be tested in accordance with manufactures instructions and NETA (National Electrical Testing Association - Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems) requirements. In addition to equipment tests, Contractor shall perform functional tests to verify proper operation and interlocks of equipment. Any procedures that may affect the existing plant shall be coordinated with Owner.

Contractor shall prepare detailed written step-by-step procedures for major electrical functional tests such as back-feed and synchronization. Procedures shall include predicted values as well as actual measured values. These procedures shall be submitted to Owner for review and comment. Prior to the start of any of these major tests, all associated parties shall sign-off on the procedure.

Contractor shall prepare a hardbound notebook with copies of the testing reports. In addition CD's shall be prepared with electronic copies of the reports plus any manuals, software, or reference material used in the plant testing. Owner may choose to witness some tests. Prior to start of the testing program coordinate with Owner to identify tests they may witness.

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SECTION 9.0
INSTRUMENTATION AND CONTROLS

9.1 GENERAL REQUIREMENTS

This section covers the minimum scope, technical requirements and quality standards for the combine cycle power block instrumentation, control systems, Equipment and interfaces with other plant systems and facilities. The Contractor shall provide all Materials and labor for the engineering, design, procurement, delivery, staging, installation, construction, inspection, factory testing, startup, and commissioning of all instrumentation and controls systems specified herein and necessary for a complete, functional combine cycle power generating facility and in conformance with generally accepted practices for generating facilities. All control and instrumentation design will be performed under the supervision of a Professional Engineer. In addition, all Work shall comply with applicable codes and standards identified in Section 3.0 including all State and local codes, laws, ordinances, rules and regulations.

Provide instrumentation and controls for the plant to keep the number of plant operators to a minimum while providing sufficient monitoring and control capabilities, ensuring continued safe and reliable operation of the plant, and alerting the operators to any abnormal conditions or situations requiring manual intervention in a timely manner. The facility shall be capable of operating at all normal and abnormal conditions, including hot startup with one control room operator and one outside operator. During cold startup, the plant shall be capable of operating with one control room operator and two outside operators.

The integrated control of all plant systems shall be accomplished using Distributed Control Systems (DCS) as described in this Specification.

Provide discrete, independent, and dedicated I/O racks, DCS controllers, and operator interfaces. Controllers and operator interfaces shall be networked together to provide an integrated control system. The controllers, I/O racks, raceways, and conduit shall be completely physically independent of other system. DCS, controller, communication modules, I/O racks shall be partitioned to logical arrangements.

In general, modulating controls shall be backed up by interlocks and/or safety systems which cause pre-planned actions in cases where unsafe conditions develop faster than the modulating controls or the operator can be expected to respond.

Skid mounted Programmable Logic Controllers (PLC) shall be interfaced with the DCS to provide full remote control and monitoring capabilities to the operator. Specific control and monitoring requirements for major systems are described in the Specification sections covering the systems.

All instrumentation and control equipment shall be of proven design and shall be selected to achieve the highest level of plant availability and ease of equipment maintenance. Control and instrumentation provided shall be complete in all respects, requiring no further additions. Standardization of instrumentation and controls hardware shall be observed throughout the Project. All instruments, control valves, PLC controllers, and other control devices of a common nature shall be of the same manufacture, and wherever practical, shall be of identical model. DCS controllers shall be of identical manufacture and model. All electronic field devices shall be Smart, Highway Addressable Remote Transducer (HART) compatible.

All PLC controllers shall be located in air conditioned rooms or enclosures.

In general, local single closed loop control may be utilized for the control of systems that do not require optimization such as, for example, blowdown tank level. Individual sensors with integral or local controls, for example, direct level controllers shall be utilized for these types of loops.

Redundant components, as required by code, shall be installed as completely separate devices with individual sensing taps and individual isolation capability.

All critical sensors for continuous controls and protection shall be redundant. No control I/O signals shall be multiplexed. Indication signals may be multiplexed at the Contractor's option.

Mechanical equipment shall be provided with safety interlocks incorporated into the system controls to prevent damage to the equipment. Mechanical systems shall incorporate in their control the necessary equipment recommended by the manufacturer to assure that operational Contract conditions, as set forth by Owner, have been complied with.

Mechanical equipment on standby status shall automatically start when system conditions are beyond the parameters set for normal operation. Annunciation shall be provided whenever a "standby" piece of equipment is placed into service.

9.2 DISTRIBUTED CONTROL SYSTEM (DCS)

The DCS shall be designed for automatic supervisory control of the combined cycle generation plant as well as to initiate manual commands and shall provide safe, reliable, and efficient operation of the plant.

The DCS shall include supervisory controls, plant process operation monitoring, plant operating condition indication, and display to advise operating personnel of the current operating status of the plant. During normal operation or in the event of an abnormal plant upset condition(s), the DCS shall enable the operator to take over and manually control the plant.

The DCS shall contain sufficient built-in hardware and software redundancy to include but not limited to redundant control processors, redundant data highway and power supplies with automatic changeover to the standby unit upon detection of a fault of the operating units. The failure of any single element shall not affect the operations or monitoring of the plant.
The DCS shall be utilized to the maximum extent possible for control, monitor, logging, alarm annunciation of plant equipment and the process. Features of the DCS shall include redundancy of controllers, redundancy of power supplies, operator stations, printers, and redundant communications. In addition to control capabilities, the system shall include all features required for historical data recording, data processing, and minor calculations for report generation and billing purposes. Consolidation of files shall be selectable. A minimum of thirty (34) days data storage capacity shall be provided with system to allow for downloading to a CD/DVD drive or DAT-tape drive.

Where process equipment is furnished with its own packaged controls and instruments, these devices shall be interfaced with the DCS as required to provide full data for monitoring, logging, to annunciate, and acknowledge alarm conditions, and to fully communicate DCS commands and responses to and from the packaged controls as required via redundant gateway interfaces.

A control room operator using the DCS shall be capable of supervisory control including starting, stopping, normal operation, and monitoring and acknowledging of alarms for the gas turbine generator(s) and steam turbine without physically needing to go to the GTG or STG control interfaces.

Provide first-out indication, annunciation, alarming, and sequence of event (SOE) monitoring, time stamp to 1 millisecond for each GTG and STG. Provide a GPS time stamping synchronization system or Owner approved equal for the synchronization of all system clocks.

Installation of the DCS shall be in accordance with the manufacturer's recommendations and guidelines. Installation shall take into account noise and grounding considerations. A complete power-up and grounding check shall be performed subsequent to cabinet installation and prior to beginning terminations. The Contractor shall be responsible for the application loading and debugging of all software, and for testing, calibration, startup and commissioning of the DCS and communication links with other plant systems.

Coordination of all electrical and steam generating systems with respect to one another shall be maintained and designed into the DCS controls so that a change in plant load demand shall be translated into a smooth, characterized change in demand to each affected system. The coordinated control shall recognize all limitations exhibited in these systems and shall take appropriate action.

The DCS shall be supplied with all process signals required to perform calculations and comparisons by the operator.

The plant consumption and generation of energy shall be monitored and logged in the DCS. Metering requirements are provided in Section 8. Reports shall be generated for each billing period documenting gross and net generation. These reports will be used to confirm the utility furnished metering system and may be relied on for billing in the event of a utility metering system malfunction.

Provisions shall be made for the prevention of unauthorized or accidental changes to system configuration. System data logging and recovery capability shall be provided so that control system configuration and database can be quickly restored in the event of an operator error or system failure.

The DCS shall interface with the Owner supplied PI data storage system.

The DCS shall also include the following capabilities for monitoring and controlling electrical systems within the facility, displayed on operator console graphic screen(s):

1. Control, status, and alarm indications of all high voltage circuit breaker on electrical one-line diagram.
2. Analog Input and output signals as indicated on electrical one-line diagram.
3. Control, status, and alarm indications of the emergency AC system transfer switches.
4. Status and alarm indications of uninterruptible power supply (UPS) and DC system.
5. Other analog, status, and alarm indications for complete monitoring of electrical systems and subsystems.

DCS system shall have the following as a minimum:

1. Four operator workstations for plant monitoring and control each equipped with an operator keyboard, mouse, and dual 19" CRT Flat Panel or LCD graphic displays.
2. One dedicated engineering workstation for programming modifications equipped with keyboard, mouse, and dual 19" CRT Flat Panel or LCD graphic displays.
3. Two printers, one for periodic reports and operator logging, the other for an alarm printer.
4. One color laser printer for hardcopy documentation of system configuration and color graphics.

5. 100 custom interactive P&ID graphics shall be included in the design. In addition to these displays, all control loops, indicator, and alarms will be shown on group displays depicting H/A stations and push button stations.

Provide the capability to allow all graphics and controls interface to be monitored and manipulated from any of the operator interfaces and the engineering workstation.

All software and operating systems provided shall be manufacturer's latest offering and shall comply with the design requirements, features, and capabilities specified herein.

All control room furniture and consoles provided for the Project shall be of identical manufacture and configuration. Consoles shall be provided for the operator stations, engineering station, GTG and STG Remote HMI's, CEMS stations, 5 printers, and trip panel containing GTG, STG, HRSG MFT Trip pushbuttons. The existing Block 1 combined cycle plant control room shall be expanded by Owner to incorporate the new Block 2 combined cycle plant consoles, and plant control workstations. A layout for existing Block 1 Central Control Room detailing Block 2 layout is attached in Appendix C.

9.3 DCS CONTROLLERS AND I/O

DCS Controllers shall be loaded to no more than 60-percent upon completion of Factory Acceptance Testing and 75-percent upon completion of commissioning. Controller cabinets shall be located throughout the plant, as required, to enhance reliability and to reduce wiring requirements.

The DCS shall be sized such that there shall be 20-percent spare's of each I/O type at each location at time of shipment to the site and 10-percent spares of each I/O type at each location at Substantial Completion, as a minimum. In addition, cabinets will be furnished with at least 10-percent spare card slots in every card cage and 20-percent extra space in each cabinet for future use.

The system will be capable of scanning, processing and storing any inputs and outputs at the rate of at least four times per second and at 1 millisecond for SOE points. Peer-to-peer communications between controllers will communicate all points at the rate of once per second. Actual scan times will meet the hardware requirements for the controller loop processing time. Overall system scan rate shall not exceed 250 milliseconds.

To permit removal of I/O modules without removing field wiring, all I/O field terminations shall be terminated on separate field termination blocks in I/O cabinets.

Analog input signals to the system will be isolated and either current limited or fused from the internal circuitry so that shorting, grounding or opening the circuit at the transmitting Equipment will not affect control system performance. Analog inputs shall not exceed 8 per card. The system shall provide quality checks for all analog inputs. Data will be automatically tagged as bad on all displays or logs if the input value is out of range. System accuracy shall be 0.1-percent of calibrated range, (excluding transmitters).

Analog output signals from the system will be isolated and either current limited or fused from the internal circuitry so that shorting, grounding or opening the circuit at the receiving Equipment will not affect control system performance. Analog outputs will not exceed eight per card. System accuracy will be less than 0.5-percent of output signal range (excluding final element).

Digital (contact) outputs will be individually fused in the control system. Digital outputs will not exceed 16 per card. Interposing relays will be used for all applications where the current and/or voltage requirements exceed the capability of the DCS outputs. The system will be capable of assigning each digital output as momentary or maintained. Momentary outputs will be present for at least 100 milliseconds but not more than two seconds. The system will be capable of providing normally open and normally closed contact outputs.

Digital (contact) inputs will be individually current limited. Digital inputs will not exceed 16 per card. Contact inputs will be scanned at the controller level for status change. Normal state for a contact will be definable as either open or closed. In general, digital inputs shall be failsafe or closed for normal state. The system software will have the ability to apply digital filtering or time delay to all contact inputs.

The DCS shall be capable of resolving at least 100 inputs for Sequence of Events (SOE) monitoring at a resolution of 1 millisecond. Control shall provide a preliminary SOE list for Owner review and approval. System shall be able to assign any digital point in the control system for SOE service. Grouping of these points is acceptable, but the points or groups may be distributed in all I/O locations including remote I/O. The provided GPS time stamping synchronization system shall be used for the synchronization of all system clocks and for the SOE time stamp.

The processing for thermocouple and RTD inputs is the same as that described for analog inputs above. The system will also check for open thermocouple and provide alarm. Thermocouple readings will be linearized.

9.4 INTERFACES AND NETWORKS

The DCS shall be interfaced to a number of systems throughout the plant and remotely to include, but not limited to the following:

1. GTG
2. STG
3. HRSG Duct Burner PLC's
4. RTU for Dispatch Control
5. CEMS
6. Plant Skids/systems implementing PLC's

The DCS control system components shall incorporate a 100mbps Ethernet communications network. The network shall be provided for control and monitoring from the operator, engineering servers and client workstations.

Data communication link interfaces shall be provided with watchdog timers and communications alarms.

All communications cabling running exterior to plant buildings shall utilize multimode fiber optic cabling with fiber patch panels, fiber to Ethernet media converters as specified in Section 8.0.

9.5 REMOTE TERMINAL UNIT (RTU) DISPATCH

An RTU to implement Dispatch Automatic Generation Control (AGC) will be furnished and installed in the switchyard control building by others. The Contractor will provide a fiber optic connection from the switchyard RTU located in the switchyard control building to the plant DCS. Provide all facilities required for RTU communications between the power plant and Switchyard control building. Any I/O points required at RTU but not available in the DCS shall be hardwired to the RTU. Facilities shall include but not be limited to, ductbank, fiber, wiring, programming, and interface equipment. The Contractor shall provide all required Fiber Patch Panels at the substation and control room and/or other location to allow for the complete termination of all fibers into and out of each location. The Contractor shall work with the Owner Dispatch Center and personnel and to test and commission the DCS to Dispatch link for control, monitoring and alarming functions as specified in Section 8.

9.6 DCS FACTORY ACCEPTANCE TEST (FAT)

The Contractor and DCS manufacturer shall completely configure, load, and debug the DCS control system components and database at the factory or Contractor's facilities prior to FAT. A hardcopy printout and electronic copy of the I/O database, graphic screens, logic diagrams and detailed hardware configuration and FAT plan itemizing FAT activities shall be supplied to the Owner in advance for review and comment prior to finalization of system configuration and FAT. FAT plan and schedule shall be agreed to by Contractor and Owner early in the Project cycle. The DCS manufacturer shall provide 3 weeks for the FAT of the hardware, logic and software design and data communication interfaces. The FAT Logic shall be verified by simulation. Data communication links to the GTG, STG, and HRSG Duct Burner PLC shall be verified using a test simulator per the manufacturer's recommended practices. Owner shall witness FAT. DCS manufacturer shall provide problem or variance report sheets to document any and all problems encountered with hardware, software, graphic screens or control logic implementation. All problems found during the FAT shall be reconciled prior to shipment to the field. Owner reserves the right to require additional FAT, at Contractor's and/or DCS manufacturer's expense, if original testing proves the system design to be incomplete or substantial revisions are required.

9.7 HARD PANEL CONTROL BOARD

Hardwired, redundant, emergency trip, mushroom-style push buttons one pair for each GTG, STG, and HRSG MFT one for the entire block, and one for closing the emergency fuel gas shutoff for Block 2 shall be provided as a part of the emergency shutdown protection panel as required by the system per Section 5.

9.8 INSTRUMENTATION AND CONTROL DEVICES

9.8.1 General

Signals for analog control system inputs and outputs shall be provided from process transmitters at 4-20 mA signal level, or direct-wired RTDs and thermocouples. Pneumatic signals shall be 3-15 psi.

Instrument primary sensing devices shall be nominally ranged at 150 percent of the systems normal operating pressures and temperatures.

Instrument calibration shall be verified by Contractor and documented for submittal to Owner.

Instrumentation and sensing lines shall be freeze protected where appropriate for instrumentation supplied by Contractor and by equipment manufacturer as required.

Gauges and indicators, including position indicators on valves, shall be installed to be visible from normal operating platforms or accessways without the need for ladders, mirrors, or other devices. All termination lugs shall be applied with a ratchet type crimping tool to insure an equal pressure connection between lug and signal cable core.

9.8.2 Thermocouples and Resistance Temperature Detectors

Temperature measurement shall in most cases be performed using thermocouples. Thermocouples and extension wire shall comply with the standard limits of error according to ANSI MC96.1-1975 and shall be Type E.

Resistance temperature detectors (RTDs) of the three-wire platinum type shall be used in certain cases such as motor winding temperature measurements. The nominal resistance of the platinum detectors shall be 100 ohms at 0°C. All resistance temperature detectors shall be metal sheathed, and ceramic packed.

Thermocouples and RTDs shall have stainless steel sheathed elements and spring-loaded to provide good thermal contact with the thermowell. All connection heads shall be weatherproof equivalent to NEMA 4, with chain-connected screwed covers, and supported from the well by lagging extension long enough to clear the head of the temperature element above the process pipe lagging.

9.8.3 Thermowells

Temperature sensors shall be equipped with thermowells made of one piece, solid bored Type 316 stainless steel (or higher alloy if required for the application) of step-less tapered design. Maximum bore internal diameter shall be 0.385 inch.

Test wells shall be provided on main steam, feedwater, condensate, and other piping as required to meet ASME test requirements. Test wells shall be provided with screw cap and chain.

9.8.4 Flow Elements

Flow elements shall be provided in accordance with appropriate applications and in accordance with requirements contained in Section 5. Weld-in type Factory Certified Flow Nozzles shall be used for Main Steam, Hot Reheat and Cold Reheat flow measurements. Flow Nozzle shall be provided with two (2) sets of pipe wall pressure taps. All FEs required for performance testing shall be PTC6 certified to include but not limited to: HP and IP Feedwater, LP Steam, Condensate, and Cold Reheat.

9.8.5 Transmitters

Transmitters shall be used to provide the required 4-20 mA DC signals to the DCS. Transmitters shall be of the smart electronic two-wire type, HART compatible and capable of driving a load of at least 500 ohms with non-interacting zero and span adjustments and remote recalibration features.

9.8.5.1 Static Pressure and Differential Pressure Transmitters

Differential pressure transmitters shall be HART compatible with transmitter sensor specified to withstand 150 percent of design pressure. DP transmitters shall be provided with remote seals and filled capillaries where required, static pressure protection limit and any other applicable options required to accommodate specific applications.

9.8.5.2 Level Transmitters

Sensing elements for level transmitters shall be as follows:

1. Gauge pressure transmitters for vessels exposed to atmospheric pressure.

2. Enclosed, pressurized vessel level shall be measured using radar, ultrasonic, guided wave radar or Differential Pressure transmitters with filled capillaries and remote seals.

3. Differential Pressure element with constant head chamber for high pressure and temperature applications where installation of float cage becomes impractical (level transmitters of this type are the same as differential pressure transmitters).

9.8.5.3 Flow Transmitters

Flow transmitters, in general, shall be differential pressure types. Square root extraction shall generally be performed electronically in the control system.

9.8.6 Gas Meters

Contractor shall tie into the existing gas metering station. A check meter shall also be provided on the main gas supply to Block 2. Meters used for fuel gas flow measurement shall be complete with temperature and pressure compensation capability using design pressure and temperature as its base conditions. Total gas flow shall be indicated locally, and gas flow rate shall be transmitted to, and monitored and totalized in, the DCS. Flow meters shall meet the requirement of the EPA and Currant Creek Air Quality Permit. Manufacturer's calibration certificate shall be provided that shows that flow meter meets the accuracy requirements of the EPA and Currant Creek Air Quality Permit.

9.8.7 Temperature, Pressure, Level, and Flow Switches

Temperature, pressure level, and flow switches shall generally have two Form C contacts for each actuation point and shall be equipped with screw type terminal connections on a terminal block for field wiring. Switch set point and deadband shall be adjustable with a calibrated scale. Contacts shall be snap acting type. Switch enclosures shall be NEMA 4 for non-hazardous locations, and NEMA 7 or 9 for hazardous locations. All termination lugs shall be applied with a ratchet type crimping tool to insure an equal pressure connection between lug and signal cable core.

9.8.8 Local Indicators

9.8.8.1 Thermometers

Thermometers shall be the bimetallic adjustable, every-angle types with minimum 4-½ inch dials. Where view is obstructed or unavailable, thermometers shall be provided for remote mounting including filled capillaries..

9.8.8.2 Pressure Gauges

Pressure gauges shall be the bourdon tube type with solid front cases with blowout back, 4-½ inch dials, stainless steel movements and nylon bearings. Gauges shall have ½-inch NPT bottom connections. Gauges shall be provided with pigtail siphons for steam service, snubbers for pulsating flow, and diaphragm seals for corrosive or severe service. Gauges located on process lines exposed to ambient temperature shall be freeze protected.

9.8.8.3 Local Level Indicators (Gauge Glasses)

Tubular gauge glasses shall be used for high-pressure applications. Mica shields shall be used with transparent gauges on steam/condensate service. All gauge glasses shall be equipped with gauge valves, including a safety ball check.

9.8.9 Control Valves

Control valves shall be used in modulating service throughout various processes within the facility and as specified in Section 5. Globe valves shall be used extensively in water, steam, gas, and oil service with butterfly and ball valves used in limited applications, typically low pressure and temperature water service.

Pressure retaining component and valve trim materials shall be selected based on process conditions such as type of fluid, static and differential pressures, and temperature. In general, control valves in water and steam service shall be provided with hardened stainless steel trim.

Modulating control valves shall be sized to pass design flow at 60 to 80% of valve capacity. Multiple service conditions should be specified when a control valve is expected to operate over a wide range of travel, i.e., feedwater flow and drum level control valves. When the calculated Cv is less than the manufacturer's recommended minimum Cv, two valves with split range control shall be provided, unless otherwise approved by Owner.

Minimum control valve body size shall be not less than 50% of the upstream pipe size. When a calculated Cv requires a smaller valve, reduced trim shall be used in order to maintain the body size requirement. Reduced trim shall not be less than 40% of valve capacity.

Pneumatic actuators of the diaphragm or piston/cylinder type shall be Smart, Hart compatible, with the ability to provide position feedback and diagnostic information on each valve. All critical valves shall be equipped with hardwired position feedback modules. Careful consideration should be given to the fail-safe position of control valves. Where practicable, actuators with integral springs shall be specified. All control valves shall be capable of operating with a 60 psig air header pressure.

In general, all control valves shall have ANSI class IV leakage ratings. Valve failure philosophy shall be developed with Owner participation.

Control valves shall be designed to operate from a control signal range of 3 to15 psi.

Each control valve shall be provided with accessories such as handwheels, filter regulators, solenoid pilot valves, limit switches, and position indicators as applicable.

9.8.10 Instrument Racks

Where possible, field instruments other than local indicators shall be grouped together on instrument racks. Maximum tubing run from the sensing point to the rack shall be 50 feet, unless approved otherwise by Owner. Interior instrument racks shall be open structures with frames constructed of angle or structural tubing. The frames shall be reinforced as required to provide adequate support for instruments and equipment. Equipment supports shall be horizontal members, which provide a place for the attachment of mounting brackets and clamps for piping and tubing.

Instruments exposed to ambient temperatures shall be housed in heated instrument enclosures with heat traced impulse lines with integral tubing bundle. Integral tubing bundle shall be O'Brein or Owner approved equal. Heated enclosures shall be diagonal, clam-shell style to provide easy access to process instruments from the front, top or either side. No flexible insulation (soft-case) is acceptable. Enclosures shall have a maximum of three (3) instruments each and shall be large enough to house all required blowdown valves inside enclosure. Heat trace system shall be designed to activate enclosure heaters when ambient temperature is below 40 degrees Fahrenheit. Heat trace panel requirements are defined in Section 8.

9.8.11 Tubing Systems

Instrument, control, and sampling tubing systems shall be designed, fabricated, and tested in accordance with ANSI ISA RP 7.1.

Primary process instrument and sampling tubing for steam and water systems shall be ASME SA213 grade TP316H SS 3/8 inch .049 standard wall or 1/2 inch .065 standard wall, respectively (Note: On high pressure, high temperature applications, tubing shall be 316H minimum wall per ANSI B31.1 specifications).

Fittings shall be manufactured of the same material as the tubing, wherever practical. Where not practical, fittings shall be manufactured of a harder material than the tubing and at minimum of Rockwell 80B.

Pressure type instruments shall have associated isolation and test valves or combination two-valve isolation/test manifolds. Differential pressure type instruments shall have associated pairs of isolation and test valves plus an equalizing valve or combination three-valve isolation/test/equalizing manifolds.

Blowdown valves shall be provided for each remote device as required. Tandem blowdown valves shall be provided on high pressure, high temperature applications (pressure greater than 600 PSIG and/or temperature greater than 450 degrees Fahrenheit). Blowdown valves are not required for vacuum, gas, or dry air service.

Sample tubing systems carrying high temperature samples shall be insulated or guarded in areas which require personnel protection.

9.9 CONTROL SYSTEM LOOP COMPONENT DESIGN

The major plant systems to be controlled and monitored are described and presented in Section 5. They include the following:

1. Gas Turbine/Generator Systems.
2. Steam Turbine/Generator Systems.
3. Heat Recovery Steam Generator Systems.
4. Feedwater Systems.
5. Air Cooled Condenser (ACC) System
6. Water Treatment System
7. Fuel Gas Metering and Conditioning System.
8. Plant systems to include tie-in to Block 1 Raw Water System.
9. Plant Monitoring System.

9.9.1 Gas Turbine Generator (GTG)

Each gas turbine generator is supplied with a dedicated microprocessor based control system which contains the unit metering, protection, and control switches. The GTG control system provides control functions including: fuel, air and emissions control; sequencing of turbine fuel and auxiliaries for startup, shutdown and cool down; monitoring of turbine control and auxiliary functions; protection against unsafe and adverse operating conditions. Gas turbine controls shall be designed to minimize unnecessary trips, nuisance alarms, and false starts. Runbacks, rather than trips, shall be utilized whenever possible. The GTG control system shall provide for the automatic and semi-automatic starting, automatic and manual synchronizing, loading, and shutting down of the turbine. Comprehensive supervisory systems and equipment for monitoring operational status, alarms and automatic protection shall be provided for the safe, reliable remote operation of the machine. The GTG and GTG control system is described in Section 5 of these Specifications. Gas turbine controls shall be designed to minimize unnecessary trips, nuisance alarms, and false starts. Runbacks, rather than trips, shall be utilized whenever possible.

The DCS shall be implemented to provide supervisory control, monitoring, alarming and historical functions for each GTG and shall interface to each GTG control system through hardwired and data link interfaces. The DCS interface to each GTG control system shall be in accordance with the turbine manufacturer's recommended configuration. The DCS, through a combination of hardwired and data link interfaces, shall be able to perform all actions necessary to start and stop the unit, raise and lower load, monitor status, log operating data, and annunciate and acknowledge alarms. Critical control functions, status and alarms for essential gas turbine operation will be hardwired to the DCS control system. Remaining control functions, status, and alarms shall be interfaced with each GTG control system through a high speed 100 Mbps, fiber data link per manufacturer's recommended configuration. The link will provide all data on the manufacturer's standard interface list, as required. Final determination of I/O will be subject to Owner approval. Key GTG system control, alarm, and status graphics shall be integrated with the DCS to provide the identified supervisory control. A common GTG Remote HMI shall be provided in the main control room for detailed controlling, alarming, and monitoring of the Gas Turbine system. The main control room shall serve as the primary operator interface.

All critical control trips and interlocks shall be hardwired between the DCS and the GTG control system. Remote manual tripping of the GTG shall be possible using the auxiliary console-mounted, hard-wired emergency stop pushbuttons located in the control room.

The Contractor shall submit with Bid a conceptual Control System Architecture diagram outlining the anticipated configuration for Owner review. This diagram shall define what control and monitoring functions will be provided at the centralized control room, and at various locations throughout the system, location of each I/O drop, number of processors at each location, approximate number and type of I/O at each location, PLC drops, communications protocol, and other applicable information.

9.9.2 Steam Turbine Generator

The steam turbine generator will be provided with a dedicated microprocessor based control system that includes an electronic governor for speed and load control with all standard interlocks required for start-up, loading, shutdown, and tripping of the turbine-generator. The steam turbine speed control and inlet pressure control will be done through the governor. Comprehensive supervisory systems and equipment for monitoring operational status, alarms and automatic protection shall be provided for the safe, reliable remote operation of the machine. The STG and STG control system is described in Section 5 of these Specifications.

The DCS shall provide supervisory control, monitoring and alarming for the STG and shall interface to the STG control system and governor through hardwired and data link interfaces. The DCS interfaces to the STG control system shall be in accordance with the turbine manufacturer's recommended configuration. The DCS, through a combination of hardwired and data link interfaces, shall be able to perform all actions necessary to start and stop the unit, raise and lower load, monitor status, log operating data, and annunciate and acknowledge alarms. Critical control functions, status and alarms for essential steam turbine operation will be hardwired to the DCS control system. Remaining control functions, status, and alarms shall be interfaced with each STG control systems through a high speed 100 Mbps fiber data link per manufacturer's recommended configuration. The link will provide all data on the manufacturer's standard interface list, as required. Final determination of I/O will be subject to Owner approval. Key STG system control, alarm, and status graphics shall be integrated with the DCS to provide the identified supervisory control. A STG Remote HMI shall be provided in the main control room for detailed controlling, alarming, and monitoring of the steam turbine system. The main control room shall serve as the primary operator interface.

All critical control trips and interlocks shall be hardwired between the DCS and the STG control system. Remote manual tripping of the STG shall be possible using the auxiliary console-mounted, hard-wired pushbuttons located in the control room

9.9.3 Heat Recovery Steam Generator (HRSG)

Control of the HRSG shall consist of the following loops under control of the DCS to safely and efficiently maintain steam header pressure and feedwater to match turbine-generator requirements during start-up, normal operation, upsets, and shutdown. Duplicate controls shall be supplied for each HRSG, as required. Consult Section 5 for further requirements.

Control of each HRSG shall include the following subsystems:

9.9.3.1 HRSG Drum Level Control System

The HRSG drum level control system shall be conventional three-element control using main steam flow as the feed-forward signal, drum level, and feedwater flow as the feedback signals. Based on demand, the system controls the feedwater control valve to adjust feedwater flow to the HRSG. The system will be designed to operate on single-element control using drum level only during start-up. Transfer from single-element to three-element and back to single-element shall be automatic based on steam flow.

9.9.3.2 Duct Burner Safety System

The duct burner control system shall be fully integrated with the plant DCS.

The duct burner safety system shall be a self-contained PLC and shall be designed to safely shut down the HRSG auxiliary burner system on abnormal and emergency conditions. The system shall be interlocked to shut down the fuel gas to the HRSG as recommended by the HRSG manufacturer. The duct burner safety system shall comply with NFPA 8506 and the NEC code. The duct burner safety system shall incorporate hardwired and softlink status, alarms, controls signal for control and monitor from the DCS.

9.9.3.3 Ammonia Injection Control System

The ammonia injection control system shall be designed to control stack emissions to meet permit requirements.

9.9.3.4 Steam Temperature Control System

The purpose of this system is to maintain the final superheater and reheater outlet temperatures at a set value with minimum fluctuation. This shall be a single station, cascade-type control system in which the final superheater and reheater outlet control units serve as the master or primary control units, and the desuperheater outlet control units serve as the slave or secondary control units.

9.9.3.5 LP Drum Level Control System

The LP Drum levels shall be controlled by the DCS. Level switches shall be provided to alarm high and low levels and to trip the feedwater pumps on low-low level.

9.9.4 Feedwater System

Feedwater systems will be comprised of the following subsystems:

9.9.4.1 Condensate Receiver Tank Level Control

The level shall be controlled from the DCS. Cycle water make-up flow shall be regulated through a control valve to maintain condensate tank level. If the level is low, make-up will be admitted from the demineralized water storage tank. If the level is high, a fraction of the condensate flow will be routed to the demineralized water storage tank to prevent condenser flooding. Level switches shall be provided to alarm high and low levels. Pump run indicators shall be provided to alarm pump cutout. Condensate tank shall also be provided with local level indication.

9.9.4.2 Boiler Feed Pump Minimum Flow Control

Feedwater pump minimum flow control consisting of a recirculation valve which circulates water back to the LP drum during periods of low HRSG feedwater demand shall be provided. This may be in the form of a flow control valve.

9.9.4.3 Boiler Feed Pump Existing Vibration Monitoring

BFP shall be equipped with Bentley Nevada Vibration Monitoring Control monitoring systems. This system shall be tie to Block 1 main Bentley Nevada Vibration Monitoring System.

9.9.5 Air Cooled Condenser (ACC) System

The ACC system controls shall be implemented through the DCS. The ACC system components, performance and requirements are identified in Section 5. ACC fans shall be controlled automatically from the DCS as required to maintain the steam turbine condenser backpressure at operator selected values associated with acceptable steam quality in the steam turbine and maximum plant net output. In addition, the implemented controls shall protect system from freezing, include no sub-cooling, and minimize parasitic power consumption.

9.9.6 Water Treatment Systems

The water treatment systems shall be prepackaged units with self-contained PLC controls. All data from the water sample panels shall be provided for control, monitoring and alarming in the DCS.

9.9.7 Fuel Gas Metering and Conditioning System

The Fuel Gas Metering and conditioning system shall be prepackaged units with self-contained PLC controls. Data from this system shall be provided via communication link and/or hardwired interface for monitoring and alarming in the DCS. See Section 5 for system requirements.

9.9.8 Plant Systems – Raw Water

Block 1 Raw Water Supply System shall be modified to support the new Block 2 combine cycle plant. Block 1 Raw Water System includes two (2) existing Well pumps, and an existing Raw Water Storage Tank. A second Raw Water Storage Tank shall be added for Block 2. Modification of existing Block 1 Raw water system and controls may be required to enable Block 2 to control existing well water pumps, and to monitor the level in Block 1 Raw Water Tank.

9.9.9 Plant Monitoring System

Plant parameters shall be monitored and indicated, alarmed and/or recorded in the DCS to facilitate the plant operator with control of the plant. The gas turbine and steam turbines shall be interfaced to the DCS for monitoring, trending, and control from the DCS. All local controllers shall be interfaced with the DCS for monitoring, trending, and control from the DCS.

9.10 HISTORICAL DATA STORAGE AND RETRIEVAL

Provide historical trending of all DCS data points including data provided from the combustion turbine and steam turbine control systems. Provide enough on-line memory to support a 34-day recall of all data points taken at the following periods:

Temperature:	5 min.
Levels:	1 min.
Pressures:	1 min.
Flows:	15 sec.

Provide a CD/DVD writer in the control system to facilitate downloading and archiving of the trended data.

9.11 CONTINUOUS EMISSIONS MONITORING SYSTEMS

Dedicated extractive continuous emissions monitoring systems (CEMS) complete in all respects including analyzers, sample extraction system, sample lines, flue gas flow equipment, data acquisition system, controllers, printer, monitor display, keyboard, mouse, software, controls, modem link, and other system specific accessories shall be installed in the HRSG stacks to measure the NO_X, CO, and O_2 concentrations at the HRSG stacks. The CEMS shall be housed in a shelter located at the base of the HRSG stacks.

Additional NO_X monitors shall be installed in HRSG upstream of SCR catalyst to monitor ammonia injection and CTG emission rates.

Each CEMS shall meet all the requirements of the plant air quality permit and state and local regulations. The CEMS shall be designed to comply to the requirements of the Environmental Protection Agency as stated in 40 CFR Part 60 "Standards of Performance for New Stationary Sources," specifically Paragraph 40 CFR 60 Subpart GG; 40 CFR Part 60.13; 40 CFR 50 Appendices B and F; and 40 CFR Part 75.

Each CEMS shall monitor the operation of each unit by obtaining a reading of NOx, CO, and O_2 concentrations at least once every 15 minutes for each unit for each sample point, and shall display the following air pollution control parameters:

1. Exhaust unit flow.
2. NOx, CO, and O_2 in ppmv at actual stack conditions.
3. NOx in ppmv and lb/hr upstream of SCR catalyst.
4. NOx, CO, and O_2 in ppmv corrected to 15% oxygen on a dry basis.
5. NOx and CO in lb/hr.
6. Temperature at the SCR.
7. NO_X at SCR inlet.
8. Fuel consumption.

Each CEMS shall be designed with a stand-alone personal computer, with an emissions software package which includes emissions warning, archiving, and report generation, as required under CFR 40, Part 60, Appendix F; 40 CFR PART 75; and the air quality permit. Daily calibration error test can not exceed 5.0% of span value (or exceed 10 ppm). Linearity – No quarterly linearity test required. RATA shall be </= 0.015 lb/MMBtu mean difference.

The CEMS personal computers shall be networked together with a supervisory station located in the control room. The DCS/PI Data Historian shall interface with the CEMS supervisory station through a communication link. The link shall provide up to 50 analog data points and 75 digital data points.

Equipment standards shall be per PacifiCorp CEMS Currant Creek Requirements document to be provided at Contractors request. The dedicated extractive CEMS shall be supplied with the following analyzers and systems:

1. NOx Analyzer shall be TE 42i-LS Dual Range (Low 0 – 5 ppm, High 0 – 200 ppm) Note: Readings obtained during typical unit operation shall be kept between 20.0 and 80.0 percent of full-scale range of the instrument (1 - 4 ppm).

2. CO Analyzer shall be TE 48i CO Dual Range (Low 0 - 10 ppm, High 0 – 150 ppm).

3. Oxygen Analyzer shall be_Servomex 1440 with Range: 0 – 25%.

4. Extractive Sample Probe shall be M&C SP-2020 extractive or Universal 270S w/ heated stack filter.

5. Sample Line will be heat traced with a temperature controller capable of maintaining 240 degrees F at minus 20 degrees F ambient. Each sample line will consist of three (3) 3/8" Teflon tubes (sample line, blow back, spare) and two (2) 1/4" Teflon Tubes (calibration gas, spare).

6. Sample Conditioner shall be M&C or Universal and shall utilize the peltier effect for condensing moisture from the gas sample. The condensate will be removed with a Masterflex dual head peristaltic pump. The sample system must include an inline 2.0 micron particulate filter and a moisture conductivity sensor.

7. Contractor provided Fuel Flow meter shall be Yokogawa vortex flowmeter. The flowmeter must be certified for Part 75 using the applicable procedure found in 40 CFR Part 75, Appendix D, section 2.1.5. The certification results must accompany the flowmeter.

9.12 ONLINE PERFORMANCE MONITORING SYSTEM

Contractor shall supply a General Physics Eta-Pro Performance Monitoring System including software license and all equipment and services required for software configuration, installation, testing, and training to provide a fully functional performance monitoring system. The system will provide plant and component performance at actual operating conditions compared to expected plant and component performance at the operating conditions. Expected plant and component performance shall be adjusted to levels demonstrated in the plant performance tests.

The system shall include the following:

1. Gas Turbine Performance. Actual and expected performance of each GTG based upon OEM correction curves for heat rate, heat consumption, exhaust energy, exhaust temperature, compressor pressure ratio and efficiency. Performance shall be calculated based upon ambient conditions and selected load. Effects of evaporative inlet cooling shall be included in the calculations.

2. HRSG Performance. Actual and expected performance of each section of the HRSG to include duct burner duty, efficiency, pinch points, steam flows and temperatures.

3. Steam Turbine Performance. Actual and expected steam turbine performance of the HP, IP, and LP section at actual steam and backpressure conditions.

4. Air Cooled Condenser Performance. Actual and expected ACC performance at actual ambient temperature and wind conditions and load conditions including approach, duty, and STG backpressure.

5. Pump Performance for CCW Pumps, Boiler Feed Pumps, and Condensate Pumps. Actual and expected pump performance at actual operating conditions including efficiency, head and power consumption. Boiler feed pump calculations shall include consideration of variable speed drive.

6. Contractor shall provide software customization including screens, reports, and performance calculations as reviewed and approved by Owner. Reports shall be in Excel spreadsheet format.

Contractor shall provide a plant weather station to provide necessary ambient inputs such as wet bulb temperature, relative humidity, barometric pressure, and wind speed and direction.

The system shall interface with Owner provided PI Historian. Contractor shall provide all interfaces required for the PI system as necessary for a complete and operable system.

The system shall be designed to allow expansion to an Owner supplied LAN serving other PCs at a later date.

SECTION 10.0
TRAINING PROGRAM

The purpose of the training program is to provide specific information about the power plant to qualified operator trainees. The overall intent is to provide a comprehensive program that will increase the competence level of the plant operating personnel to ensure that the plant can be safely operated.

The training shall consist of basic theory, as well as specific technical training on major equipment and systems functions. The basic theory shall provide an effective base for those who have had no formal training and a refresher for those who have experience. This shall prepare everyone to a common level for specific technical training on major equipment and systems.

The training program shall include, at a minimum:

1. Classroom instruction with active instructor-trainee interaction and utilize a full range of training materials and professionally produced training tapes.
2. In-plant, hands-on training by various instructors and major equipment suppliers.
3. Exercises to familiarize trainees with all the different systems in the plant.

Skill testing and progress monitoring shall be used throughout the training program to gauge the effectiveness of the training and the knowledge of the trainees. All training shall be reviewed with Owner on an ongoing basis.

Training program shall include a minimum of 100 hours of overall plant training by Contractor. Training program shall also include major equipment training, both classroom and hands-on, to be conducted by the equipment vendors. Vendor training for equipment purchased by Owner shall be coordinated and managed by Contractor. As a minimum, vendor training shall be provided for the following equipment:

1. Gas turbine generators.
2. Steam turbine generator.

3. Transformers.
4. Heat recovery steam generators including duct burners and SCR ammonia injection systems.
5. Boiler feedwater pumps.
6. Distributed control system.
7. Continuous emissions monitoring system.
8. Air Cooled Condenser System.

SECTION 11.0

START-UP, INITIAL OPERATION AND PERFORMANCE TESTING

11.1 GENERAL

11.1.1 SUMMARY:

1. Contractor shall prepare all Equipment and systems installed under this Contract for initial operation in accordance with the manufacturer's instructions, these Specifications.
2. Contractor shall provide all labor and materials to perform cleaning, flushing, sterilization, steam line blowdown, operational checks and adjustments, and preparation for initial operation.
3. Contractor shall cooperate with Owner and manufacturer's service personnel during the start-up period.
4. Contractor shall provide all supervision and labor as required for initial operation of all piping systems, equipment and appurtenances installed under this Contract until the Project is turned over to the Owner.
5. Owner shall provide to Contractor all reasonable and necessary support during the commissioning and startup of the Plant.
6. Owner shall provides operations and maintenance staff personnel to participate in the commissioning activities. This support shall be provided during normal working hours or other times as may be requested by Contrator with advance notice.
7. General Requirements:
   A. Perform specified inspections and tests and report all deficiencies in Equipment and Materials to Owner immediately upon becoming aware of them. Where applicable, perform Work under the direction of equipment manufacturer's field service representatives.
   B. Contractor shall be responsible for any damage to Equipment or Material due to improper test procedures or test apparatus handling, and replace or restore to original condition at the Owner's option, any damaged Equipment or Material.
   C. Furnish miscellaneous hand tools, ladders, or scaffolding, as required, to allow access to equipment, boxes, cabinets, or devices.

D. Certain inspections and tests specified to be performed by this Contract may also be performed by others. This overlapping and duplication is necessary and intentional. Contractor will be notified of tests by others prior to test to assure proper safety procedures are followed.

E. Owner will review and approve the testing schedule of all plant testing and inspections. Contractor shall cooperate and work closely with Owner during all phases of construction, especially with respect to the following:

F. Sequence and priorities of construction and start-up.

G. Testing and testing methods.

H. Equpment checkout and procedures.

I. Equipment start-up.

J. Testing records.

K. Tagging procedures for personnel and equipment safety.

11.1.2 QUALITY ASSURANCE:

1. Perform all work to meet the quality specified hereinafter and the quality assurance requirements of the Equipment manufacturers, including, but not limited to, the following standards:

   American National Standards Institute (ANSI).

   American Society of Mechanical Engineers (ASME).

11.1.3 SUBMITTALS:

1. Submit as specified in SECTION 4 of this Specification.
2. Submittals required shall include the following:
   A. Contractor shall submit a detailed flushing and cleaning procedure 90 days prior to performance of the activity. This will include, but not be limited to, calculations, demineralized water source, disposal procedure, pipe routings, auxiliary requirements, equipment source, schedules, etc.
   B. Contractor shall submit a detailed steam blow procedure 90 days prior to performance of the activity. This shall include, but not be limited to, calculations, pipe routings, steam requirements, support designs, schedules, etc.
   C. Contractor shall submit a detailed gas blow procedure 90 days prior to performance of the activity. This shall include, but not be limited to, calculations, pipe routings, support designs, schedules, etc.

11.1.4 ACCEPTANCE AND PERFORMANCE TESTS:

1. After a period of initial operation, a performance test will be conducted by Contractor on the complete power plant.
2. If operation and performance of the power plant is unsatisfactory due to any deficiency in Contractor's Work, Contractor shall make repairs and redo his Work to obtain satisfactory operation and performance.

11.1.5 EXECUTION

1. <u>FLUSHING AND CLEANING</u>:

   A. General:

      1) Flush, hydro-blast, or blow out all piping systems and Equipment to remove all dirt, scale, chips, and other foreign material.
      2) Furnish and install all necessary equipment and materials required for flushing and cleaning including pumps, temporary blank-off plates, steam sources and supply lines, special fittings, temporary piping systems, gaskets, supports, anchors, and bracing required for the flushing and cleaning operations.
      3) Provide temporary water supplies for filling and flushing and provide temporary drain lines and hoses for disposal of water without flooding.
      4) Furnish labor and materials to dismantle Equipment and open handholes and manholes as required to inspect and clean piping and Equipment.
      5) Furnish labor, materials, portable pumps, and equipment to clean out and inspect existing sumps and tanks.
      6) Remove orifice plates and flow element from pipelines before cleaning and flushing and reinstall after cleaning and flushing.
      7) Remove control valve internals before cleaning and flushing and reinstall after cleaning and flushing.
      8) Remove, clean and replace pump suction strainers as necessary during cleaning and flushing operations.
      9) Protect all equipment during cleaning and flushing.
      10) Protect instruments and appurtenances during cleaning and flushing.
      11) Remove all temporary piping, supports, anchors, bracing, fittings, and blank-off plates after flushing.
      12) Reassemble all Equipment ready for operation. Furnish and install

new gaskets as required to reassemble Equipment.

B. Heat Recovery Steam Generator (HRSG) cleaning:

1) Perform a hot alkaline detergent degreasing and cleaning of the HRSG in accordance with OEM recommended cleaning procedures. Alternative cleaning measures may be proposed by Contractor for Owner consideration, acceptance of which is in Owner's sole discretion.
2) Cleaning shall be performed by a firm specializing in such services.
3) Provide all required chemicals and equipment including heat source necessary to heat cleaning solution to proper temperature. Provide all piping, hoses, and drain lines required to deliver water and chemicals to the unit for cleaning. Dispose of waste offsite after cleaning is completed.
4) Install orifice plates in HRSG downcomers to obtain 0.5 – 1.0 ft/sec flow rate during alkaline degrease cleaning.
5) After boilout, open the unit, wash down, and inspect. Replace gaskets, gauge glasses, and other parts damaged by boilout with new parts and material.

C. Condensate System:

1) Thoroughly clean the condensate system from the ACC Drain Pots to the Heat Recovery Steam Generator (HRSG) preheater inlet.
2) Hydro-blast clean the condensate suction and discharge piping from the air cooled condenser drain pots to the HRSG preheater inlet connection as follows:
3) Install blanking plates on the following:
   a. Condensate Receiver Tank outlet connections.
   b. ACC Drain Pots outlet connections
   c. Suction and discharge of the condensate pumps.
   d. Suction and discharge of the ACC Drain Pot Pumps.
   e. Inlet and outlet of the Inter/After condenser and gland steam condenser.
4) Clean the main condensate header by hydro-blasting as specified.
5) Hydro-blast from the tank discharge connection to the condensate pump suction strainer.
6) Hydro-blast from the condensate pump suction expansion joint inlet (do not hydro-blast the expansion joint) to the suction strainer.

7) Hydro-blast from the condensate pump discharge cleaning connection to the pump discharge connection.
8) Hydro-blast from the condensate pump discharge to the HRSG preheater inlet connection.
9) When hydro-blasting is completed remove blanking plates from Inter/After condenser and gland steam condenser and flush the main header from the condensate pump discharge cleaning connection to the HRSG preheater inlet connection with condensate. Then flush each branch line in the condensate system with condensate. Flush until system is clean as determined by Owner.

D. Feedwater System:

1) Thoroughly clean the boiler feed pump suction and discharge piping from the LP drum to the HP economizer inlet.
2) Hydro-blast clean the suction and discharge piping as follows:
   a. Install blanking plates on the inlet and outlet of the boiler feed pumps.
   b. Hydro-blast clean the boiler feed pump suction line from the HRSG LP drum to the pump suction connection.
   c. Hydro-blast clean the boiler feed pump HP discharge line from the boiler feed pump HP discharge to the HRSG HP economizer inlet.
   d. Hydro-blast clean the boiler feed pump IP discharge line from the boiler feed pump IP discharge to the HRSG IP economizer inlet.
   e. Hydro-blast clean the boiler feed pump recirculation line from the boiler feed pump HP discharge to the HRSG LP drum inlet.
   f. Hydro-blast clean the feedwater line from the IP economizer outlet to the fuel gas heater inlet and from the fuel gas heater inlet to the condensate header. Add blanking plates on the fuel gas heater connections during hydro-blasting operations.
   g. When hydro-blasting is complete flush each branch line in the feedwater system with condensate from the boiler feed discharge cleaning connection throughout the system. Flush until system is clean as determined by Owner.

E. Steam Systems:

1) Thoroughly clean the following steam system main lines by hydro-blasting:
   a. Main high pressure steam lines from the main steam turbine stop

valves to the HRSGs superheater outlet.

b. Main high pressure steam bypasses to cold reheat line.

c. Main high pressure steam reverse flow discharge valve to condenser (if applicable).

d. Hot reheat steam lines from the hot reheat stop valve to the HRSG reheater outlet.

e. Hot reheat steam line bypasses to the condenser.

f. Cold reheat steam lines from the stream turbine cold reheat check valve to the HRSG reheater inlet.

g. Low pressure steam lines from the LP inlet butterfly isolation valves at steam turbine o the HRSG LP superheater outlet.

h. Low pressure steam line bypasses to condenser.

i. Power augmentation steam lines from the HP steam line to the Combustion Turbine (GTG) power augmentation steam inlet.

j. All common steam lines as listed above.

2) Install blanking plates where required.

3) Perform steam blow cleaning as specified below.

F. Hydro-blasting requirements:

1) Hydro-blasting equipment minimum requirements shall be as follows:

a. Shall be high pressure water nozzle cleaning designed to be self propeller and revolve.

b. Cleaning nozzle shall be supplied with a minimum pressure of 13,000 psig and a minimum flow of 50 gpm.

c. Nozzle rotation speed and feed rate shall be as required to blast clean 100 percent of the interior pipe surface.

d. Nozzle withdraw rate shall not exceed 3 feet per minute and be as required to flush clean pipe.

e. Feed and withdraw shall provide two pass cleaning/flushing.

2) Remove items from Equipment and pipelines that might be damaged during hydro-blasting, including, but not limited to, flow elements, control valves, instruments, etc.

3) Do not hydro-blast expansion joints.

4) Blast in segments as required to achieve complete cleaning.

5) Hydro-blast in a manner that allows water to wash debris to be flushed from system high points in the system to low points.

6) Direct hydro-blast discharge to plant floor drains. Install temporary

pumps in the oil/water separator and discharge cleaning/flush water to plant collection sump and evaporation pond. Contractor shall confirm that waste water is suitable for discharge to the evaporation pond.

G. Water Flush Other Liquid Systems:

1) Flush all other systems until clean as determined by Owner.
2) Remove items from, blank off or bypass Equipment and pipeline items that might be damaged during flushing, including, but not limited to, flow elements, control valves, instruments, etc
3) Discharge flush water to plant collection sump and evaporation pond. Contractor shall confirm that waste water is suitable for discharge to the evaporation pond.
4) Permanent plant pumps may be used for flushing. Turn all system pumps on when flushing.
5) Flush the main headers and each branch line.
6) Flush the raw water system from the well pumps to the raw water storage tank.
   a. Flush from each well.
   b. Flush to include underground piping, above ground piping and branch lines.
   c. Install temporary drainage pipe from tank inlet to equipment drains.
7) Flush the potable water system from the raw water supply to the potable water skid inlet and throughout the potable water system as it applies to the system extension.
   a. Flush from the water treatment plant.
   b. Flush to include underground piping, above ground piping and branch lines.
   c. Install temporary drainage pipe from the potable water skid inlet to equipment drains.
   d. Flush from the potable system to each eye wash and shower and each fixture.
8) Flush the service water system as it applies to the system extension.
   a. From the raw water tank to the service water pumps.
   b. From the service water pumps to the RO/Demineralizer system, blowdown tanks and miscellaneous drains tank.
   c. From the service water pumps to hose bibs.

d. All other branch lines.

9) Flush the demineralized water system as it applies to the system extension.
   a. Flush through all demineralized water system piping and evaporative cooler make-up system.
   b. Install blanking plates on all equipment connections. Disconnect piping at equipment and direct flush water to equipment drains.
   c. All other branch lines.

10) Flush the condensate makeup water system.
   a. From demineralized water tank to condensate receiver tank and condensate system.
   b. All other branch lines.

11) Flush the closed cooling water system.
   a. From the closed cooling water pump to each heat exchanger and the return line back to the pump.
   b. Install a temporary bypass around the closed cooling water heat exchanger.
   c. Install temporary bypasses around each heat exchanger.
   d. All other branch lines.

12) Chemical feed, ammonia and sample lines. (These lines may be air blown at Contractor option.)
   a. Flush with temporary pumps.
   b. Disconnect piping at process connections and flush water to equipment drains.

13) Boiler blowdown and steam turbine drains.
   a. Flush to respective blowdown and miscellaneous drains sumps.

14) General drains.
   a. Flush with general drains pumps.
   b. Flush to the collection sump.

15) Combustion Turbine drains.
   a. Flush with temporary pumps to the wash water sumps.
   b. Install temporary pumps in the wash water and discharge cleaning/flush water to plant evaporative pond in a manner which does not cause erosion. Contractor shall confirm that waste water is suitable for discharge to the evaporation pond.

16) Open up Equipment and clean and flush.

17) Provide all temporary pump, pipe, and Equipment as required

H. Air blow the following systems:

(1) Contractor shall provide source of compressed air for air blowing purposes.

(2) Blow piping at a minimum velocity of 200 fps until air is free of grit and foreign material as determined by Owner.

(3) Air blow the following systems:

a. Instrument air.

b. Compressed gas carbon dioxide.

c. Compressed gas hydrogen.

d. Compressed gas nitrogen.

e. Compressed generator gas.

f. Combustion turbine bleed heat lines.

g. All 2 inch and small Combustion Turbine Generator system lines.

h. All lube oil lines.

I. Equipment:

1) Open all Equipment installed by this Contract including, but not limited to, the following for inspection, swab, blow out, flush, and clean.

a. Air Cooled Condenser and condensate receiver tank.

b. Blowdown and miscellaneous drains tanks.

c. Closed cooling water expansion tank.

d. Wastewater tanks.

e. Compressed air receivers.

f. Ammonia Storage Tank.

g. Raw Water Storage Tank.

h. Oil/water separator.

2) Thoroughly inspect, clean, and flush any other Equipment affected by the flushing operations.

3) Furnish and install new manhole gaskets as required.

4) Contractor shall submit manufacturers recommended cleaning procedures for the Air Cooled Condenser System for Owner review and approval.

J. Lubricating and Hydraulic Oil Systems:

1) Thoroughly clean and flush steam turbine and boiler feed pump lubricating and hydraulic oil systems until clean and in accordance with manufacturer recommendations and instructions.

2) Provide a separate flushing pump for the steam turbine lube oil flush.
3) Heat oil, circulate oil, vibrate lines, clean strainers, and replace filters in accordance with Equipment manufacturer's instructions. Contractor shall furnish all flushing oils. Flushing oils shall meet the requirements the equipment manufacturers.
4) Contractor shall be responsible for all costs and equipment associated with flushing oil testing required to confirm if the oil system flushing operations has satisfied the manufacturer's requirements and recommendations.
5) Drain systems, dispose flushing oil off site, wipe out reservoirs, and clean as required.
6) After flushing dispose flushing oil offsite. Fill lubricating systems with oil and lubricate Equipment.

K. Initial Turbine Operation:

1) After turbine stretch-out or when directed by Owner, dump the Condensate Receiver Tank to waste for proper disposal off-site by Contractor.
2) Clean and flush condensate receiver tank and LP drum.
3) Furnish and install new manhole gaskets as required.
4) Repack valves, retighten flanges, tighten valve bonnets, and make repairs and adjustments for all piping systems, equipment, and appurtenances installed under this Contract.at least once during initial operation.

2. <u>WATER LINE STERILIZATION:</u>

A. General:

1) Sterilize entire potable water system installed under this Contract. Sterilize the system from the potable water treatment system connection throughout all potable water pipe lines up to and including fixtures.
2) Provide all required materials including the following:
    a. High test hypochlorite (HTH) with 65% available chlorine.
    b. Sterilized pipe, valves, fittings, and accessories.

B. Sterilization:

1) Perform sterilization as follows:
    a. Flush lines with clean water.

b. Make slurry of HTH in separate container.
c. Simultaneously add slurry and water to obtain a uniform concentration of 40 ppm of available chlorine throughout the system.
d. Maintain system full for 6 hours during which time all valves and faucets shall be operated several times.
e. Drain and flush system with potable water until residual chlorine content is not greater than 0.2 ppm.
f. Allow system to stand full for 24 hours.
g. Draw sample under direction of Owner and designated officials.
h. Test sample in approved laboratory for bacterial count, and as directed by health authorities.

2) After sterilization make connections to system with sterilized fittings only.

3. <u>STEAM LINE BLOWDOWN</u>:

A. General:

1) Clean each Heat Recovery Steam Generator (HRSG) and steam lines with steam with low pressure, high velocity continuous blows to completely clean the lines to the satisfaction of Owner.
a. Provisions shall be made to thermally shock the steam lines without affecting the steam drums.
b. Blowdown steam lines in accordance with a schedule approved by Owner. Owner will notify the proper authorities of the time and duration of the blows.
c. Contractor shall design the temporary steam blow system and shall furnish and install all temporary piping, silencers test targets (coupons), valves, thermocouples, pressure gauges, anchors, and supports required for blowing steam lines as indicated on the drawings and as required.
d. Discharge of steam blows shall not enter the condensate system.

B. Furnish all labor and attendance, and pay all expense for overtime work required to blow steam lines and install or remove temporary pipe, valves, and related items between blowing sequences. Blow steam lines around the clock including weekends and holidays if so directed by Owner. Contractor shall be responsible for obtaining permitting for such work, as required.

C. Steam line blowdown shall be performed by a firm specializing in such services.

D. System Design:

1) The temporary pipe and silencer shall be sized to provide a cleaning mass ratio of 1.5 through the steam system. The cleaning mass ratio is defined as:

$$C.R. = \frac{M_B^2 V_B}{M_D^2 V_D}$$

where M_B is the main steam flow during steam blow, V_B is the steam specific volume measured at the superheater outlet, M_D is the design operating main steam flow, and V_D is the design operating specific volume.

2) Steam line conditions for determining the cleaning mass ratio shall be provided by Contractor for Owner review.

3) Contractor shall submit calculations verifying the cleaning mass ratio at the superheater outlet and at the highest velocity on the main steam line, attemperation water flow rates required, and condensate makeup water flow rates required.

4) System shall be designed to inject water in the temporary vent piping and the vent silencer to reduce the steam velocity and temperature. Contractor to provide temporary piping from the construction water system to the injection points. All valves, piping and fittings shall be furnished by the Contractor.

5) Additional attemperation water will be supplied through temporary feedwater attemperation lines installed by this Contract to shock the steam lines through steam attemperation. Contractor shall provide any temporary piping hose fittings, or equipment required to supply attemperation water to the steam line connections required for thermal shocking.

6) Steam blow test coupons shall be installed in the temporary piping upstream of final quenching water. Test coupon shall be designed for quick and easy removal and inspection and insertion into the temporary piping.

7) Steam line blowdown test coupon acceptance criteria shall be as follows:
    a. No raised impacts shall be visible.
    b. No greater than three visible impacts for two consecutive steam line blowdown cycles.
    c. In accordance with steam turbine manufacturer's requirements.
8) All temporary piping hanger to supports shall be designed in compliance with SECTION 5 of this Specification.
9) Test coupons shall be made available to Owner 30 days prior to conducting the steam line blowdown.
10) A temporary silencer shall be utilized and shall be designed for a maximum steam velocity of 50 ft/min. Silencer shall be capable of limiting the steam discharge sound pressure level to 85 dBA at 100 feet from the silencer. Silencer location shall be such that the silencer exhaust plume will not impact existing structures or electrical lines. Silencer location shall be located a significant distance from the steam turbine building (minimum of 75 feet) and shall be subject to the approval of Owner.
11) Contractor shall supply mobile demineralizer as required to provide demineralized water for steam blows. Contractor shall supply temporary hose from the mobile demineralizer to the demineralized water storage tank and/or condensate receiver tank.
12) Demineralized water quality shall be as follows:

a. Conductivity, micromhos/cm at 25°C,	< 0.15
b. Sodium, mg/l as Na	< 0.003
c. Silica, mg/l as SiO_2	< 0.010
d. Chloride, mg/l as Cl	< 0.003
e. Sulfate, mg/l as SO_4	< 0.003
f. Total Organic Carbon, mg/l as C	< 0.100

13) Existing site construction water source is well water. Raw water quality shall be as indicated in Appendix I.
14) Wastewater from the Contractors temporary mobile demineralizer shall be disposed of off site by the Contractor.
15) Use test coupons installed in the exhaust lines to indicate when lines are clean. Test coupons shall be 1 inch wide and extend the full diameter of the line being blown. Test coupons shall be made from

AISI 1030 brass keystock and shall be ground and polished so that the root mean square surface irregularities does not exceed 16 micro-inches. Lines will be considered clean when test coupons are acceptable to Owner.

E. Owner will operate combustion turbine and heat recovery steam generator to generate steam at Contractor specified conditions for steam blows.

F. After Owner acceptance of test coupons, remove all temporary piping, supports, and associated material. Reassemble valves under Owner supervision. The Owner will inspect the existing main steam/hot reheat/cold reheat tie-ins for cleanliness prior to making the final fit-up.

G. At no time is it acceptable for Contractor to make any temporary weld to any critical piping system or associated equipment for support or any other reason, without approval from Owner.

4. STEAM BLOWING SEQUENCE:

A. General:

Portions of the cold reheat and the low pressure steam line may not be included in the steam blow (at the turbine connections). For sections of piping, which will not be in steam blow, piping shall be received from fabricator clean, shop blasted, and sealed. Contractor shall assume all responsibility in assuring piping is protected against any contamination. Immediately before installation, and upon completion of steam blows, Contractor shall provide means for Owner to perform visual inspection of the piping. Final piping welds shall not be performed until Owner has signed off on all piping inspections.

Furnish and install temporary steam blow piping, blow valves and silencers.

Install stop valve blow kits.

B. First Blow

1) Steam blowdown will begin after all temporary piping, silencers and demineralized water makeup systems are installed.

2) Owner will operate the combustion turbine to provide a heat source to generate steam from the HRSG. Steam drum pressure will be held constant during the steam line blowdown.

3) Install blow kits in the main steam stop valves.

4) Furnish and install temporary blow piping from the stop valve to a safe discharge point outdoors. Piping shall include blow valve and silencer.
5) Blow from the HP drum through the HP steam piping and the steam turbine HP stop valves, through temporary piping and blowdown valve to exhaust silencer.
6) After a period of blowdown, the attemperation water flow shall be increased to shock the main steam line. Steam line shock will be repeated as directed by Owner to enhance cleaning.
7) Install test coupons after a period of steam line blowdown.
8) The initial blow shall clean from the HRSG through main steam piping and out temporary piping to a silencer. The first stage blow shall be completed only after Owner acceptance of test coupon insertion test result.
9) Blow through HRSG, main steam piping, stop valve, temporary piping, and blowdown valve to atmosphere until clean.

C. Second Blow:
1) Furnish and install bypass piping and temporary blowdown valve from main steam outlet to cold reheat connection at the steam turbine.
2) A temporary connection shall be made to the cold reheat piping at the steam turbine and shall be performed by this Contract.
3) Contractor shall provide temporary attemperation line in the temporary piping between the main steam and cold reheat line to limit the temperature of the steam entering the cold reheat line to the cold reheat design temperature limit.
4) Install blow kits in the hot reheat steam stop valves.
5) Furnish and install temporary blow piping from the stop valve to a safe discharge point outdoors. Piping shall include blow valve and silencer.
6) Contractor shall provide temporary attemperation line in the temporary piping between the main steam and cold reheat line to limit the temperature of the steam entering the cold reheat line to the cold reheat design temperature limit.
7) Blow from the main steam piping, through the main steam bypass to hot reheat piping, hot reheat stop valves and temporary piping to atmosphere until clean.
8) Blow from the IP drum to the cold reheat inlet connection and then blow through the reheater, hot reheat piping, hot reheat stop valves

and temporary piping to atmosphere until clean.

9) Blow through main steam piping, through main steam to cold reheat bypass piping, cold reheat piping, to the reheater, hot reheat piping, hot reheat stop valves and temporary piping to atmosphere until clean

10) Blow through main steam piping, stop valve, bypass piping, cold reheat piping, to the reheater, hot reheat piping, hot reheat stop valves and temporary piping to atmosphere until clean.

11) After a period of blowdown, the attemperation water flow shall be increased to shock the reheat steam line. Steam line shock will be repeated as directed by Owner to enhance cleaning

12) Third stage blow shall be completed only after Owner acceptance of test coupon

D. Third Blow (may occur concurrently with other blows):

1) LP steam blowdown will begin after all temporary piping, silencers and condensate makeup systems are installed.

2) Furnish and install temporary blow piping from the strainer upstream of the turbine to a safe discharge point outdoors. Piping shall include blow valve and silencer.

3) Install test coupons after a period of steam line blowdown.

4) The LP steam blow shall clean from the HRSG LP drum through low pressure steam piping and out temporary piping to a silencer. The fourth stage blow shall be completed only after Owner's acceptance of test coupon insertion test result.

5) Blow through LP steam piping, stop valve, temporary piping, and blowdown valve to atmosphere until clean.

E. Additional Steam Blows:

1) Contractor shall blow remaining lines as required for service blows, which shall include at least:

a. Main Steam to Combustion Turbine (Power Augmentation Steam Line, if applicable)

b. Hot Reheat Bypass to Condenser

c. LP Steam Bypass to the Condenser

d. Steam cold reheat lines through the Turbine Gland Steam System

e. Auxiliary Boiler steam lines through the Turbine Gland Steam System, steam jet air ejectors, condenser sparger, HRSG spargers.

f. Other steam system lines as designated by the Owner.

g. No steam blow discharge shall pass into the condenser and/or condensate system.

5. FUEL GAS LINE BLOWDOWN AND CLEANING:

A. General:

1) Fuel gas line shall be cleaned in accordance with gas turbine manufacturer's gas cleaning procedure or as defined herein, whichever is more stringent.

2) Clean the fuel gas system by blowing down the main line from the gas metering station to each combustion turbine main inlet with enough blows to completely clean the lines of all foreign matter and to the satisfaction of the Owner and Engineer.

3) Blowdown fuel gas lines in accordance with a schedule approved by Owner. Owner will notify the proper authorities of the time and duration of the blows.

4) No welding, grinding or other activities that could generate a spark shall be conducted during the blowing operation.

5) Perform blowing and line cleaning operations in accordance with Equipment manufacturer's cleaning procedures and as specified herein.

6) Blowing procedure shall be developed by Contractor and submitted to Owner for review and approval. Procedure shall blow clean all fuel gas piping from the fuel gas yard to inlet of the filter separators. After this segment is clean, blow from the filter/separators to the combustion turbine accessory modules.

7) Blow down piping with at least 4 short duration blows (approx. 15 seconds), then blow with at least 4 medium duration blows (approx. 60 seconds), then blow with long duration blows (approx. 2 minutes) until clean

8) Furnish and install all temporary piping, blanking flanges and plates, valves, thermocouples, pressure gauges, anchors, and supports required for blowing fuel gas lines as indicated on the drawings and as required. Remove valve internals and inline flow elements during blowing.

9) Install temporary piping to bypass the heat exchangers, knock out tank and filter separator during the initial blows. Remove temporary piping during the final blows and blow through the heat exchangers, knock out tank and filter separator.
10) Remove filter separator internals during blowing operations. Inspect and remove all foreign matter from filter separator after blowing operations. Reinstall internals when blowing is completed.
11) Furnish and install all required temporary blowdown piping and valves as required to discharge blow gas in a safe location. The temporary blowdown valves shall be equipped with a pneumatic operator with an opening and closing time under pressure not exceeding 10 seconds.
12) Gas line blowdown test target acceptance criteria shall be as follows: No visible impacts, pits, dings or holes shall be visible.
13) Use test targets installed at the exhaust lines to indicate when lines are clean. Test targets shall be made from 2 foot by 2 foot plywood painted white. Position test target at a 30 or 45 degree angle to the exhaust pipe and position the centerline of the target 2 foot from the exhaust pipe exit.
14) Lines will be considered clean when test targets are acceptable to Owner.
15) Furnish all labor and attendance, and pay all expense for overtime work required to blow fuel gas lines. Blow fuel gas around the clock and on weekends and holidays if so directed by Owner.
16) Fuel gas blowdown shall be performed by a firm specializing in such services.
17) The temporary pipe and silencer shall be sized to provide a cleaning mass ratio of 2.0 through the fuel gas system. The cleaning mass ratio is defined as:

$$C.R. = \frac{M_B^2 V_B}{M_D^2 V_D}$$

where M_B is the fuel gas flow during gas blow, V_B is the fuel gas specific volume measured at the fuel gas meter yard, M_D is the design operating fuel gas flow upstream of the combustion, and V_D is the design operating main fuel gas specific volume.

18) Fuel gas blow test targets shall be installed at the temporary piping exhaust at a safe location as approved by Owner. Test target shall be designed for quick and easy removal and inspection and reinstallation at the exhaust of the temporary piping.
19) All temporary piping hanger to supports shall be designed in compliance with this Specification.
20) Test targets shall be made available to Owner 15 days prior to conducting the gas line blowdown.
21) Owner will furnish the fuel gas for the gas blows.
22) After Owner acceptance of test targets, remove all temporary piping, supports, and associated material. Reinstall the filter/separator internals. Reconnection Combustion Turbine Accessory Module. Owner will inspect the tie-ins for cleanliness prior to making the final fit-up.
23) After completing blow procedure clean gas piping in accessory module and downstream to combustion turbine injection nozzles. After cleanliness verification by Owner, restore the system when complete.

B. Gas Blowing Sequence:
   1) First Blow:
      a. Bypass the gas fired heat exchangers and hot water heated fuel gas heaters.
      b. Furnish and install temporary blow piping including blow valve and silencer and which discharges to a safe point.
      c. Blow from the gas yard to the filter/separator inlets until clean.
      d. The first stage blow shall be completed only after Owner acceptance of test coupon insertion test result.
   2) Second Blow:
      a. Close Bypass and open flow through the gas fired heat exchangers and hot water heated fuel gas heaters.
      b. Blow from the gas yard to the filter/separators inlet until clean.
      c. The first stage blow shall be completed only after Owner acceptance of test coupon insertion test result.
   3) Third Blow:
      a. Install blanking plate at accessory modules.
      b. Furnish and install temporary blow piping including blow valve and silencer and which discharges to a safe point.

c. Blow from the gas yard to the accessory module inlets until clean.

d. The third stage blow shall be completed only after Owner's acceptance of test coupon insertion test result

6. INITIAL OPERATION:

A. General:

1) As soon as Contractor's equipment, system or a portion of a system is completed in accordance with Owners defined turnover packages (to be provided after Contract award) and ready for turnover, Owner will perform a walk down of the equipment, system or a portion of a system as follows:

a. Contractor shall notify Owner as soon as a system is ready for initial operation.

b. Owner will inspect the system to ensure that all work required preparing it for initial operation has been completed.

c. As soon as Owner is satisfied that a system has been properly prepared for initial operation, Owner will give Contractor written notice that it is accepted for initial operation. Owner will furnish Contractor an exceptions list for system completion and correcting.

d. After acceptance for initial operation, Owner will assume all operational and maintenance duties as defined. All other Contractor's personnel are specifically prohibited from starting or stopping any equipment in the system, opening or closing any valve in the system, operating any switches, breakers or controls in the system, or performing any other operational and maintenance duties whatsoever.

2) When the Owner accepts a system or a portion of a system for operation it will be so marked in accordance with the Project standard marking system (to be provided after Contract Award).

3) After acceptance for operation, Contractor shall continue to provide all specialized personnel and attendance required to correct defective material and workmanship and to perform the Work specified within.

4) Acceptance by Owner of a system or a portion of a system for initial operation does not constitute final acceptance for making final payment nor does it constitute that the system is properly constructed

and/or adjusted for proper operation.

5) Contractor shall follow instructions given in manuals supplied by the manufacturer of equipment and materials for erection, installation, cleaning, testing, checkout and start-up.
6) Contractor shall follow instructions of service representative of equipment and materials.
7) Contractor shall cooperate with Owner and manufacturer's service personnel during the start-up period.
8) Contractor shall strictly enforce his own and Owner's safety measures for the protection of equipment and personnel. Owner's tagging procedure shall be strictly complied with.

B. Equipment and System Turnover Packages:

1) The Acceptance for Initial Operation Turnover Package shall contain the following items, and shall be documented in the manner indicated:
    a. Agreement for Acceptance for Initial Operation form signed by the responsible personnel.
    b. Table of Contents sheet listing the documents contained in the Turnover Package.
    c. A copy of the Construction Exceptions List and the Deficiency List with a status of items noted.
    d. Performance Test data sheets signed and dated by designated personnel.
    e. Lubrication and alignment data sheets signed and dated by designated personnel.
    f. Marked-up P&ID drawings, electrical schematics and any other drawings necessary to define the system boundaries. All drawings shall be current with all known corrections made prior to Acceptance for Initial Operation.
    g. List of instruments by instrument number that are within the scope of the system boundaries.
    h. A list of equipment that is within the scope of the system boundaries.

2) System Turnover boundaries shall be established by Owner to reflect functional systems. Each system shall be assigned a system designator by Owner, and Owner will prepare a system turnover schedule. Every reasonable effort shall be made on the part of all responsible parties to

turnover systems within the boundaries described on the scheduled date.

3) Approximately six (6) to eight (8) weeks prior to the scheduled turnover date, Contractor shall conduct an informal walkdown of the system with his subcontractors and Owner. This early informal walkdown will define the system boundaries. The informal walkdown shall mark the beginning of the Construction Exception and Start-up Deficiency listing process. One (1) to two (2) weeks prior to the scheduled turnover date, Contractor shall perform a final pre-turnover walkdown. An official Exception List and a Deficiency List shall be prepared at this time. These Lists are to be agreed upon by all parties as exceptions to the system turnover. Those items that Owner indicates must be completed prior to turnover shall be so noted on the Construction Exception List.

4) Once the proper signatures have been affixed, the package will be transmitted to Owner for review and acceptance. Owner will also review the turnover package. If accepted by Owner, Contractor shall release all Construction safety tagging within the boundaries of the turnover and Owner shall affix tags/labels where necessary to signify jurisdictional transfer to Owner. If necessary, the Turnover Package shall be returned for completion to Contractor with a written description of outstanding items.

5) When performing the final walkdown between Owner and Contractor, all known exceptions shall be clearly identified and documented. All exceptions shall be noted on the up Deficiency List or on the Construction Exception List. Control of the Exception List shall be as follows:

   a. Exception List shall be numbered in accordance with the turnover schedule.
   b. Owner shall maintain control of the both Exception and Deficiency Lists until completed.
   c. The Construction Exception List and the Deficiency List with estimated completion dates for open exceptions shall be transmitted to Owner with the Turnover Package.
   d. Contractor shall meet scheduled completion dates for turnover exceptions and notify Owner of each item completed.
   e. Contractor shall contact Owner to obtain safety tag clearance as required for completion of turnover exception items.

f. Contractor shall document the completion of each exception on the list.

g. Contractor shall, as required, transmit copies of updated Exception Lists to Owner.

6) Once Owner accepts the Turnover Package, Owner will place Owner tags or labels on all major valves, boundary valves, breaker panels and breaker panel control switches, various control switches, instrument and instrument panels and other components as necessary to identify boundaries and equipment within boundaries. Once tags are hung, no Contractor personnel shall be permitted to operate or otherwise work on the equipment under tags unless clearance is obtained from Owner. All boundary valves or breakers shall be safety tagged to prevent Owner from interfering with construction activities. Turnover from Contractor is not complete until tagging is complete. Tags or labels indicate jurisdictional transfer only. These are not to indicate safety protection for personnel or protect equipment from accidental damage. If protection for personnel or against equipment damage is deemed necessary by Contractor or Owner, the appropriate safety tags will be hung in accordance with a Safety Tagging Procedure.

7. PERFORMANCE AND ACCEPTANCE TESTS:

A. Summary

1. All Performance and Acceptance Tests shall be witnessed by the Owner. Contractor will provide reasonable notice to Buy of any the above tests.
2. Contractor, or its Subcontractors, shall conduct the Performance Tests associated with both Substantial Completion and Final Completion of the Facility.
3. This Section specifies the requirements for Performance Tests of the Facility and Materials and Equipment demonstration tests. Before performing any Facility Performance Tests for capacity and heat rate, the Emissions Test and Noise Level Test shall be performed. The Emissions Test is performed to demonstrate that the Emissions meet the Emissions Guarantee and requirements of the air permit. The Noise Level Test is performed to demonstrate that either the Noise Level Guarantee is met or any failure to achieve the Noise Level

Guarantee does not preclude Owner from operating the Facility. The test procedures shall include correction curves for operating conditions which vary from guarantee, including, but not limited to, ambient air temperature, ambient air pressure, ambient air humidity, fuel constituent analysis, generator power factor, steam generator blowdown rate, make-up water conditions, and fuel supply temperature and pressure.

4. Acceptance and performance tests will be conducted by Contractor as soon as possible after initial operation to meet the performance guarantees.
5. Acceptance tests shall include a load rejection test at full turbine-generator load. A full-load turbine trip shall also be demonstrated.
6. Contractor shall furnish, maintain, and remove all special test equipment and instruments required for the tests which are not part of the permanent installation.
7. Owner will furnish operating labor assistance.
8. Owner will provide fuel up to the quantities specified in the APSA. Additional fuel quantities will be provided by Owner, but subject to reimbursement by Contractor under the APSA.
9. Contractor shall provide services of sound specialist equipped with adequate sound level meters and an octave band noise analyzer to measure the performance of the silencing equipment.
10. Performance tests will be made in accordance with a test method mutually agreed upon by Owner and Contractor.

B. Testing Sequence and Schedule

1. Facility Performance Tests

   a. Prior to Substantial Completion, Contractor shall conduct a Performance Test that demonstrates at least 95% of the Net Electrical Capacity Guarantee while operating at a Net Heat Rate of not more than 105% of the Net Heat Rate Guarantee while maintaining environmental compliance with all air permit requirements. Improperly operating Materials and Equipment may be corrected by Contractor prior to Performance Tests. The sequence for testing of the Facility and Material and Equipment shall be agreed to between the Parties. Materials and Equipment demonstration testing may be conducted prior to or after

Substantial Completion, but must be conducted prior to Final Completion.

b. If Performance Tests prior to Substantial Completion do not demonstrate 100% of Net Electrical Capacity Guarantee and 100% of Net Heat Rate Guarantee, and 100% of Duct Fired Net Unit Capacity Guarantee, then prior to achieving Final Acceptance of the Facility, Contractor shall conduct a final Performance Test to determine final Net Electrical Capacity and Net Heat Rate, and 100% of Duct Fired Net Unit Capacity Guarantee.

c. Prior to Substantial Completion, Contractor shall conduct Functional Testing of the Facilty. The following tests shall have been successfully completed:

(1) Plant Hot Start - Contractor will complete two (2) tests that demonstrate the ability of the Plant to start-up from a hot standby condition (overnight shutdown equivalent, 8 hours or less) to base load condition (each Gas Turbine at its normal firing temperature limit without duct firing) within 105 minutes.

(2) Plant Full Load Capability Test - Contractor will complete one (1) test during a Plant Hot Start test in (i) above that demonstrates the ability of the Plant to reach full duct-fired Plant capability (each Gas Turbine at its normal full load firing temperature limit and the HRSG is duct firing at the maximum duct burner fuel flow for the ambient conditions of the test within 165 minutes.

(3) Plant Partial Load Operational Test - Contractor shall demonstrate that the loading on the Plant can be successfully and smoothly transitioned from full load to the OEM's minimum load in 10% load increments. The Plant shall be operated with stable output at each load setting for a period of not less than 60 minutes at each load setting.

(4) Plant Shutdown Test - Contractor will complete two (2) consecutive tests that demonstrate the ability of the Plant to safely shutdown from base load condition to a hot standby condition within 45 minutes.

d. Prior to Final Acceptance, Contractor shall conduct additional

Functional and Average Equivalent Availability Testing of the Facility. The following Functional Tests shall have been successfully completed:

(1) Plant Cold Start - one (1) test that demonstrate the ability of the Plant to start-up from a cold standby condition (shutdown for 72 hours or more) to base load condition (each Gas Turbine at its normal firing temperature limit without duct firing) within 270 minutes.

(2) Plant Warm Start - two (2) consecutive tests that demonstrate the ability of the Plant to start-up from a warm standby condition (weekend shutdown equivalent, or 48 hours) to base load condition (each Gas Turbine at its normal firing temperature limit without duct firing) within 150 minutes.

(3) Plant Hot Start - two (2) tests that demonstrate the ability of the Plant to start-up from a hot standby condition (overnight shutdown equivalent, 8 hours or less) to base load condition (each Gas Turbine at its normal firing temperature limit without duct firing) within 105 minutes. In the event the Plant demonstrated a Plant Hot Start time less than or equal to the time in the immediately preceding sentence during the Function Test pursuant to this Section, this Functional Test shall not be a condition of Final Acceptance and shall be deemed satisfied.

(4) 1x1 Operational Test - one (1) test of each Gas Turbine that demonstrates its ability to operate in a 1x1 operating mode. The functional test shall consist of startup from a hot standby condition, operate at full load for two hours (120 minutes), and safely shutdown within a total of 350 minutes.

(5) Full Load Steam Bypass To Condenser - one (1) test that demonstrates the ability of the steam turbine to be tripped off line with the Plant at full load capacity so that the Gas Turbines continue to operate at full load with steam from the HRSGs bypassed to the condenser for a period of not less than four (4) hours.

(6) Auxiliary Boiler Capability Test (if applicable) - one (1) full

load capability demonstration test of the ability of the auxiliary boiler to produce a nominal 15,000 lbs/hr of steam. The demonstration may be by the input-output method of boiler testing and utilizing only Plant instrumentation. Results shall be corrected to the boiler vendor's reference conditions and, for purposes of this demonstration, a tolerance equivalent to the test uncertainty shall be applied.

e. A one-hundred sixty-eight (168) hours Average Equivalent Availability test will be performed as a requirement of Final Acceptance. The test period will be a rolling window interval such that for successful completion of this test, the Average Equivalent Availability during the test run of one hundred sixty eight (168) consecutive hours must not be less than ninety-five percent (95%) ("Guaranteed Average Equivalent Availability").

The term "Average Equivalent Availability" is specifically defined as follows for the purposes of the test:

$$\text{Average Equivalent Availability (\%)} = \frac{A + B + C}{D} \times 100\%$$

Where:

A = Total number of hours that the Plant is available for dispatch or operated with the breakers closed to the station bus (including time required to start up and shut down the Plant) without a load restriction on the Plant imposed by Contractor or a failure of the Plant as covered in "C," below. Actual Plant load will be as determined by Owner.

B = The product of the number of hours that the Plant is available for dispatch or operated with the breakers closed to the station bus (including time required to start up and shut down the Plant) during which Contractor has imposed in writing a load restriction on the Plant multiplied by the percentage of load then allowed.

C = The product of the number of hours that the Plant is operated with the breakers closed to the station bus but is incapable of operating at base load or a lower dispatched load due to failure of Plant equipment in the scope of Contractor multiplied by the percentage of base load or dispatched load which is actually achievable.

D = Total number of hours of the test period.

The Average Equivalent Availability of the Plant shall be calculated at the end of the test period. If the Average Equivalent Availability of the Plant is equal to or greater than respective the Guaranteed Average Equivalent Availability, the test shall be conclusively deemed successful. If the Average Equivalent Availability of the Plant is less than ninety-five percent (95%) in the test, Contractor shall take appropriate remedial action. Following such remedial action, the test shall be reinitiated and the Average Equivalent Availability will be re-calculated on a continuing basis. Once the required value of the respective Average Equivalent Availability is achieved during the most recent testing period, the test will be deemed successfully completed.

2. Conditions Applicable to the Average Equivalent Availability Test:
   a. Excluded are outage hours which are not under Contractor's control, including but not limited to those caused by low fuel gas supply pressure, grid frequency variations outside of the operating manuals and instruction manuals, operator error, acts of Owner or its agents or subcontractors, and Force Majeure events.
   b. Owner shall maintain an operator log sheet, following a mutually agreeable format, indicating in detail performance parameters, cycles, and maintenance actions. Owner shall report key performance parameters on a daily basis to Contractor. Contractor may inspect the operator log sheets. Contractor, at its own expense, may provide a modem for the purpose of monitoring plant parameters during the tests. Owner will provide a phone access line for this modem.
   c. Contractor shall be entitled to have a field representative present during performance of the Average Equivalent Availability tests.

For the purposes of conducting these tests , a "Start" shall be deemed to be the period of time from the start of the gas turbine ignition sequence to valves wide open (HP and IP) for the steam turbine. All activities required for these startup and shutdown tests shall be performed through the Plant's Distributed Control System ("DCS") with the exception of any normally expected and routine action taken by an operator. The Plant's DCS shall control, or shall cause to be controlled, all Equipment necessary for the safe and reliable operation of the Plant with the exception of Equipment normally controlled manually.

8. TESTING STIPULATIONS:

A. Contractor shall conduct Performance Tests associated with both Substantial Completion and Final Completion of the Facility to demonstrate performance as specified and as guaranteed.
B. The Contractor will collect base-line data for the Materials and Equipment furnished under this Contract during the initial operation of the Facility.
C. Contractor shall be required to abide by the results of the tests, or shall provide all additional Materials and Equipment and instruments, make all preparations, furnish testing personnel, and incur all expenses connected with supplementary Performance Tests. Supplementary Performance Tests shall be scheduled at the convenience of Owner. Owner will observe such supplementary Performance Tests and shall be furnished with a complete set of test data and results. If specified conditions are not met, Contractor shall modify or replace the Materials and Equipment to obtain satisfactory performance.
D. Contractor shall submit detailed written test procedures for all Performance Tests to the Owner and Engineer for review and approval not later than 120 Days prior to the start of the initial Performance Test.
E. Contractor shall furnish Owner six (6) hard copies and one (1) electronic copy of all test data sheets, test calculations, and the test report for all tests required herein.
F. Contractor shall furnish and connect all test instruments required by the ASME codes or other appropriate code or standard, if applicable,in addition to normal Facility instruments. With the exception of those

connections and devices needed to demonstrate Contractor has met its Gross Auxiliary Electrical Load Guarantee and Water Consumption Guarantee, the Contractor shall ensure that all necessary connections and devices required for the Performance Tests are provided for in the design phase of the Work so that modifications to permanent equipment or systems are not required immediately prior to testing.

G. Contractor shall make all preparations, furnish all testing personnel, and incur all non-Owner expenses connected with the tests.

H. Should any Materials and Equipment fail to operate as required, or in case of failure to meet any Contractor guarantees, Owner shall have the right to operate the Materials and Equipment until such defects have been remedied and guarantees met. In the event that defects necessitate the replacement of the Materials and Equipment or any part thereof, Owner shall have the right to operate the Materials and Equipment until such time as new Materials and Equipment are provided to replace the defective Materials and Equipment. Removal of defective Materials and Equipment shall be scheduled at Owner's convenience and discretion, which shall not be unreasonably withheld.

I. All costs to prepare the Facility for a Performance Test shall be to the Contractor's account.

J. Instruments shall be calibrated by the Contractor before the tests. Calibration is defined as comparison of a test instrument's indication against a known standard. Instrument calibrations, where applicable, may be applied to raw data to calculate test results.

K. A deadband of 1.0% (±0.5%) is applicable to the guaranteed Net Electrical Capacity and Net Heat Rate. In comparison of a test result to the Net Electrical Capacity Guarantee and Net Heat Rate Guarantee, the deadband will be superimposed over the guarantee. The Contract guarantee will be deemed fulfilled if the test result falls within the dead band, or, if outside the deadband, the test result indicates better performance than the Contract guarantee. No allowances shall be made for instrument uncertainty.

L. Contractor shall submit degradation curves and calculations for all equipment with the detailed written procedures that shall be used to correct Performance Test results to guaranteed performance conditions, as applicable.

M. The Performance Guarantees shall apply to a Facility in a new and clean condition. However, no adjustments shall be made for operation of the unit(s) under Contractor's responsibility during the start-up and commissioning phase.

N. If operation and performance of the Facility is unsatisfactory due to any deficiency in Contractor's Work, Contractor shall make repairs and re-perform or replace his Work to obtain satisfactory operation and performance and shall provide evidence satisfactory to Owner that his corrective work has corrected the defective work. Performance improvements arising out of a remedy shall be calculated based on the difference between a Performance Test performed immediately before and another one immediately after a remedy is implemented. Requirements for re-testing due to deficiencies shall be mutually agreed upon by the Parties.

9. <u>EQUIPMENT DEMONSTRATION TESTING:</u>

A. Contractor shall perform demonstration tests of major equipment provided by Contractor or Owner These tests shall be conducted to verify Subcontractor Materials and Equipment performance. Materials and Equipment demonstration tests are not Performance Tests, they are the tests and checkouts used during commissioning, which verify that the components are fully operational.

B. Owner shall receive reasonable notice and the opportunity to witness these tests.

C. Materials and Equipment demonstration tests shall be conducted using either permanent Facility instrumentation or temporary test instrumentation that is functioning in support of the Facility Performance Test.

D. At least six (6) months prior to testing, test protocols for Materials and Equipment demonstration tests shall be submitted by Contractor to be agreed upon by Owner and Contractor. The intent is to determine performance of individual components to serve as a baseline for trending component performance for long term Facility operation as compared to the initial performance.

E. Materials and Equipment demonstration tests may be conducted concurrently with the Facility Performance Test for Substantial Completion.

F. The following equipment shall be indiviually tested:

   1) Combustion Turbine Generators
   2) Steam Turbine Generators
   3) Heat Recovery Steam Generators
   4) Air Cooled Condenser
   5) Main and Auxiliary Transformers

G. The test procedure shall include, but not be limited to, the following, as a minimum:

   1) Administrative procedured
   2) Correction curves and sample calculations, including all corrections to be applied, in both manual and electronic spreadsheet formats
   3) Sample test data sheets
   4) Marked-up P&ID's that show the location of all test instrumentation

Prior to the Performance Tests, all Plant equipment directly associated with cycle performance shall be properly adjusted, calibrated, tuned, and washed, shall be in proper and clean working condition, and shall be functioning within its normal operating range as allowed by the equipment manufacturers.

10. FACILITY NET ELECTRICAL CAPACITY AND NET HEAT RATE PERFORMANCE TESTS:

A. General: Performance Tests shall be run with three operators and under normal operating conditions with essential equipment in automatic control (i.e., no control system jumpers, forces, alarm bypasses, temporary hookups or special equipment to allow for operation). Safety devices, protective relays, and trips mechanisms shall be checked and confirmed operational. Contractor's testing personnel, as well as representatives of any major equipment supplier whose equipment is being tested or are performing simultaneous tests, will also be present during the conduct of Performance Tests.

B. Performance Tests should be performed at conditions as close as possible to the reference conditions.

C. All Performance Testing shall be subject to review and potential re-testing if performance-related control system settings are materially changed after Performance Tests have been run. Performance Test protocols shall incorporate a logical sequence of testing to reduce the potential of control system setting changes being required after related Performance Tests are run (i.e. Gas Turbine emissions and control settings should be complete prior to emissions testing, which in turn should be complete prior to Performance Testing).

D. Facility Net Electrical Capacity and Net Heat Rate Performance Tests shall be in accordance with applicable ASME PIC test codes specifically PTC-46 "Overall Plant Performance." The Net Electrical Capacity and Net Heat Rate, and BOP Gross Auxiliary Electrical Load Guarantee test procedures shall include correction curves for operating conditions which vary from the Guarantee Conditions, including, but not limited to, ambient air temperature, ambient air pressure, ambient air humidity, fuel constituent analysis, generator power factor, steam generator blowdown rate, makeup water conditions, and fuel supply temperature and pressure.

E. Facility input/output testing shall be performed in accordance with the following:

1) Performance Tests shall be performed when the Facility is operating in steady-state full load condition without HRSG blowdown.
2) Power output of the gas turbine and steam turbine generators shall be measured with Contractor-supplied permanent Facility electrical metering.
3) Contractor may use the plant side revenue quality meters or provide temporary revenue quality certified meters for the measurement of net plant output. If Contractor provides temporary meters, measurement shall be performed at the high side of the step up transformers for station net power and the high side of the auxiliary transformers for the calculation of auxiliary power.
4) Contractor may also use the plant revenue quality metering system to calculate plant net output and station auxiliary power. Meters are provided for each generator and auxiliary transformer. The net plant output is the sum of each generator less auxiliary power less step-up

transformer losses. If the meters have been configured a net plant output calculation a direct reading may be made. If not, the plant output will be calculated by summing the output of each of the generators, subtracting the auxiliary power and transformer losses.

5) Fuel gas mass flow to the gas turbine shall be measured during the Performance Test with the Contractor-supplied orifice plate metering run (in accordance with ASME MFC-3M) installed as a permanent Facility flowmeter. Temporary test instrumentation and applicable permanent Facility instrumentation will be used to measure fuel gas temperature, pressure, and differential pressure, as applicable. A minimum of three gas fuel samples shall be taken for analysis during each one-hour test. Natural gas conforming to the OEM's requirements, shall be provided by Owner during all tests. Natural gas samples will be collected before, during, and at the end of the performance test runs. Both Contractor and Owner receive one set of fuel samples. A third set of fuel samples is set aside that can be used in the case of subsequent disputes. A mutually acceptable independent testing laboratory will be used for analysis of natural gas. Test results shall be corrected to the performance gas analysis used for the Performance Guarantees and based on the gas analyses performed on the gas samples taken during testing. The fuel heating value shall be determined by the average value of samples taken during each test run. The cost for sampling and analysis is by Contractor. If an on-line gas chromatograph is available then these readings may be used as the basis for all evaluations if Contractor approves. The gas chromatograph unit must, in this case, be properly calibrated prior to the Performance Test, and verification thereof must be made available to Contractor. Contractor shall always reserve the right to substitute the laboratory fuel analysis once received for the final test results All testing and analysis shall be conducted in accordance with appropriate ASME or other mutually acceptable codes.

6) Ambient air temperature shall be measured using laboratory calibrated RTD's or thermocouples installed upstream of the evaporative cooler in the vicinity of the gas turbine air filters. Relative humidity shall be measured at this same location. Barometric

pressure shall be measured at a site location away from building structures.

7) Each Performance Test shall consist of three one-hour tests performed within an eight-hour period. Data shall be recorded at intervals in accordance with the agreed upon test procedures. These individual results shall then be averaged for the one-hour period and corrected to Guarantee Conditions. The corrected results of the three one-hour tests shall then be averaged together to determine the performance levels achieved during the Performance Test.

8) The Duct Fired Net Unit Capacity Test will consist of one one-hour run performed as soon as is reasonable after the Net Capacity and Net Heat Rate Test. The results of the Duct Fired Net Unit Capacity test will be corrected to the Guarantee Conditions. If there are any limitations prohibiting full duct firing at the time of the test, then the unit may be operated at part load in order to determine by test the maximum added capacity by duct firing. In this circumstance, two one hour test runs, consisting of one unfired test run and one fired test run conducted at the same load, will be required.

F. The Performance Tests shall be conducted as described above and the measured performance shall be corrected to Guarantee Conditions. One set of correction curves will be developed per PTC 46 for the Net Electrical Capacity Guarantee, Net Heat Rate Guarantee, and BOP Gross Auxiliary Electrical Load Guarantee.

1) If the corrected Net Electrical Capacity is less than the Net Electrical Capacity Guarantee or if the corrected Net Heat Rate is greater than the Net Heat Rate Guarantee, the Facility shall be considered unacceptable and Contractor shall take appropriate action as indicated elsewhere in this Contract.

2) At the conclusion of the Performance Test, Contractor shall perform calculations to determine performance relative to the Performance Guarantees and shall issue a report covering the entire testing program.

11. <u>EMISSIONS MONITORING AND SAMPLING:</u>

A. HRSG stack Emissions will be measured using U.S. EPA methods.

Emissions Guarantees are as specified in the air permit. U.S. EPA Method 25A/18 will be used for measuring VOC. U.S. EPA Conditional Test Method 27, will be used to measure ammonia slip (NH3). U.S. EPA Method 20 for NOx and U.S. EPA Method 10 for CO will be used to show compliance with Unit Emissions Guarantees. Method 201A and 202 will be used for measuring particulates, and Method 9 will be used for opacity.

B. A certified CEMS is defined as a CEMS that has been installed, calibrated, tested and maintained in accordance with the requirements 40 CFR part 75 and Part 60.

12. NOISE TESTING:

A. After the Facility is placed into successful operation and before Substantial Completion, Contractor shall perform a Noise Level Test on the Facility and Materials and Equipment to verify compliance with Section 1.

B. Appropriate corrections, in accordance with recognized industry standards, shall be made to the operating plant sound level measurements.

13. WATER CONSUMPTION TEST:

A. During Performance Tests, Contractor shall demonstrate, using Contractor supplied flow measuring equipment and temporary measuring equipment, that the process Water Consumption Rate does not exceed the process Water Consumption Rate Guarantee provided by the Contractor.

Performance Test Completion Certificate

Contractor, under the Contract dated _______,, 20___, between Contractor and Owner for the Facility hereby certifies that on the __ Day of_______, 20___ the Contractor has completed a Performance Test [run or rerun]. A copy of these Performance Test results is attached hereto as Attachment A. The Performance Test [run or rerun, is or is not] the final such Performance Test to demonstrate Facility performance. [Additional or No additional] Performance Testing shall be performed.

Contractor has/has not achieved the Performance Guarantees.

Contractor has/has not achieved the Minimum Performance Standards.

IN WITNESS WHEREOF, Contractor has executed and delivered this certificate through its duly authorized representative as of the _____ Day of ________ , 20__

By: ____________________________

Title: ____________________________

Performance Test Completion Certificate

ACCEPTANCE OF PERFORMANCE TEST COMPLETION CERTIFICATE

Owner hereby accepts the foregoing certificate and confirms that acceptance of this certificate constitutes acknowledgment by the Owner of the level of performance achieved by the Facility.

Owner's Representative hereby accepts the foregoing certificate and confirms that acceptance of this certificate constitutes acknowledgment by the Owner of the level of performance achieved by the Facility.

Consultant hereby accepts the foregoing certificate and confirms that acceptance of this certificate constitutes acknowledgment by the Owner of the level of performance achieved by the Facility.

IN WITNESS WHEREOF, Owner, Owner's Representative and Consultant have caused this Acceptance of Performance Test Certificate to be executed by their duly authorized representative as of the ____ Day of ______ ,20_

OWNER'S REPRESENTATIVE	OWNER
By: ________________________	By: ________________________
Title: ________________________	Title: ________________________

CONSULTANT

By: ________________________

Title: ________________________

APPENDIX A

ABBREVIATIONS

LIST OF ABBREVIATIONS

ac	alternating current
AGC	automatic generation control
ARMA	Air and Radiation Management Administration
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
Btu	British thermal unit
°C	degree Centigrade
CEMS	continuous emissions monitoring system
CO	carbon monoxide
CO_2	carbon dioxide
CPCN	Certificate of Public Convenience and Necessity
CRT	cathode ray tube
GT	gas turbine
GTG	gas turbine-generator
dBA	decibel
dc	direct current
DCS	distributed control system
DNR	Department of Natural Resources
EAF	equivalent availability factor
EPC	engineering/procurement/construction
EPA	Environmental Protection Agency (U.S. unless noted)
°F	degree Fahrenheit
FAA	Federal Aviation Administration
FERC	Federal Energy Regulatory Commission
gal	gallon

GNP	Gross National Product
gpd	gallons per day
gpm	gallons per minute
Hga	mercury absolute
HHV	higher heating value
HP	high pressure
hp	horsepower
hr	hour(s)
HRSG	heat recovery steam generator
HVAC	heating, ventilating and air conditioning
Hz	hertz
I&C	instrumentation and control
in	inch(es)
IP	intermediate pressure
ISO	International Standards Organization
kV	kilovolt(s)
kVA	kilovoltampere(s)
kW	kilowatt(s)
kWh	kilowatt-hour(s)
lb	pound(s)
lb/hr	pounds per hour
LHV	lower heating value
LNG	liquid natural gas
LP	low pressure
mA	milliampere(s)
MCC	motor control center
MCR	maximum continuous rating
mgd	million gallons per day
MMBtu	million British thermal units
MVA	megavoltampere

MW	megawatt(s)
MWa	megawatt(s)
MWe	megawatt(s) electrical
MWh	megawatt-hour
NO_2	nitrogen dioxide
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NO_x	oxides of nitrogen
NSPS	new source performance standards
O_2	oxygen
O&M	operation and maintenance
PCS	Parallel Condensing System
pf	power factor
PM	particulate matter
PM-10	particulate matter below 10 microns
ppm	parts per million
ppmvd	parts per million by volume, dry
PPRP	Power Plant Research Program
PSC	Public Service Commission
PSD	Prevention of Significant Deterioration
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PURPA	Public Utility Regulatory Policy Act
QF	qualifying facility
RH	relative humidity
rpm	revolutions per minute
scf	standard cubic feet
SCR	selective catalytic reduction

sf	square foot
SO_2	sulfur dioxide
STG	steam turbine-generator
TSP	total suspended particulates
UL	Underwriters Laboratory
UPS	uninterruptible power supply
V	volt
VAR	volt ampere reactive
VOC	volatile organic compounds

APPENDIX B

ACCEPTABLE VENDORS LIST

APPENDIX B

APPROVED VENDORS LIST

Approved Vendors List

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Steam Turbine	*Toshiba ITBD)* **GE** Mitsubishi Siemens Alstom
Combined Main Stop and Control Valve/Actuator	Rexroth
Combined Reheat Valve Actuator	Rexroth
Gland Steam Condenser	Southern Heat Exchanger ITT Industries Struthers Industries Krueger Engineering & Mfg. Co.
Gland Steam Exhauster	Gardner Denver The New York Blower Co. Chicago Blower Co. or Equivalent
Main Oil Cooler	Tranter PHE (E) Southern Heat Exchanger ITT Industries GEA Ecoflex (E) Alfa Laval
Oil Conditioner	Kaydon TORE
Oil Mist Eliminator	Burgess-Miura Co. (E) Koch-Otto York
Actuator	**Limitorque - Preferred** Rotork
Steam Turbine Generator	GE Siemens Alstom *Toshiba (TBD)*
Turbine Supervisory Instrumentation Unit	Bently Nevada
Position Switch	Namco Co.
Position Transmitter	M-System
Flow Indicator	Yokogawa Electric Co.
Purity Analyser	**Yokogawa PacifiCorp Standard**
Solenoid Valve	Asco, Co.
Positioner	Fisher Co.
Instrument Valve	**Swagelok, Co. - Preferred** **Whitey Co. – Preferred Valves**
Instrument Fittings	**Swagelok, Co. - Preferred** Whitiey Co.
Control Valve	**Fisher Co. – Preferred**
I/P Converter	Yokogawa
Instrument Rack/Generator	**E-One – PacifiCorp Standard**
Seal Oil Gauge Panel	**E-One – PacifiCorp Standard**
Hydrogen Gas Measuring Rack	**E-One – PacifiCorp Standard**
Generator Condition Monitor	**E-One, GCMX – PacifiCorp Standard**
H2 Gas Dryer	LectroDryer
Combustion Turbine (	GE Siemens
Generator	GE Siemens
Cooling Tower	SPX (Marley) GEA Midwest Towers, Inc International Cooling Tower

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
HRSGs	Deltak Corporation Nooter/Ericksen Vogt Power Alstom
HRSG Duct Burners	Coen Forney John Zink
SCR and CO Systems	Peerless Mfg. Hitachi Vector
SCR Catalyst	Cormetech Hitachi (aka BHK) Argillon (formerly Siemens)
CO Catalyst	Engelhard EmeraChem
Auxiliary Boiler	Babcock & Wilcox Nebraska
Boiler Feed Pumps and Motors	**KSB, Inc. - Preferred** Sulzer Pumps Weir Pumps Ltd.
Condensate Pumps and Motors	Flowserve Johnston Pump Company Weir Pump Company Sulzer Pumps Goulds Pumps KSB
Circulating Water Pumps and Motors	Flowserve Johnston Pumps Weir Pump Company Sulzer Pumps Goulds Pumps
Condenser, Wet Surface	Alstom Graham TEI Yuba Holtec International SPX (Marley)
Condenser, Air Cooled (ACC)	SPX (Marley) GEA
Heat Exchangers, Plate & Frame	Alfa Laval APV Graham Tranter
Water Treatment Systems (Demin)	Graver Water Co. Hungerford & Terry, Inc. US Filter GE Water Technologies (Glegg) Water and Power Technologies Ecolochem
Oil Water Separators	Anderson Great Lakes Environmental Highland Tank PS International (E)
Air Compressors	**Atlas Copco – Preferred** Ingersoll Rand Gardner Denver Sullair Cooper/Joy Industries Dresser

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Air Dryers	Kemp **Atlas Copco - Preferred** Ingersoll Rand Pneumatic Productions Corporation Sullair GDI Deltech
Fuel Gas Treatment	Anderson Separator/Clark Reliance/National Filtration Burgess Manning Flowtronex Gas Packagers GTS Energy Hanover Smith Oil & Gas Systems Peerless Total Energy Resources Tran-Am Universal Compressors
Miscellaneous Horizontal Pumps	Aurora Pumps Flowserve Goulds Pumps Peerless Aurora Sulzer Johnston KSB
Pumps, Vertical	Aurora Pumps Goulds Pumps Flowserve Johnston
Vacuum Pumps	Graham Manufacturing Nash Nitech
Sump Pumps (Submersible)	Aurora Pumps Flygt Corporation Warman Nagel Goulds Flowserve Johnston Pumps
Pumps, Fire Water	Peerless ITT Allis Chalmers Pump Aurora Pumps Fairbanks Morse
Steam Conditioning Valves (attemporators)	CCI Emerson/Fisher-Rosemount Con-Tek
Fire Protection System	F.E. Moran **Delta Fire Protection – Salt Lake City -Preferred** Grinnell Fire Protection McDaniel Fire System Shambaugh S&S Sprinkler Dooley Tackaberry Securiplex International Fire Protection
GSU Transformers and Unit Auxiliary Transformers	ABB Alstom **GE/Prolec - Preferred** VA Tech **Waukesha – Preferred**

Equipment / Construction Package	**Approved Subcontractors / Equipment Suppliers**
Switchgear	**GE – Preferred 4160V** **Square D – Preferred 480V** Powell (Only if part of package) **Cutler-Hammer – 4160V and 480V**
Motor Control Centers	Powell (Only if part of package) **Allen Bradley – Preferred for 480V MCC, 4160V MCC** **Cutler-Hammer – Preferred for 480V MCC, 4160V MCC**
Variable Frequency Drives	Allen-Bradley Saftronics Cutler-Hammer Danfoss
Isolated Phase Bus Duct	ABB Calvert **Delta-Unibus - Preferred** **GE Canada - Preferred** Hitachi
Non Segregated Phase Duct	Calvert Square D **Delta-Unibus - Preferred** **Powell - Preferred**
Power Control and Instrumentation Cables	BICC Rockbestos Supernaut Tamaqua Pirelli **Okonite - Preferred** Furon/Dekoron Rome **Southwire - Preferred** **Belden – Communication Cable Preferred** Kerite
High and Medium Voltage Cable	Pirelli **Okonite - Preferred** Rome Kerite
Distributed Control System	**Emerson Ovation - PacifiCorp Standard**
Continuous Emissions Monitoring System	**KVB Enertec DAHS Software; and PacifiCorp specified instruments – PacifiCorp Standard**
Chemical Feed Systems	Liquitech, Inc. Neptune JCI Wadsworth Pumps Flowtronex **Milton Roy/LMI or Micro Pump – Preferred** Nalco Johnson March Systems, Inc. Sentry Equipment
Water Sample Panel	Delphi Control Systems Johnson March Systems Sentry Equipment Corp. Waters Equipment Co.
Instrumentation Analytical Measurements	
Chromatographs	ABB Daniel (Natural Gas) EG&G Rosemount
Conductivity	**Yokogawa – PacifiCorp Standard**
Oxygen	**Orbisphere/Hach or Yokogawa – PacifiCorp Standard**
Silica	**Hach – PacifiCorp Standard**
Sodium	**Orion – PacifiCorp Standard**

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
pH Probe	**Yokogawa – PacifiCorp Standard**
Vibration	**Bentley Nevada – PacifiCorp Standard**
Chlorinators	Advance Capital Controls Fischer & Porter Wallace & Tieman
Computers (Flow)	Daniel Omni Fisher
Controllers, Field Mounted, Pneumatic	Fisher
Flame Supervisory Systems	Fireye Forney Honeywell Allen Bradley Iris (E)
Indicators Manometers	**Dwyer – preferred** Meriam
Indicators Press/Receiver Gauge	**Ashcroft – Preferred (Except in the case of pre-packaged equipment)**
PLC	**Allen Bradley - PacifiCorp Standard (Except in the case of pre-packaged equipment) Control Logix or SLC 5/05 (Ethernet Version)**
Transmitters, Electronic	
Differential Pressure	**Rosemount - PacifiCorp Standard (Except in the case of pre-packaged equipment)**
Level Measurement	
Capacitance, Etc.	Drexelbrook Fisher
Displacement	Fisher
Process Radar	Rosemount Ohmart-Vega
Custody Transfer/Radar/Displacement	Enraf Saab
Radioactive	Kay-Ray Ohmart-Vega Texas Nuclear
Ultrasonic	Endress & Hauser Inc. Kistler Morse Magnetrol Millitronics
TDR	Magnetrol **Rosemount – preferred**
Magnetic Flow	**Rosemount – preferred**
Mass Flow	ABB/Bailey **Rosemount – preferred**
Pressure	Foxboro Honeywell Yokogawa **Rosemount – preferred**
Target Meter	Foxboro Hersey Measurement
Temperature	Foxboro Moore Industries **Fisher-Rosemount – preferred** Honeywell Yokogawa
Turbine	Daniel Foxboro

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Transmitters, Pneumatic	
Differential Pressure	**Fisher – preferred**
Level Displacement	Fisher Magnetrol
Pressure	Fisher Foxboro
Target Meter	Foxboro
Temperature	Fisher-Rosemount Foxboro
UPS	Best SCI
Valves and Regulators	
Actuators, Diaphragm	**Fisher – PacifiCorp Standard (Except in the case of pre-packaged equipment)**
Actuators, Piston	Automax Bettis Contromatics George-Fischer Hills-MC Canna Neles-Jamesbury Posacon Valtek Vanton Whitey XACT
Control Valves – ON/OFF or Throttling Ball	**Fisher – preferred** Atwood & Morrill (E) Copes Vulcan Masoneilan Neles-Jamesbury TYCO (E) Valve Technologies Watts WKM
Positioners, Electric	**Limitorque, MX – Preferred** Fisher-Rosemount Auma
Butterfly/ECC Disk	AMRI Continental Durco Fisher-Rosemount Masoneilan Moisten Neles-Jamesbury Valtek
Valves, Butterfly <24-inch	Bray Valves & Controls Dezurik Flowseal Henry Pratt Co. Jamesbury Keystone Valve KSB-AMRI
Valves, Butterfly >24-inch	Atwood & Morrill Dezurik Flowseal Grinnell Corp. Henry Pratt Co. Keystone Valve Watts

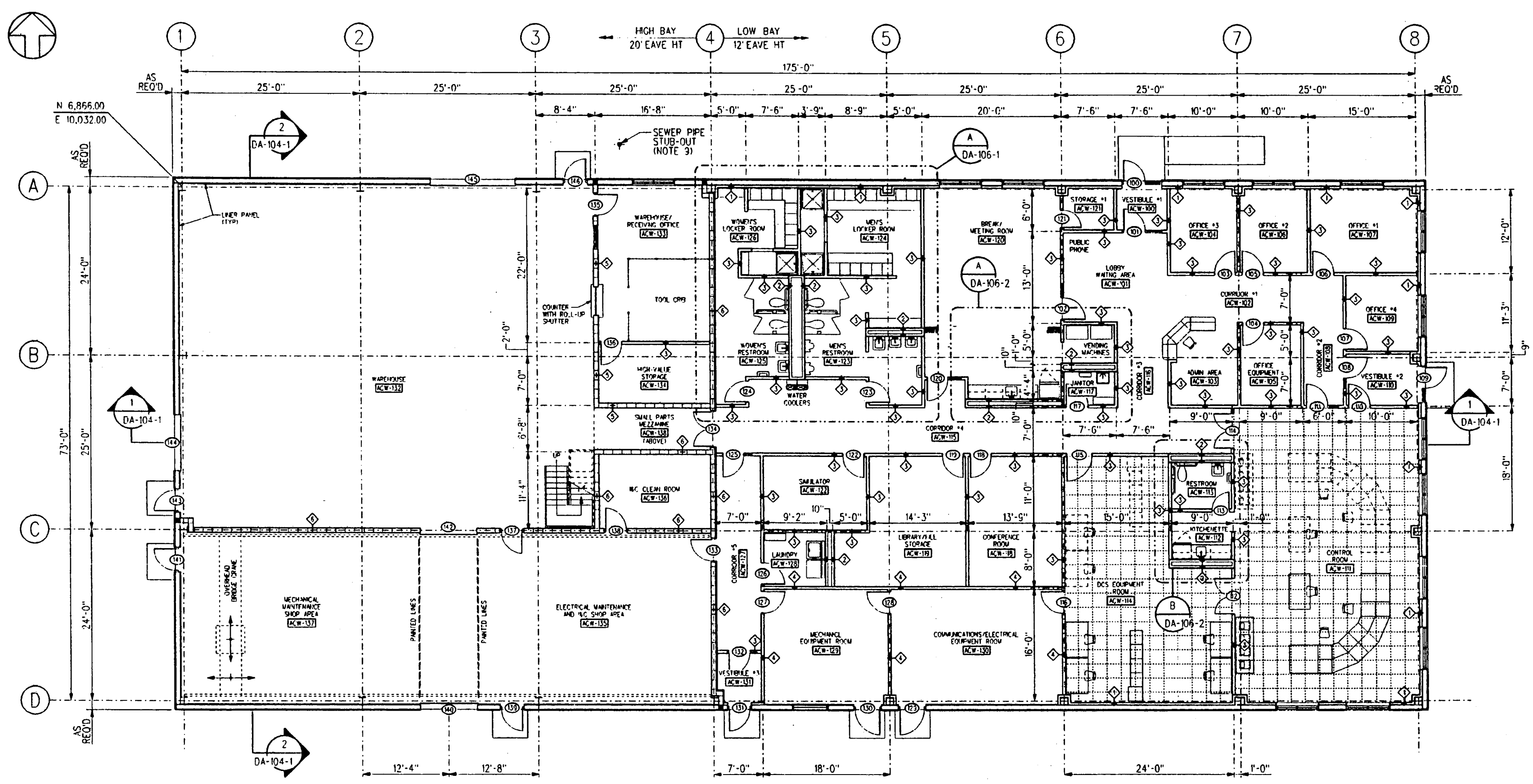
Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Valves, Globe	Atwood & Morrill Edwards Newco Valves Pacific Valves Whitey Yarway
Valves, Cast Steel	Atwood & Morrill Crane Edwards Pacific Valves Tyco Velan Valve Co. WM Powell Co.
Control Valves, Severe Duty, (Bypass, Recirculation, Drum level control, ACC spargers)	**CCI – PacifiCorp Standard**
Valves, Forged Steel	Edwards Valves, Inc. Conval, Inc. Dresser Industrial Valve Yarway Velan Valve Corp Vog Newco Bonney Forge
Valves, High Pressure	Atwood & Morrill Crane Edwards Pacific Valves Tyco Velan Valve Co.
Valves, Knifegate	Warman Dezurik Newcon Clarkson
Valves, Check	APCO Crane Edward Valves Pacific Valves Stockham Valves & Fittings Yarway/Tyco
Globe / Cage (No Split Body) 300#	Collins Instrument (Plastic) Fisher Masoneilan Samson Valke Control Component, Inc. (CCI)
Miniature / Special	Collins Instrument Research Controls Whitey
Pinch, Weir, Diaphragm	ASAHI Fisher-Rosemount Grinnell Red Valve RKL
Plug	Durco Tufline
Regulators	Air Service Fisher-Rosemount Process Service Cashco

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Strainers, Automatic Flushing	Hayward Strainers Hellan SP Kinney Engineers
Valves, Ball	ITT Engineered Valves Mogas Neles Jamesbury NIBCO, Inc Stockham Valves & Fittings Whitey
Relief or Safety Valves	**Consolidated – PacifiCorp Standard for Steam Service** Crosby Ferris Dresser
Installation Hardware	
Boxes or Cabinets – Instrument and Junctions Metal	Appleton **Hoffman – preferred**
Boxes or Cabinets – Instrument and Junctions Fiberglass or Plastic	**Hoffman – preferred** Stahlin
Cable Tray and Tubing Support Tray Metal	B-Line OBO Betterman PW
Cable Tray and Tubing Support Tray Nonmetallic	Channel Way Enduro Fibergrate Seagate Stahlin
Instrument Manifolds and Valving Assemblies	Anderson Greenwood PGI Rosemount
Tubing Metal	Dekoron Thermoelectric
Tubing NonMetallic	Dekoron Thermoelectric
Fittings (Compression) Metal	Gyrolok **Swagelok – Preferred**
Fittings (Compression) Non-metallic	JACO (Kynar)
Fittings (Compression) Valves, Metal	Anderson Greenwood Hoke PGI **Whitey - Preferred**
Wire Signal	Alpha Belden Dekoron
Wire Thermocouple	Dekoron
Other	
Expansion Joints	Bachmann Industries Effox Pathway Wahlco Engineered Products
Fluid Couplings	Voith
Pipe, Circulating Water	Ameron La Barge Pipe McAbee Construction Northwest Pipe Company Dixie Southern
Pipe, Fabricated LP	Bendtec International Piping Systems McAbee Construction Team Industries

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
	Scott Process
Pipe, Supports	Froneck Lisega Bergen PTP
Tanks, Field Erected	CBI Columbian Tank Matrix Pittsburgh Tank Fisher Tank HMT, Inc
Tanks, Shop Fabricated	Arrow Tanks Eaton Modern Welding Palmer Dixie Southern
Equipment/Construction Package	**Approved Subcontractors**
Fittings (Compression) Metal	Gyrolok **Swagelok– preferred** Nonmetallic JACO (Kynar)
Fittings (Compression) Valves, Metal	Anderson Greenwood Hoke PGI **Whitey – preferred**
Tubing NonMetallic	Dekoron Thermoelectric
Wire Signal	Alpha Belden Dekoron
Wire Thermocouple	Dekoron
Protective Relaying Devices and Systems	**Schweitzer Engineering Labs, Inc.300 Series – Preferred**
Lockout Relays	**Electroswitch – PacifiCorp Standard**
Test Switches	**ABB – Preferred** States
Revenue Meters	**Landis & Gyr 2510 – PacifiCorp Standard**

APPENDIX C

CONCEPTUAL SITE ARRANGEMENTS



FLOOR PLAN

SCALE: 1/8"=1'-0"
(13,440-SF)

NOTES

1. THE ADMIN/CONTROL/WAREHOUSE BUILDING HAS BEEN DESIGNED FOR CONSTRUCTION AS A PRE-ENGINEERED, PRE-FABRICATED BUILDING SYSTEM AND, AS SUCH, ALL RELATED STRUCTURAL DIMENSIONS ARE APPROXIMATE AND MAY BE CHANGED, WITH ENGINEER APPROVAL, TO ALLOW THE USE OF STANDARD BUILDING FRAMES AND COMPONENTS.
2. PRE-ENGINEERED BUILDING DESIGN SHALL BE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, INCLUDING THE LOAD CONDITIONS AND DESIGN REFERENCES/CODE DESCRIBED IN ICB 2000.
3. SEE SHEET DA-100-2 FOR ARCHITECTURAL SYMBOLOGY AND GENERAL NOTES.
4. SEE SHEET DA-100-3 FOR ARCHITECTURAL ABBREVIATIONS.
5. SEE SHEET DA-100-4 FOR ARCHITECTURAL MATERIALS AND FINISHES.
6. FLOOR SLAB ELEVATION SHOWN (EL 100'-0") IS THE NOMINAL ELEVATION. ACTUAL ELEVATION IS 5052'-0".
7. SEE SHEET DA-108-1 - DOOR AND FRAME SCHEDULE - FOR INDIVIDUAL DOOR OPENING (DO) DIMENSIONS.
8. SEE SHEET DA-108-2 - ROOM FINISH AND WINDOW SCHEDULE - FOR INDIVIDUAL WINDOW OPENING (WO) DIMENSIONS AND ARCHITECTURAL FINISH MATERIALS.
9. SEE SHEET 100545-DY-120 - SANITARY SEWER SYSTEM PLAN - FOR EXACT LOCATION AND ADDITIONAL INFORMATION.

0 4' 8' 16' 24'
SCALE: 1/8"=1'-0"

Shaw Stone & Webster, Inc.

PROJ# 100545
PL#
DATE 2-24-2004
ENG MAP DES MAP
DR MLN CH MLN
APPROVAL

CURRANT-CREEK POWER PROJECT
MONA, UTAH
ADMIN/CONTROL/WAREHOUSE BUILDING
FLOOR PLAN

PACIFICORP

SCALE: 1/8"=1'-0" SHEET 5 of 16 100545-DA-101-1 REV. B

No.	DATE	REVISION	BY	CHK	APP
A	12-19-03	CLIENT REVIEW	MLN	GMP	

No.	DATE	REVISION	BY	CHK	APP	DRAWING No.	REFERENCE DRAWINGS

PLOT SCALE: 1 - PLOT_SCALE

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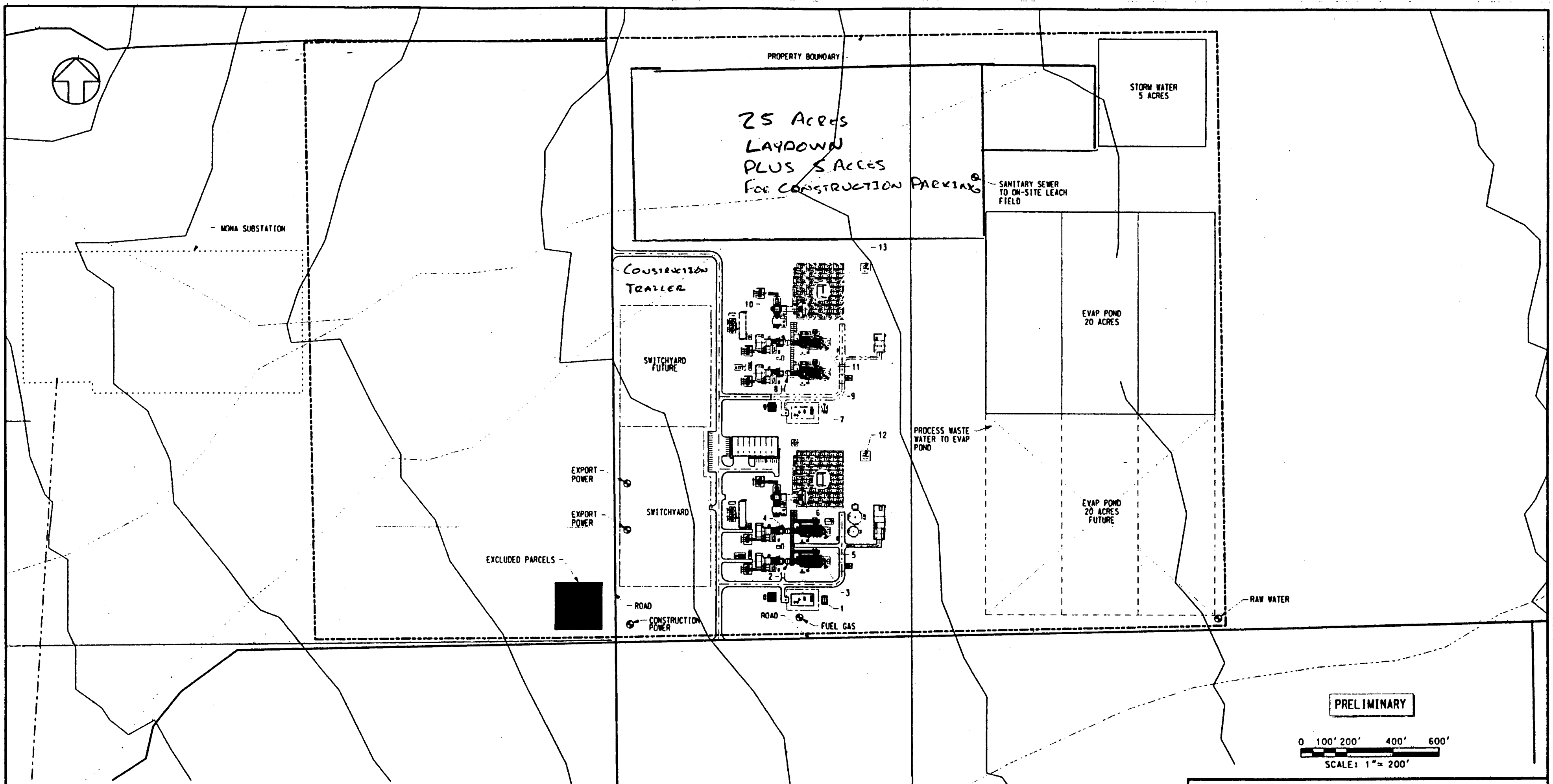

EMISSION POINT COORDINATES			PERMIT DESCRIPTION	
ITEM NO	NORTHING	EASTING		DIMENSION (DIA/HEIGHT)
1	14462797'	1389559'	DEWPOINT HEATER STACK 1	24"O.D. @ 35' HIGH
2	14462975'	1389397'	SIMPLE CYCLE STACK 1A1	23'I.D. @ 140' HIGH
3	14462975'	1389553'	HRSG STACK 1A2	16'-10"I.D. @ 150' HIGH
4	14463105'	1389398'	SIMPLE CYCLE STACK 1B1	23'I.D. @ 140' HIGH
5	14463105'	1389554'	HRSG STACK 1B2	16'-10"I.D. @ 150' HIGH
6	14463148'	1389593'	AUX STEAM BOILER STACK	24"O.D. @ 35' HIGH
7	14463956'	1389596'	DEWPOINT HEATER STACK 2	24"O.D. @ 35' HIGH
8	14463785'	1389402'	SIMPLE CYCLE STACK 2A1	23'I.D. @ 140' HIGH
9	14463784'	1389558'	HRSG STACK 2A2	16'-10"I.D. @ 150' HIGH
10	14463915'	1389403'	SIMPLE CYCLE STACK 2B1	23'I.D. @ 140' HIGH
11	14463914'	1389559'	HRSG STACK 2B2	16'-10"I.D. @ 150' HIGH
12	14463430'	1389741'	COOLING TOWER 1	26'I.D. @ 42' HIGH
13	14464240'	1389746'	COOLING TOWER 2	26'I.D. @ 42' HIGH

ALL COORDINATES SHOWN ARE UTM (83) ZONE 12

PACIFICORP

CURRANT CREEK POWER PROJECT
MONA, UTAH

(2)-500MW 2X1-COMBINED CYCLE
GENERAL ARRANGEMENT
SITE PLAN

STONE & WEBSTER A SHAW GROUP COMPANY

JOB NO. 59321
07/01/03

DM-011A-C

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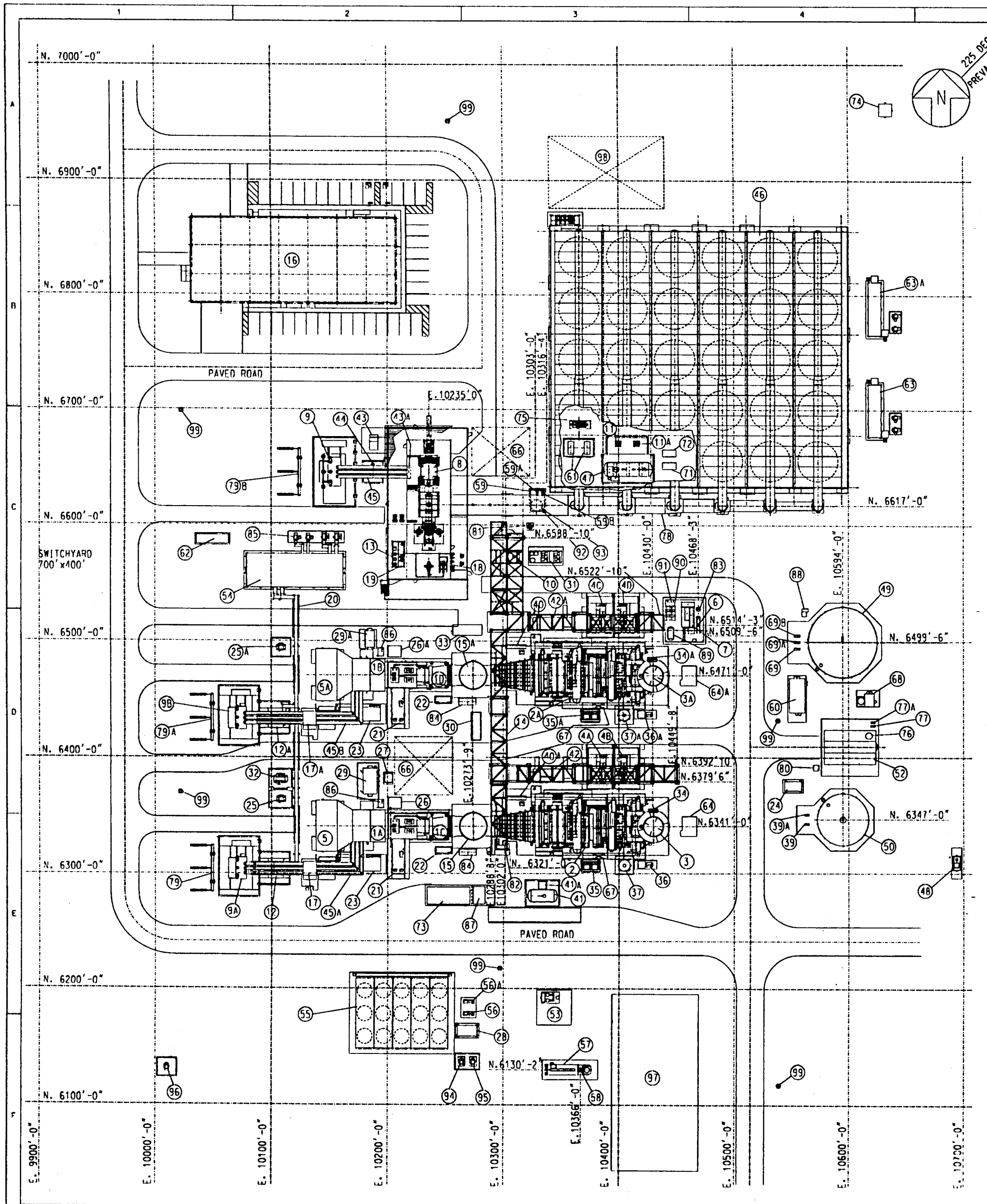


LEGEND

ITEM	EQUIPMENT NO.	EQUIPMENT TYPE	EQUIPMENT NAME
1A	1CTG-G-101	GENERATOR	COMBUSTION TURBINE GENERATOR 1A
1B	1CTG-G-201	GENERATOR	COMBUSTION TURBINE GENERATOR 1B
1C	1CTG-T-101	TURBINE	COMBUSTION TURBINE 1A
1D	1CTG-T-201	TURBINE	COMBUSTION TURBINE 1B
2	1MBS-HRSG-101	HEAT REC. STM. GEN.	HEAT RECOVERY STEAM GENERATOR
2A	1MBS-HRSG-201	HEAT REC. STM. GEN.	HEAT RECOVERY STEAM GENERATOR
3	1MBS-STK-102	STACK	HRSG STACK 1A
3A	1MBS-STK-202	STACK	HRSG STACK 1B
4A	1FWS-P-101A	PUMP, CENTRIFUGAL	BOILER FEED PUMP 101A
4B	1FWS-P-101B	PUMP, CENTRIFUGAL	BOILER FEED PUMP 101B
4C	1FWS-P-201A	PUMP, CENTRIFUGAL	BOILER FEED PUMP 201A
4D	1FWS-P-201B	PUMP, CENTRIFUGAL	BOILER FEED PUMP 201B
5		FILTER	INLET AIR FILTER HOUSE 1A
5A		FILTER	INLET AIR FILTER HOUSE 1B
6		STACK	AUXILIARY STEAM BOILER STACK
7	0ABS-B-001	BOILER, FIRED	AUXILIARY BOILER
8	1STG-G-301	GENERATOR	STEAM TURBINE GENERATOR
9	1MTX-XV301	TRANSFORMER	STG MAIN STEP-UP TRANSFORMER
9A	1MTX-XV101	TRANSFORMER	CTG 1A MAIN STEP-UP TRANSFORMER
9B	1MXT-XV201	TRANSFORMER	CTG 1B MAIN STEP-UP TRANSFORMER
10	1SDS-TK-301	TANK	TURBINE DRAINS TANK
11	1CNM-P-001A	PUMP, CENTRIFUGAL	CONDENSATE PUMP 1A
11A	1CNM-P-001B	PUMP, CENTRIFUGAL	CONDENSATE PUMP 1B
12	1ATX-XS101	TRANSFORMER	UNIT 1 AUXILIARY TRANSFORMER
12A	1ATX-XS201	TRANSFORMER	UNIT 2 AUXILIARY TRANSFORMER
13		LUBE OIL UNIT	STEAM TURBINE LUBE OIL UNIT
14		MODULE	PIPE RACK (MODULAR)
15	1MBS-STK-101	STACK	CT SIMPLE CYCLE STACK 1A
15A	1MBS-STK-201	STACK	CT SIMPLE CYCLE STACK 1B
16	0ADMIN-BLDG-001	BUILDING	ADMIN. / CONTROLL BLDG & WHSE
17	1GML-BKR101	BREAKER	UNIT 1 GENERATOR BREAKER
17A	1GML-BKR201	BREAKER	UNIT 2 GENERATOR BREAKER
18	1TME-CND-301	CONDENSER	GLAND STEAM CONDENSER
19		LUBE OIL CONDITIONER	STEAM TURBINE LO CONDITIONER
20		BUS DUCT	NON-SEGREGATED BUS DUCT
21		ACCESSORY MODULE	COMBUSTION TURBINE ACCESSORY MODULE
22		SKID	CT FIRE PROTECTION CO2 SKID
23		PEECC	COMBUSTION TURBINE PEECC BUILDING
24	1PDC-103	PDC	WATER TREATMENT PDC BUILDING
25	11EXS-ET	TRANSFORMER	UNIT 1 EXCITATION TRANSFORMER
25A	12EXS-ET	TRANSFORMER	UNIT 2 EXCITATION TRANSFORMER
26	1WTU-SUMP-101	SUMP	WASH WATER SUMP - CTG 1A
26A	1WTU-SUMP-201	SUMP	WASH WATER SUMP - CTG 1B
27		REACTOR	DC LINK REACTOR
28	1PDC-102/202	PDC	CCW PDC BUILDING
29	LS2100/EX2100	LCI/EXCITER	LCI BUILDING/EXCITER 2100
29A	EX2100	EXCITER	CT EXCITER 2100
30	1CTA-SKD-038	SKID	WASH WATER SKID - CTG 1A/1B
31	1IAS-SKD-001	SKID	AIR COMPRESSOR SKID
32	11LCI-ISO	TRANSFORMER	CTG ISOLATION TRANSFORMER
33	1SSS-PNL-001	SAMPLE PANEL	STEAM AND WATER SAMPLE PANEL
34	1LPS-P-101	PUMP, CENTRIFUGAL	LP ECONOMIZER RECIRC PUMP 1A
34A	1LPS-P-201	PUMP, CENTRIFUGAL	LP ECONOMIZER RECIRC PUMP 1B
35	1AFS-SKD-101	SKID	AMMONIA FLOW CONTROL SKID HRSG 1A
35A	1AFS-SKD-201	SKID	AMMONIA FLOW CONTROL SKID HRSG 1B
36	1MBH-SKD-101	SKID	HRSG 1A PHOSPHATE FEED SKID
36A	1MBH-SKD-201	SKID	HRSG 1B PHOSPHATE FEED SKID
37	1MBL-TK-101	TANK	HRSG 101 ATMOSPHERIC BLOWDOWN TANK
37A	1MBL-TK-201	TANK	HRSG 201 ATMOSPHERIC BLOWDOWN TANK
38	DELETED		
39	1WTD-P-001A	PUMP, CENTRIFUGAL	DEMINERALIZED WATER PUMP A
39A	1WTD-P-001B	PUMP, CENTRIFUGAL	DEMINERALIZED WATER PUMP B
40	1MBS-SKD-101	SKID	DUCT BURNER SKID 1A
40A	1MBS-SKD-201	SKID	DUCT BURNER SKID 1B
41	1AFS-TK-001	TANK	AQUEOUS AMMONIA STORAGE TANK
41A	1AFS-P-001A/B	SKID	AQUEOUS AMMONIA FORWARDING PUMP 1A & 1B
42	PDC-011	PDC	HRSG 1A POWER DISTRIBUTION CENTER
42A	PDC-012	PDC	HRSG 1B POWER DISTRIBUTION CENTER
43	STG-FCB	CABINET	STG FCB CABINET/BLDG.
43A		CABINET	STG VT & SA CABINET
44	1EXS-EXTR	TRANSFORMER	STG EXCITATION TRANSFORMER
45		BUS DUCT	STG ISOLATED PHASE BUS DUCT
45A		BUS DUCT	CTG 1A ISOLATED PHASE BUS DUCT
45B		BUS DUCT	CTG 1B ISOLATED PHASE BUS DUCT
46	1CNM-CND-301	AIR COOLED CONDENSER	AIR COOLED CONDENSER
47	1CNM-TK-301	TANK	CONDENSATE RECEIVER TANK
48	1WTU-SP-001	SEPARATOR	OIL/WATER SEPARATOR
49	0RAW-TK-001	TANK	RAW WATER / FIREWATER STORAGE TANK
50	0WTD-TK-001	TANK	DEMINERALIZED WATER STORAGE TANK
51	DELETED		
52	0WTD-DEMN-001A/B	DEMINERALIZER	DEMINERALIZER SYSTEM
53	1FGS-FLT-001A/B	FILTER	FUEL GAS FILTER/SEPARATOR A/B
54	PDC-001	PDC	MAIN ELEC POWER DISTRIBUTION CENTER
55	1CCW-HEX-002	HEAT EXCHANGER	AIR COOLED HEAT EXCHANGER
56	1CCW-P-001A	PUMP, CENTRIFUGAL	COMPONENT COOLING WATER PUMP A
56A	1CCW-P-001B	PUMP, CENTRIFUGAL	COMPONENT COOLING WATER PUMP B
57	1FGS-H-001	HEATER	FUEL GAS DEW POINT HEATER
58		STACK	FUEL GAS DEW POINT HEATER STACK
59		PIT	ACC DRAIN POT PIT
59A	1CNM-P-002A	PUMP, CENTRIFUGAL	ACC DRAIN POT PUMP A
59B	1CNM-P-002B	PUMP, CENTRIFUGAL	ACC DRAIN POT PUMP B
60	0FPS-BDG-001	BUILDING	FIRE PUMP HOUSE BUILDING
61	1ARC-SKD-301	VACUUM PUMPS	ACC HOGGING SKID
62	1EGS-EG-001	EMERGENCY GENRATOR	EMERGENCY DIESEL GENERATOR
63	PDC-010	PDC	ACC AREA POWER DISTRIBUTION CENTER
63A	PDS-020	PDC	ACC AREA POWER DISTRIBUTION CENTER
64	1CEM-PNL-101	CONT. EMIS. MONITORING	CONTINUOUS EMISSIONS MONI. SYSTEM 1A
64A	1CEM-PNL-201	CONT. EMIS. MONITORING	CONTINUOUS EMISSIONS MONI. SYSTEM 1B
65	DELETED		
66		DEFINED AREA	LAYDOWN AREA AND CRANE AREA
67		DEFINED AREA	SCR REMOVAL AREA
68	0DWS-SKD-001	SKID	POTABLE WATER SKID
69A	1SWS-P-001A	PUMP, CENTRIFUGAL	SERVICE WATER PUMP A
69B	1SWS-P-001B	PUMP, CENTRIFUGAL	SERVICE WATER PUMP B
69C	1SWS-P-001C	PUMP, CENTRIFUGAL	SERVICE WATER PUMP C
70	DELETED		
71	1CFS-SKD-001	CHEM. INJECTION SKID	AQUEOUS AMMONIA FEED SKID
72	1CFS-SKD-002	CHEM. INJECTION SKID	OXYGEN SCAVENGER FEED SKID
73		DEFINED AREA	HYDROGEN BULK STORAGE
74	0MBL-SUMP-001	SUMP	COLLECTION SUMP
75	1ARC-SJAE-301A/B/C/D	EJECTOR	STEAM JET AIR EJECTORS A/B/C/D
76	1WTD-TK-002	TANK	EVAP. COOLER MAKEUP WTR. STO. TANK
77	1WTD-P-002A	PUMP, CENTRIFUGAL	EVAPORATIVE COOLER MAKEUP PUMP A
77A	1WTD-P-002B	PUMP, CENTRIFUGAL	EVAPORATIVE COOLER MAKEUP PUMP B
78		DUCT	STEAM EXHAUST DUCT
79	DE-1		DEAD-END STRUCTURE 1
79A	DE-2		DEAD-END STRUCTURE 2
79B	DE-3		DEAD-END STRUCTURE 3
80	0WTS-SUMP-001	SUMP	RO/EDI MEMBRANE CLEAN-IN-PLACE SUMP
81	1SDS-TK-302	TANK	CONDENSATE FLASH TANK
82	1CCW-TK-001	TANK, P.V.(AMBIENT TEMP)	CCW EXPANSION TANK
83	0ABS-TK-001	TANK, PRESS. V.(HEATED)	AUXILIARY BOILER BLOWDOWN TANK
84		SKID	SEAL AIR HPU SKID
85		TRANSFORMER	STATION SERVICE TRANSFORMER
86		SKID	AIR PROCESSING SKID
87	1CDO-SKD-001	SKID	BULK CO2 STORAGE
88	0RAW-SKD-001	SKID	RAW WATER TANK CHLORINATOR SKID
89	0ABS-DA-001	DEAERATOR	AUXILIARY BOILER DEAERATOR
90	0ABH-SKD-001/002/003	SKID	AUX BOILER CHEM. INJECTION SKIDS
91		MCC	AUX BOILER MOTOR CONTROL CENTER
92	1DEM-P-001	PUMP, SUMP	ACC PIT SUMP PUMP
93	1DEM-SUMP-001	SUMP	ACC PIT SUMP
94	1NNS-XS102	TRANSFORMER	500KVA TRANSFORMER
95	1NNS-XS202	TRANSFORMER	500KVA TRANSFORMER
96	1NNS-XS300	TRANSFORMER	1000KVA TRANSFORMER (ALTERNATE)
97		SKID	FUEL GAS METERING SKID
98		DEFINED AREA	FUTURE WATER CONDENSER
99	1-HMP-LTG	LIGHT POLE	HIGH MAST LIGHTING

0 25' 50' 100' 150'
SCALE: 1"= 50'

NOTE:
STACK ITEM #'S DENOTE UTM (83) ZONE 12 COORDINATES AS NOTED ON DRAWING 100545-DM-011A.

PROJ#	100545
PL#	
DATE	
ENG	DES
CK	CH
APPROVAL	

Shaw Stone & Webster, Inc.

CURRANT-CREEK POWER PROJECT
MONA, UTAH

500 MW 2x1 - COMBINED CYCLE UNIT
PLOT PLAN

PACIFICORP

SCALE: 1"= 50' | SHEET 1 OF 1 | 100545-DM-012A | REV. 0

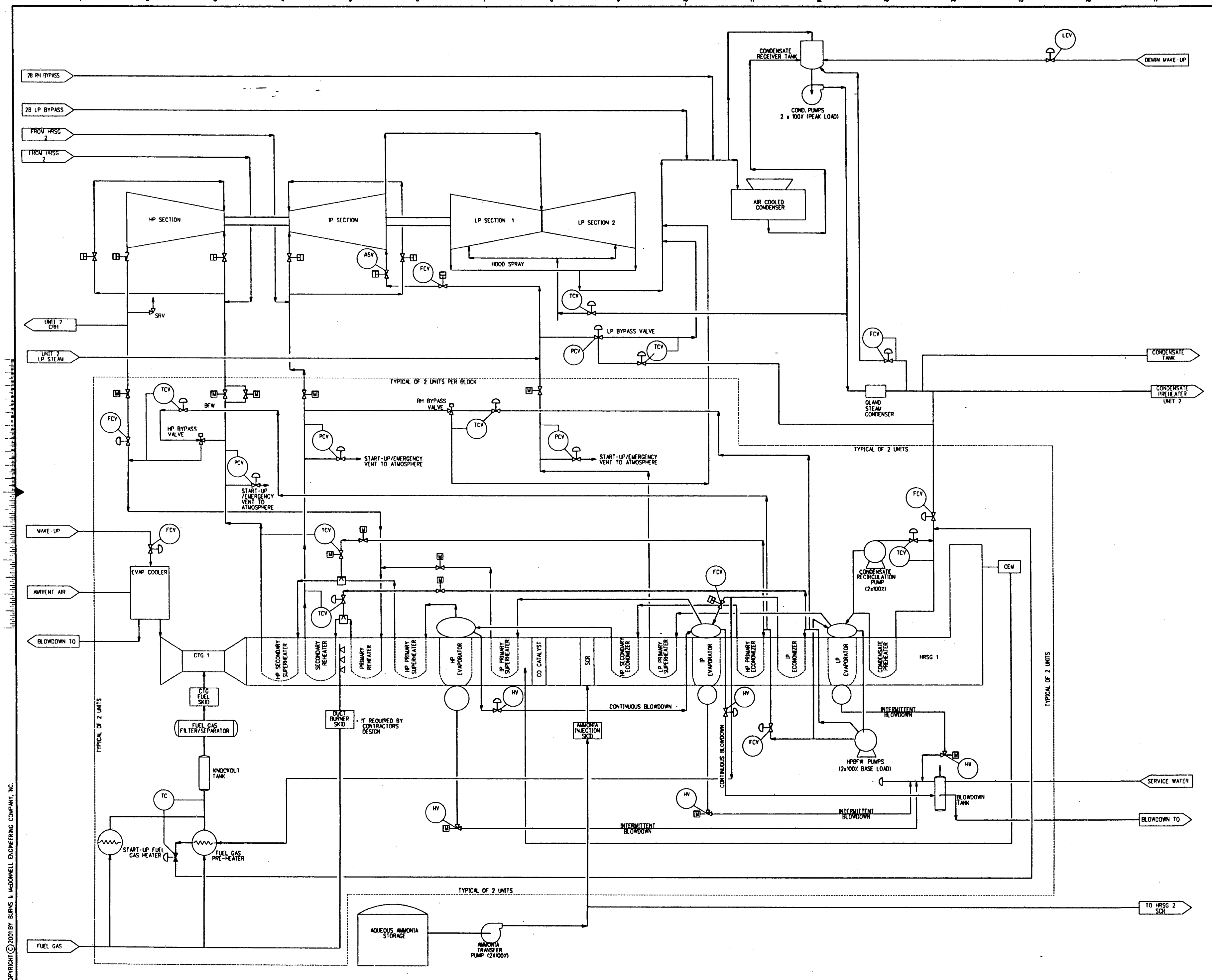
NO.	DATE	REVISION	BY	CHK	APP
E	01/21/04	ISSUED FOR EQUIPMENT SPECIFICATIONS			
F	03/19/04	ISSUED FOR DESIGN	KEH		
0	08/10/04	ISSUE FOR CONSTRUCTION	WRM		

PLOT SCALE: 1 =PLOT_SCALE

REFERENCE DRAWINGS	DRAWING No.

APPENDIX D

CONCEPTUAL PROCESS FLOW DIAGRAMS AND WATER BALANCE



no.	date	by	revision

NOTES:

100% CAPACITY IS 100% "PEAK" BLOCK CAPACITY OR DESIGN DUTY UNLESS NOTED OTHERWISE

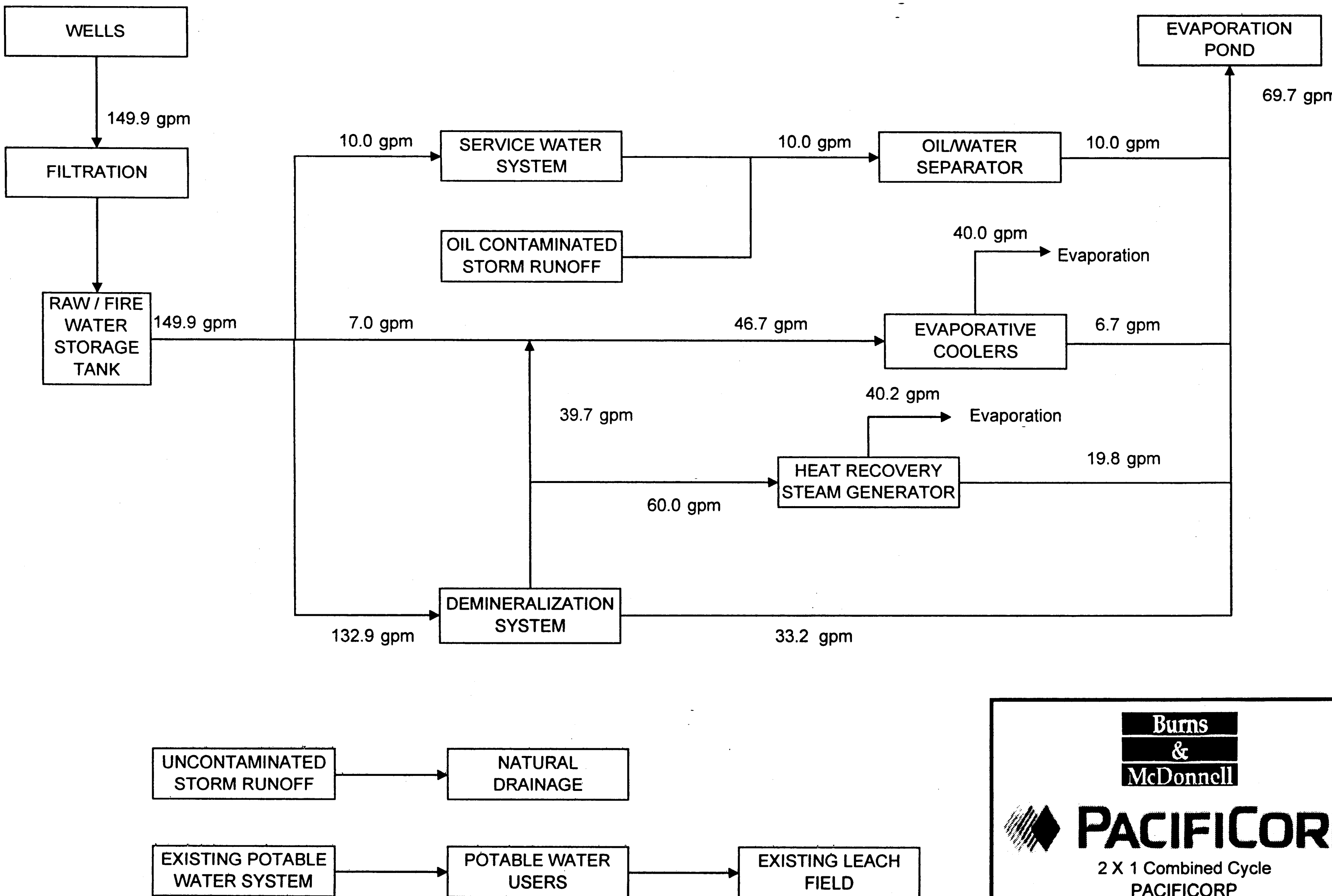
Burns & McDonnell

date | detailed
designed | checked

PACIFICORP
CURRENT CREEK
POWER PROJECT
BLOCK 2

CONCEPTUAL PROCESS
FLOW DIAGRAM

project | contract
drawing FD-1 — rev. A
sheet of sheets
file FD-01.DGN /10-19-2004 13:34 /



Note * - All water quantities are based upon 2 x 1 7FA GE combined cycle power plant.

Burns & McDonnell

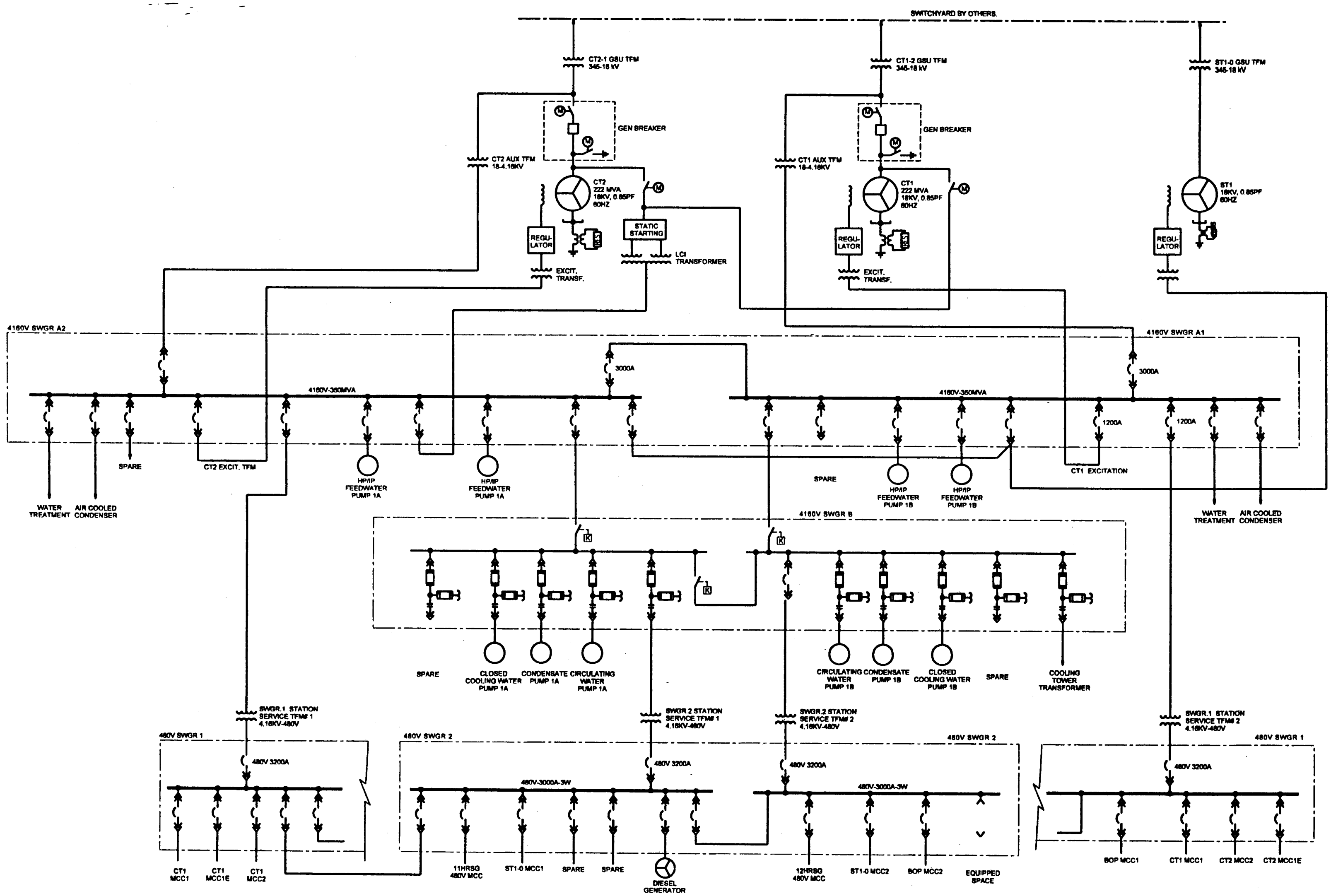
PACIFICORP

2 X 1 Combined Cycle
PACIFICORP
CURRANT CREEK
Water Balance Diagram

April, 2005	Rev. A

APPENDIX E

CONCEPTUAL ONE-LINE DIAGRAMS



NOTES:

1. ONELINE TO BE REVISED TO REFLECT PROPOSED COMBUSTION TURBINE.

Burns & McDonnell SINCE 1898

date APRIL 20, 2005

designed D. STEPHENS

PACIFICORP POWER SUPPLY

CURRANT - CREEK

2 x 1 COMBINED CYCLE

CONCEPTUAL ONE-LINE DIAGRAM

project 38849

contract

SKE-1 rev. – 2

SKE-1 CURRANT.DGN / 4-20-2005 16:03 / VLV

APPENDIX F

PACIFICORP - "Material Specification ZS 001-2004, Substation Equipment – Power Transformer All Ratings"

APPENDIX G

GEOTECHNICAL REPORT

APPENDIX H

LARGE GENERATION INTERCONNECTION AGREEMENT (LGIA)

APPENDIX I

MAKE-UP WATER ANALYSIS

APPENDIX I

MAKE-UP WATER ANALYSIS

	Design (Raw) Water Analysis
Calcium, mg/l as Ca	73
Magnesium, mg/l as Mg	11.2
Sodium, mg/l as Na	37
M-Alk, mg/l as $CaCO_3$	130
Sulfate, mg/l asSO_4	15
Chloride, mg/l as Cl	15
Nitrate, mg/l as NO_3	0.02
Phosphate, mg/l as P	0.012
Silica, mg/l as SiO_2	18
Barium	0.077
Strontium	0.043
pH	7.5 -8.5
Conductivity, µS/cm	310
TDS, mg/l	220
TOC, mg/l	<2
TSS, mg/l	1

APPENDIX J

FUEL ANALYSIS

APPENDIX K

DATA TO BE SUBMITTED WITH BID

SECTION 18049 - GAS TURBINE DATA TO BE SUBMITTED WITH BID

PART 1 - GENERAL

1.01 PERFORMANCE GUARANTEES:

The Contractor guarantees the performance of the equipment furnished to be at least as stated below when operated under the conditions specified. If (steam) (water) injection is required for NO_x control, the guarantees shall include the effect of the (water) (steam) injection.

A. Unit Performance Guarantees:

1. Unit Operating Conditions:

Gas Turbine Inlet:	Wet Bulb	_______°F
	Dry Bulb	_______°F
Bus Voltage:		_______ volts
System Power Factor:		90%
Evaporative Cooler Operating:		(Yes) (No)
Fuel:		Natural Gas

a. Base net output rating of turbine-generator, kW __________

(1) Fuel Input, MMBtu/Hr (HHV) (LHV) __________

(2) Exhaust gas flow, lbs/hr __________

(3) Exhaust gas temperature, °F __________

(4) Exhaust gas specific heat, Btu/lb/°F __________

(5) Analysis of turbine exhaust gas, % vol.

(a) CO_2 __________

(b) N_2 __________

(c) H_2O __________

(d) O_2 __________

(e) VOC __________

(f) Particulate __________

(6) (Steam) (Water) injection lb/hr __________

b. Peak net output rating of__________

(1) Fuel Input, MMBtu/Hr (HHV) (LHV)

Turbine-generator, kW __________

(2) Exhaust gas flow, lbs/hr ____________

(3) Exhaust gas temperature, °F ____________

(4) Exhaust gas specific heat, Btu/lb/°F ____________

(5) Analysis of turbine exhaust gas, % vol.

(a) CO_2 ____________

(b) N_2 ____________

(c) H_2O ____________

(d) O_2 ____________

(e) VOC ____________

(f) Particulate ____________

(6) (Steam) (Water) injection lb/hr ____________

c. The net heat rate including all losses and auxiliary power uses will not exceed Btu/kWh (based on (HHV) (LHV) of fuel and net power to step-up transformer

(1) Peak load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(2) Baseload

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(3) 3/4 load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(4) 1/2 load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

d. The spinning reserve net heat input will not exceed the following:

Heat input, Btu/hr (HHV) (LHV) ____________

At minimum stable operating load of, kW ____________

e. The maximum generator capability at ____ volts, 90% power factor, when temp. rises are in accordance with ANSI standard C50 will be, kW: ____________

f. NO_x Emissions Control System:

(Steam pressure/temperature) ____/____

(Minimum quality of water required) ____________

Flow required at peak output, lb/hr ____________

Flow required at base output, lb/hr ____________

Flow required at 1/2 of baseload, lb/hr ____________

g. Exhaust Emissions (Corrected to 15% Oxygen):

At Peak Rating:

CO, ppm by volume ____________

NO_x, ppm by volume ____________

SO_2, ppm by volume ____________

VOC, ppm by volume ____________

Particulate, ppm by volume ____________

At Base Rating:

CO, ppm by volume ____________

NO_x, ppm by volume ____________

SO_2, ppm by volume ____________

VOC, ppm by volume ____________

Particulate, ppm by volume ____________

h. Evaporative cooler water requirements:

Flow required at peak output, gpm ____________

Flow required at base output, gpm ____________

Flow required at 1/2 of base output, gpm ____________

Minimum water quality required pH ____to____

Alkalinity, ppm max ____________

Hardness, ppm max ____________

B. Other Guarantees:

1. Silencing: When operating at baseload service rating, the sound pressure level is decibels to the reference level of 0.0002-microbar at all ground-level locations 3 feet from the unit will not exceed the following (based on 80°F, background noise 10 dB lower all octaves):

Octave Band No.	
1	________
2	________
3	________
4	________
5	________
6	________
7	________
8	________
"A" Level	________

The above values are maximum values and the orientation of maximum sound pressure level is ____.

2. Silencing: When operating at baseload service rating, the sound pressure level is decibels to the reference level of 0.0002-microbar at all ground-level locations 10 feet from the air inlet filter will not exceed the following (based on 80°F, below 5 mph wind, and background noise 10 dB lower all octaves):

Octave Band No.	
1	________
2	________
3	________
4	________
5	________
6	________
7	________
8	________
"A" Level	________

The above values are maximum values and the orientation of maximum sound pressure level is____

____

____

1.02 EXPECTED UNIT PERFORMANCE:

The Contractor shall submit with the Bid the following expected performance data by filling in the blanks provided:

A. Unit Performance Guarantees:

1. Unit Operating Conditions:

Gas Turbine Inlet: Wet Bulb	______°F
Dry Bulb	______°F
Bus Voltage:	_______ volts
System Power Factor:	90%
Evaporative Cooler Operating:	(Yes) (No)
Fuel: Natural Gas	
a. Base net output rating of turbine-generator, kW	___________
(1) Fuel Input, MMBtu/Hr (HHV) (LHV)	___________
(2) Exhaust gas flow, lbs/hr	___________
(3) Exhaust gas temperature, °F	___________
(4) Exhaust gas specific heat, Btu/lb/°F	___________
(5) Analysis of turbine exhaust gas, % vol.	
(a) CO_2	___________
(b) N_2	___________
(c) H_2O	___________
(d) O_2	___________
(6) (Steam) (Water) injection lb/hr	___________
b. Peak net output rating of___________	
(1) Fuel Input, MMBtu/Hr (HHV) (LHV) Turbine-generator, kW	___________
(2) Exhaust gas flow, lbs/hr	___________

(3) Exhaust gas temperature, °F ____________

(4) Exhaust gas specific heat, Btu/lb/°F ____________

(5) Analysis of turbine exhaust gas, % vol.

(a) CO_2 ____________

(b) N_2 ____________

(c) H_2O ____________

(d) O_2 ____________

(6) (Steam) (Water) injection lb/hr ____________

c. The net heat rate including all losses and auxiliary power uses will not exceed Btu/kWh (based on (HHV) (LHV) of fuel and net power to step-up transformer

(1) Peak load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(2) Baseload

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(3) 3/4 load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

(4) 1/2 load

Heat Rate, Btu/kWhr ____________

Load, kW ____________

d. The spinning reserve net heat input will not exceed the following:

Heat input, Btu/hr (HHV) (LHV) ____________

At minimum stable operating load of, kW ____________

e. The maximum generator capability at ____ volts, 90% power factor, when temp. rises are in accordance with ANSI standard C50 will be, kW: ____________

f. NO_x Emissions Control System:

(Steam pressure/temperature) _____/_____

(Minimum quality of water required) ____________

Flow required at peak output, lb/hr ____________

Flow required at base output, lb/hr ____________

Flow required at 1/2 of baseload, lb/hr ____________

g. Exhaust Emissions:

At Peak Rating:

CO, ppm by volume ____________

NO_x, ppm by volume ____________

SO_2, ppm by volume

based on ___% sulfur by weight in fuel ____________

At Base Rating:

CO, ppm by volume ____________

NO_x, ppm by volume ____________

SO_2, ppm by volume

based on ___% sulfur by weight in fuel ____________

h. Evaporative cooler water requirements:

Flow required at peak output, gpm ____________

Flow required at base output, gpm ____________

Flow required at 1/2 of base output, gpm ____________

Minimum water quality required pH ____to_____

Alkalinity, ppm max ____________

Hardness, ppm max ____________

2. Turbine Parts Life: Anticipated hours of operation at base rating before maintenance inspections are required based on ___ starts per year.

Combustion inspection, hrs ____________

Hot gas inspection, hrs ____________

Major inspection, hrs ____________

3. Turbine Maintenance: Anticipated maintenance requirements at base rating based upon ___ starts per year.

a. Anticipated number of maintenance man-hours required for:

Combustion inspection, man-hours ____________

Hot gas inspection, man-hours ____________

Major inspection, man-hours ____________

b. Anticipated average number of maintenance man-hours expended per year, man-hrs ____________

4. Firing Temperatures:

Firing temp. at peak rating, F ____________

Firing temp. at base rating, F ____________

Firing temp. quoted above is measured at (location on turbine) ____________

5. Pressure Losses: The following pressure drops are in inches of water based on standard air with the unit operating under:

a. "Peak rating" conditions:

Total pressure loss to inlet flange at package, In. H_2O ____________

Total pressure loss from turbine exhaust flange, In. H_2O ____________

b. "Base rating" conditions:

Total pressure loss to inlet flange at package, In. H_2O ____________

Total pressure loss from turbine exhaust flange, In. H_2O ____________

6. Standby Requirements:

Standby energy consumption per hour ___°F, kW-hr ____________

Max. standby ac power demand, kW ____________

Max. demand on battery, amps ___ volts ____________

7. Start-Up Time: Normal start/normal load

Cold standstill to ready for synchronizing, minutes ____________

Synchronizing to baseload, minutes ____________

Cooling air requirements, cfm

Base load ____________

Peak load ____________

Period of time cooling air is required after trip, minutes ____________

1.03 DESCRIPTION OF EQUIPMENT:

The Contractor shall furnish equipment in accordance with the Specifications, and guarantees the performance of the following equipment to meet the requirements specified. The Contractor shall submit with the Bid the following equipment data:

A. Equipment Data:

1. Prime Mover and Power Train:

Combustion turbine, Mfgr. and type	____________
Power turbine, Mfgr. and type	____________
Type of burners	____________
Gas turbine speed, rpm	____________
Power turbine speed, rpm	____________
Reduction gear manufacturer	____________
Reduction gear capacity at 100,000-hr service rating, kW	____________
Speed regulation full load to no load under normal conditions, percent	____________
Increase in speed over full-load speed with full load suddenly thrown off, percent	____________

2. Generator: (Data based __ F cooling water and __ ft. MSL, excepted as otherwise noted)

Manufacturer and type	____________
Rated voltage, volts	____________
Speed, rpm	____________
Short-circuit ratio	____________
Rated kVA and basis of rating	____________
Exciter type	____________
Field voltage - no load	____________
Field voltage - peak capacity, 0.9-pf	____________
Field current - peak capacity, 0.9-pf amps	____________
Max. total temp. w/_ F ambient at:	
Base Capacity/and Peak Capacity, Kva	_____/______
Rotor, degrees C (by resistance)	_____/______
Stator, degrees C (by detector)	_____/______
Calculated telephone interference factor,	

TIF of generator:

Balanced: ____________

Residual: ____________

Lowest cooling air temp. permitted at windings during operation, F ____________

Percent reactance on the peak kVA base and at rated voltage of __ kV:

Direct axis synchronous at rated current, X_d ____________

Transient unsaturated at rated current, X'_{du} ____________

Transient saturated, X'_d ____________

Subtransient (at rated voltage) X''_d ____________

Zero sequence (at rated voltage) X_o ____________

Negative sequence (at rated voltage) X_2 ____________

Synchronous impedance, Z_d ____________

Three-phase capacitance to ground, mfd ____________

3. Metal-Clad Switchgear:

Manufacturer of switchgear structure ____________

Manufacturer and type of circuit breakers ____________

Manufacturer and type of switchgear relays ____________

4. Generator Accessory Equipment:

Manufacturer and type of arresters ____________

Manufacturer and type of capacitors ____________

Manufacturer and type of main breaker ____________

Manufacturer of neutral transformer and resistor ____________

Telephone influence factor suppression accessories, if required to meet specified TIF; description ____________

5. Auxiliary Power Apparatus:

Manufacturer and type of motor starters ____________

Manufacturer of transformers ____________

Station auxiliary transformer kVA/volt rating ______/____

Starting motor transformer kVA/volt rating ______/____

6. Silencing Equipment:

Manufacturer ____________

Inlet, ft in length ____________

Exhaust, ft in length ____________

Other, describe ____

____

____

7. Exhaust Connection Dimensions ____________

8. Intake Evaporative Air Cooler

Manufacturer ____________

Face area ____________

9. Inlet Air Filter:

Number of stages ____________

Pressure drop across filters ____________

Face area ____________

10. Generator Air Filter:

Manufacturer and Model Number ____________

Face area ____________

11. Starting System:

Type ____________

Manufacturer ____________

Horsepower and Voltage ____________

12. Lubricating Oil and Special Fluids:

Type and quantity for combustion turbine ____________

Type and quantity for power turbine ____________

Type and quantity for generator ____________

Special fluids required, list ____

____

13. Other:

Ac standby power connected load, kW ____________

Dc standby power connected load, kW ____________

Describe other major equipment ____

____

____

14. Major Component Weights: (in pounds)

Combustion Turbine Unit	___________
Power Turbine Unit	___________
Generator and Exciter	___________
Other Major Equipment	___________

Describe ____

____

____

Heaviest piece to be handled during erection (identify piece)	___________
Heaviest piece to be handled after erection (identify piece)	___________
Heaviest piece to be handled for routine inspection of hot gas path	___________
Compressor rotor	___________
Power turbine rotor	___________
Generator rotor	___________

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION - Not Applicable.

END OF SECTION 18049

SECTION 18099 - HRSG DATA TO BE SUBMITTED WITH BID

PART 1 - GENERAL

1.01 PERFORMANCE GUARANTEES:

A. The Contractor guarantees the performance of the heat recovery steam generator to be as stated below when the unit is operated using combustion turbine exhaust under the conditions specified in SECTION 2.

1. Outlet steam flow, lb/hr ___________
2. Superheater outlet pressure, psig ___________
3. Superheater outlet temperature, °F ___________
4. Steam Purity:
   a. Maximum total solids in steam entering superheater, ppm ___________
   b. Maximum silica in steam entering superheater, ppm ___________
5. Duct burner nitrogen oxides production, lbs/MMBtu ___________
6. Duct burner carbon monoxides production, lbs/MMBtu ___________
7. Duct burner particulate production, lbs/MMBtu ___________
8. Duct burner VOC production, lbs/MMBtu ___________
9. Maximum combustion turbine backpressure, inch WG ___________
10. Stack exit gas temperature, °F ___________
11. Feedwater inlet pressure required, psig ___________
12. Supplemental firing fuel, MMBtu/hr ___________
13. Fan power usage, kW ___________

B. The Contractor guarantees the performance of the heat recovery steam generator to be as stated below when the unit is operated with fresh air firing under the conditions specified in SECTION 2.

1. Outlet steam flow, lb/hr ___________
2. Steam outlet pressure, psig ___________
3. Superheater outlet temperature, °F ___________
4. Steam Purity:
   a. Maximum total solids in steam entering superheater, ppm ___________

b. Maximum silica in steam entering superheater, ppm ____________

5. Gas side pressure drop, inch WG ____________
6. Maximum nitrogen oxides emissions, lbs/MMBtu ____________
7. Maximum carbon monoxides emissions, lbs/MMBtu ____________
8. Maximum particulate emissions, ppm ____________
9. Maximum VOC emissions, lbs/MMBtu ____________
10. Stack exit gas temperature, °F ____________
11. Feedwater inlet pressure required, psig ____________
12. Supplemental firing fuel, MMBtu/hr ____________
13. Fan power usage, kW ____________
14. Time to regain full steam load after combustion turbine trip, seconds ____________

1.02 EXPECTED PERFORMANCE DATA:

A. The Contractor shall submit the following expected performance data by filling in the blanks provided:

Operating Mode	CT Exhaust w/o Supp. Fire	CT Exhaust w/Supp. Fire	Fresh Air Max. Load	Fresh Air 80% Load
Steam Flow at Superheater Outlet thousand lbs/hr				
Superheater Outlet Pressure, psig				
1. Quantities				
a. Combustion air flow, lb/hr	____________	____________	____________	____________
b. Supplemental firing fuel, lb/hr	____________	____________	____________	____________
2. Pressure Drops				
a. Drum to superheater outlet, psi	____________	____________	____________	____________

b. Economizer inlet to drum, psi ________ ________ ________ ________

3. Temperatures, °F

a. Superheater outlet steam ________ ________ ________ ________

b. Steam after desuperheater ________ ________ ________ ________

c. Steam before desuperheater ________ ________ ________ ________

d. Drum outlet steam

e. Economizer outlet water ________ ________ ________ ________

f. Air/Flue Gas ________ ________ ________ ________

(1) Entering duct burner ________ ________ ________ ________

(2) Leaving duct burner ________ ________ ________ ________

(3) Entering superheater ________ ________ ________ ________

(4) Entering boiler ________ ________ ________ ________

(5) Entering economizer ________ ________ ________ ________

(6) Entering ID fan ________ ________ ________ ________

(7) Entering stack ________ ________ ________ ________

4. Air/Flue Gas Resistance, In WG ________ ________ ________ ________

a. Inlet damper ________ ________ ________ ________

b. Transition duct ________ ________ ________ ________

c. Duct burner ________ ________ ________ ________

d. Superheater ________ ________ ________ ________

e. Boiler ________ ________ ________ ________

f. Economizer ________ ________ ________ ________

g. Ductwork, economizer to fan ________ ________ ________ ________

h.	Ductwork, fan to stack	________	________	________	________
i.	Other	________	________	________	________
j.	Combustion turbine Backpressure	________	________	________	________
k.	Total or Delta on Fan	________	________	________	________

5.	Fan Test Block Data	Design Point	Test Block
a.	Inlet temp, °F	________	________
b.	Inlet flow, lb/hr	________	________
c.	Inlet flow, cfm	________	________
d.	Static pressure, in WG	________	________
e.	Fan speed, rpm	________	________
f.	BHP	________	________

1.03 DESCRIPTION OF EQUIPMENT:

The Contractor shall submit with the Bid the following equipment data:

A. Model designation: ____________________

B. Design Pressures:

1. Superheater, psi ____________________
2. Drum, psi ____________________
3. Boiler, psi ____________________
4. Economizer, psi ____________________
5. Ductwork and Casing, In WG (Vacuum/Pressure) __________/__________

C. Total Effective Heating Surface, Sq. Ft.

1. Superheater ____________________
2. Boiler ____________________
3. Economizer ____________________

D. Size and Material of Tubes:

1. Superheater ____________________
2. Boiler ____________________

3. Economizer ____________________

E. Description and Material of Fins:

1. Superheater ____________________
2. Boiler ____________________
3. Economizer ____________________

F. Casing and Ductwork:

1. Casing material ____________________
2. Thickness ____________________
3. Duct material ____________________
4. Thickness ____________________

G. Duct Burner:

1. Manufacturer ____________________
2. Type or model ____________________
3. Maximum Capacity, MMBtu/hr ____________________

H. Weights, Lbs:

1. Steam generator ____________________
2. Platforms, stairs, support steel ____________________
3. Total weight of complete unit ____________________
   a. Dry ____________________
   b. During normal operation ____________________
   c. During hydrostatic test ____________________

I. Steam Drum:

1. Length ____________________
2. Diameter ____________________
3. Thickness ____________________
4. Material ____________________

J. Connection Sizes:

1. Feedwater inlet, inches ____________________
2. Steam outlet, inches ____________________

K. Safety Valves:

1. Number ____________________
2. Model ____________________
3. Size ____________________

L. Stack Dimensions:

1. Diameter ____________________
2. Height ____________________
3. Material ____________________
4. Thickness

M. In addition to the data requested above, the Contractor shall submit the following:

1. General arrangement drawing showing duct and equipment layout. Also to be included are maximum loads and locations of duct supports, if required.
2. Preliminary foundation outline and loads of all items.
3. List of all instrumentation and boiler trim, including number of items, size, manufacturer, and model number.
4. Preliminary control panel outline drawing and panel front arrangement drawing.
5. Information concerning special requirements for curing of refractory and insulation which impact turbine operation (i.e., temperature limits and times).
6. Description of type of fins (segmented or continuous, etc).
7. List of previously completed projects.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION 18099

SECTION 18149 - DATA TO BE SUBMITTED WITH BID - STEAM TURBINE

PART 1 - GENERAL

1.01 PERFORMANCE GUARANTEES:

A. The Contractor guarantees the characteristics of the turbine generator unit to be at least as stated below when operated under the conditions specified.

1. Guaranteed capability at rated throttle and reheat conditions with _____-inch mercury absolute backpressure, zero percent makeup, full feedwater heating, rated hydrogen pressure and 0.9 power factor: ________ kW.
2. Guaranteed throttle flow at rated throttle and reheat conditions with ______ -inch mercury absolute backpressure, 0% makeup, full feedwater heating, rated hydrogen pressure, and 0.9 power factor _______ lb/hr.
3. Turbine (gross) (net) heat rates at rated throttle and reheat conditions with _____-inch mercury absolute backpressure, 0% makeup, full feedwater heating, rated hydrogen pressure, and 0.9 power factor:

Percent of Guaranteed Capability	Turbine (Gross)(Net) Heat Rate, Btu/kWh
100	________________________
80	________________________
60	________________________
40	________________________
20	________________________

4. Generator capability at 0.9 power factor:

Hydrogen Pressure	Generator Capability,
Full psig	_________________
Intermediate psig	_________________
Minimum psig	_________________

5. Output voltage: _______ volts.
6. Generator efficiency at rated load: ______%.

7. Temperature rise of the following:
   a. Generator Stator: _______ °C.
   b. Generator Rotor: _______ °C.
   c. Generator Exciter - Stator: _________ °C.
      - Rotor: _________ °C.
8. Maximum hydrogen loss at full frame pressure and at rated kVA operation: __________ standard ft^3/day.
9. Full frame hydrogen pressure: _______ psig.

1.02 EXPECTED PERFORMANCE DATA:

A. The Contractor shall submit the following expected performance data by filling in the blanks provided:

1. Maximum expected throttle flow, capability and heat rate when operating at valves wide open, 5% overpressure, 1000°F High Pressure, 1000°F Hot Reheat, _____-inch mercury absolute backpressure, zero percent makeup, full feedwater heating, rated hydrogen pressure, and 0.9 power factor:
   a. Throttle flow: __________ lb/hr
   b. Capability: ____________ kW
   c. (Gross) (Net) heat rate: ____________________ Btu/kWh
   d. Reheat steam flow: ____________________ lb/hr
   e. Condenser steam flow: ____________________ lb/hr
2. Maximum expected throttle flow, capability and heat rate when operating at valves wide open, rated pressure, 1000°F High Pressure, 1000°F Hot Reheat, _____-inch mercury absolute backpressure, 0% makeup, full feedwater heating, rated hydrogen pressure, and 0.9 power factor:
   a. Throttle flow: ____________________ lb/hr
   b. Capability: ____________________ kW
   c. Reheat steam flow: ____________________ lb/hr
   d. Condenser steam flow: ____________________ lb/hr
3. Minimum safe continuous load
   a. at _____ inch Hg absolute: ____________________ kW
4. Minimum absolute backpressure
   for safe continuous operation of the unit:

a. At full load: ____________________ in. Hg

b. At minimum continuous load: ____________________ in. Hg

5. Minimum time required for applying full load on the unit:

a. After 8-hour shutdown on turning gear ____________________ minutes

b. From cold start ____________________ minutes

6. Maximum allowable exhaust hood temperature:

a. During start-up: _______ °F for _______ minutes. _______ °F.

b. During continuous operation ____________________ °F.

7. No load throttle flow at rated conditions and _____-inch mercury absolute backpressure: ____________________ lb/hr

8. Generator efficiency with full frame hydrogen pressure:

Maximum expected load ____________________ %

Guaranteed load ____________________ %

a. 80% guaranteed load ____________________ %

b. 60% guaranteed load ____________________ %

c. 40% guaranteed load ____________________ %

d. 20% guaranteed load ____________________ %

9. Generator capability with one hydrogen cooler out of service: ____________________ kVA

10. Generator field current at rated load: ____________________ amps

11. Rated load field voltage: ____________________ volts

12. Excitation system ceiling voltage (per unit of rated field voltage) ____________________ p.u.

13. Excitation system voltage response time: ____________________ volts/sec

14. Percent reactances on a base of ______ kVA (to be maximum for generator) and at ____________________ kV

a. Direct axis synchronous at rated current X_d ____________________

b. Transient unsaturated at rated current X'_{du} ____________________

c. Transient saturated, X'_d ____________________

d. Subtransient (at rated voltage) X''_d ____________________

e. Zero sequence (at rated current) X_o ____________________

f. Negative sequence (at rated voltage) X_2 ____________________

g. Synchronous impedance, Z_d

15. Time constants:

a. Open circuit, T'_{do} ____________________

b. Armature, T_a ____________________

c. Transient, T_d ____________________

d. Subtransient, T''_d ____________________

16. Pull-out torque at rated voltage and kVA with infinite bus:

a. At 0.85 pf ____________________ kW

b. At 0.90 pf ____________________ kW

c. At 1.0 pf ____________________ kW

17. Winding capacitance, all three phases combined to ground: ____________________ mfd

18. Telephone interference factors, calculated:

a. Balanced: ____________________

b. Residual: ____________________

19. Short circuit ratio at rated kVA and maximum frame hydrogen pressure, calculated: ____________________

20. Flywheel effect, WR^2

a. For turbine: ____________________in lb-ft^2

	b. For generator and exciter:	____________ in lb-ft^2	
21.	Saturation factor:	____________	
22.	Regulation at:	____________ kVA	
	(to be maximum for generator)		
	and 0.9 power factor:	____________ %	
23.	Rated armature current:	____________ amps	
24.	Field characteristics at 125°C:	Amperes	Volts
	a. Exciter rating:	________	________
	b. No load, at rated generator terminal voltage at 20°C	________	________
	c. Rated armature current, zero generator-terminal voltage	________	________
	d. With machine carrying rated kVA, with rated terminal voltage and 0.9 power factor, at:	________	________
	(1) Full frame hydrogen pressure:	________	________
	(2) Intermediate hydrogen pressure: _____ psig	________	________
	e. Minimum field current required to hold generator in step under steady state loading at guaranteed capability.	________	________
	f. Generator load and power factor with machine carrying rated kVA, with rated terminal voltage, full frame hydrogen pressure and with leading power factor (maximum pull out on infinite bus)	________ kW	________ pf
	g. Field conductor material:	________	________
	h. Field resistance, ohms at 20°C:	________________	
	i. Field temperature coefficient of		

resistance, ohms/ohm/°C ______________________

from 0°C: ______________________

j. Field discharge resistor rating at 20°C, ohms: ______________________

25. Gas volume within stator housing with rotor in place: ______________________ ft^3

26. Hydrogen temperature at full rated kVA, 0.90 power factor, and 95°F inlet cooling water:

a. Entering Hydrogen Cooler (hot Hydrogen) ______________________ °C

b. Leaving Hydrogen Cooler (cold Hydrogen) ______________________ °C

1.03 PHYSICAL DATA:

A. Contractor shall submit his standard proposition outline drawing of the turbine generator unit which shall show at least the following information:

1. Weights of major components (including heaviest single lift required for placement and/or maintenance). .
2. Dimensions (length, width, height) adequate for layout and preliminary foundation design including turbine room hook height required for service and maintenance.
3. Number and size of Owner's connections.
4. Excitation switchgear dimensions, if applicable.
5. Neutral enclosure dimensions.
6. Last stage blade length.
7. Clearance diagram for generator rotor removal, straight and skewed.
8. Clearance diagram for hydrogen cooler removal.

1.04 MISCELLANEOUS DATA:

A. Contractor shall submit the following miscellaneous data by filling in the blanks provided:

1. Turning gear data:

a. Speed of rotor: ______________________ rpm

b. Motor size: ______________________ hp

2. Cooler data with cooling water inlet temperature listed:

a. Cooling water flow expected:

(1)	Lube oil coolers (_____°F)	____________________ gpm
(2)	Electrohydraulic system coolers (_____°F)	____________________ gpm
(3)	Gland steam condenser (min _____°F)	____________________ gpm
(4)	Hydrogen coolers (_____°F)	____________________ gpm
(5)	Seal oil coolers (_____°F)	____________________ gpm
(6)	Exciter coolers (_____°F)	____________________ gpm
(7)	Conductor cooling system coolers (______°F)	____________________ gpm

b. Cooling water pressure drop expected:

(1)	Lube oil coolers	____________________ psi
(2)	Electrohydraulic system coolers	____________________ psi
(3)	Gland steam condenser	____________________ psi
(4)	Hydrogen coolers	____________________ psi
(5)	Seal oil coolers	____________________ psi
(6)	Exciter coolers	____________________ psi
(7)	Conductor cooling system coolers	____________________ psi

c. Tube Diameter (I.D.)

(1)	Lube oil coolers	____________________ in
(2)	Electrohydraulic system coolers	____________________ in
(3)	Gland steam condenser	____________________ in
(4)	Hydrogen coolers	____________________
(5)	Seal oil coolers	____________________ in
(6)	Exciter coolers	____________________ in

(7) Conductor cooling system coolers ______________________ in

3. Gland steam flow:
   a. Maximum ______________________ lb/hr
   b. Minimum ______________________ lb/hr

   Exhaust annulus area: ______________________ sq ft

4. Lubricating oil circulation rate through coolers: ______________________ gpm
5. Total volume of lube oil required: ______________________ gal
6. Total volume of governor fluid required: ______________________ gal

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION - Not Applicable.

END OF SECTION 18149

Appendix C

Project Schedule

Seller to Supply

Appendix D

(Reserved)

Appendix E

Governmental Approvals

[Sample – to be replaced with site-specific approvals]

SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
Federal						
US Army Corps of Engineers (USACE)	Nationwide Permits as required	Filling of wetlands, discharge to Utah Lake	Seller	S	S	S
US Army Corps of Engineers (USACE)	Streambed Alteration Permit	Altering of stream beds associated with waters of the US. Joint permit with State for installation of a discharge pipe in Lindon Hollow Creek	Seller	S	S	S
Federal Energy Regulatory Commission (FERC)	Public Utilities Regulatory Policies Act/IPP Review	To obtain benefits as a qualifying cogeneration facility as an independent power plant.	NA	NA	NA	NA
Federal Aviation Administration (FAA)	Notice of Proposed Construction or Alteration	Stack height which may affect navigable air space. (If Required)	Seller	S	S	S
National Park Service	Class I/II NAAQS Visibility Analysis	Demonstrate no impact to the air quality	Seller	S	S	S
US Fish and Wildlife Services (USFWS)	Threatened & Endangered Species Act Compliance Acknowledgment	Demonstrate no impact.	Seller	S	S	S
US Environmental Protection Agency-USEPA (Operations)	SPCC Plan	Spill Prevention Control and Countermeasure Plan	Buyer	B	B	B
EIA	Power Plant Registration ORIS Code	Registration of facility (Seller provides input, Buyer prepares)	Buyer	S/B	S	S
DOT (Construction)	Equipment and Materials Handling, Including Materials Disposal	Highway transportation for materials and equipment.	Contractor	C	C	C
DOT (Operation)	Equipment and Materials Handling, Including Materials Disposal	Highway transportation for materials and equipment.	Buyer	B	B	B

B = Buyer
S = Seller
C = Contractor
X/Y = X primary responsibility and Y to provide reasonable efforts to support X.
* Seller prepares all of its supporting documentations for the Work on behalf of Buyer.

SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
State						
Utah Public Utilities Commission	Certificate of Convenience and Necessity	Establish the need for the resources	Buyer	B	B	B
DWQ	Flood Hazard Area/Stream Encroachment Permit	Development within a flood hazard area as designated by state.	Seller	S	S	S
DWQ	Permit to pump ground water	Concurrence by State regarding the transfer of water rights from Geneva and the assignment of these rights to deep well pumping using existing or new wells.	Seller	S	S	S
DWQ	State Pollutant Discharge Elimination System Permit (UPDES)	Wastewater discharge approval to a water body and for facility and stormwater discharges associated with industrial activity.	Seller	S	S	S
DWQ	Streambed Alteration Permit	Permit for installing a discharge pipe in the streambed – joint permit with ACOE. Administered by State	Seller	S	S	S
DWQ	Well Drilling Permit	Required for any well or boring including monitoring wells.	Seller	S	S	S
DAQ	Utah DAQ PSD Non-Applicability Review Permit	Approval to emit air pollutants under state and PSD permit.	Seller	S	S	S
DAQ	Utah DAQ Title V Permit	Operating Permit	Buyer	B	B	B
DAQ	DAQ AIRS Emission ID	Seller to provide input, Buyer to prepare	Buyer	S/B	B	B
DAQ, DEQ	Utah Hazardous Waste Disposal	Obtain an ID number for Site	Seller	S	S	S
DAQ	Utah DAQ/Emergency Episode Plan	Release of Hazardous Chemicals – includes RMP/PSM. Seller to provide input to preparation of risk management/Process Safety Management plans	Buyer	B	B	B
SERC	Hazardous Matter Inventory	Seller to provide input, Buyer to prepare	Buyer	S/B	B	B
DWQ	Utah DWQ Construction SWPP	Storm Water Plan to support construction	Seller	C/S	C	S
DWQ	Utah DWQ Operational SWPP	Storm Water Plan to support operations	Buyer	B/C	B	B

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SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
State (Cont.)						
DWQ	Utah DWQ Groundwater Monitoring Plan	During Construction (Contractor prepare, Seller & Buyer provide input)	Seller	S/B/C	S	S
DWQ	Utah DWQ Groundwater Monitoring Plan	During Operation (Buyer Prepare/Seller provide input	Buyer	S/B	B	B
DEQ (Construction)	Solid, Hazardous and Industrial Waste Stream	Establish the methods and means for storage, transportation, and disposal of solid, hazardous and industrial waste streams. SC = Subcontractor	Contractor/ Subcontractor	C & SC	C &SC	C &SC
DOT/OTHER (Construction)	Equipment and Materials Handling, Including Materials Disposal	Highway/road transportation, rail and river.	Contractor	C	C	C
DEP, DER	Variance for Noise During Construction	Construction noise not in compliance with code.	Seller	S	S	S
DEP, DER	Excavation Materials Disposal	Governmental Approval to dispose of excavated materials if in accordance with Contractor's Phase II Environmental Study – Appendix N.	Seller	C	S	C
DEP, DER (Construction)	Excavation Materials Disposal	Governmental Approval to dispose of excavated materials if (i) Not in accordance with Contractor's Phase II Environmental Study – Appendix N (ii) Affected by Geneva Steel Permit.	Seller	S/C	S	B
DEP, DER, WMD	Permit to Divert Surface or Subsurface Water		Seller	S	S	S
UDNR	Endangered Species Studies	Document Findings as part of Phase I Environmental	Seller	S	S	S
Historical Society (USHPO)	Confirmation of no Artifacts or Sites of Archaeological, Cultural or Historic Significance	Confirmation of no interference for construction.	Seller	S	S	S

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SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
State (Cont.)						
Utah Labor Commission, Division of Safety	Certificate of Inspection	Need State signoff on completed HRSG & Auxiliary Boiler	Seller	C	C	C
Utah Labor Commission, Division of Safety	Permit to Operate Boilers	Need State signoff on completed HRSG & Auxiliary Boiler	Buyer	B/C	B	B
Utah Division of Occupational and Professional Licensing	Contractor License	Required to construct Lake Side Power Plant	Contractor	C	C	C
EPA/Utah Dept. of Public Safety/DEQ/Division of Environmental Response and Remediation/SERC/LERC	During Construction - Emergency Planning and Community Right to Know (MSDS, Emergency chemicals Inventory Form/Facility Emergency Response Plan)	Required for On-Site storage of chemicals, fuels, lubricants, etc. used during construction	Contractor	C	C	C
EPA/Utah Dept. of Public Safety/DEQ/Division of Environmental Response and Remediation/SERC/LERC	During Operation - Emergency Planning and Community Right to Know (MSDS, Emergency chemicals Inventory Form/Facility Emergency Response Plan)	Required for On-Site storage of chemicals, fuels, lubricants, etc. used during Operation	Buyer	B	B	B

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SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
Local/County						
Local/County	Planning Board Plan of Development Approval	Review of Site Plan, Architectural Plans, Landscaping, access, Fire Protection, etc.	Seller	S	S	S
Town of Lindon	Sewer Extension Permit	Build, modify or extend sewer line.	Buyer	S	S	S
Town of Lindon	Potable Water Extension Permit	Build, modify or extend potable water line (if Required).	Buyer	S	S	S
Local/County	Soil Erosion & Sedimentation Control Plan Review	Plan required for projects that surface area of land.	Seller	S	S	S
Local/County	Provo County/Vineyard Conditional Use Permit	(If Required) Town of Vineyard indicates no further work – Industrial Zones	Seller	S	S	S
Local/County (Operation)	Preliminary and Final SPCC Plan	Plan for stored chemicals, ammonia oil, etc.	Buyer	B	B	B
Town of Vineyard	Variance for Noise During Construction	Construction noise not in compliance with Local Ordinances (if required).	Seller	S	S	S
Town of Vineyard	During Construction - Emergency Planning and Community Right to Know (MSDS, Emergency chemicals Inventory Form/Facility Emergency Response Plan)	Required for On-Site storage of chemicals, fuels, lubricants, etc. used during construction	Contractor	C	C	C
Town of Vineyard	During Operation - Emergency Planning and Community Right to Know (MSDS, Emergency chemicals Inventory Form/Facility Emergency Response Plan)	Required for On-Site storage of chemicals, fuels, lubricants, etc. used during Operation	Buyer	B	B	B
Local/County	Railroad Crossing Approvals	Access roads, underground/overhead piping, spurs, transmission lines.	Seller	C	C	C
Utility Company	Construction Water	Water supply during construction	Contractor	S	S	S

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SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
Local/County (cont.)						
Utility Company	Construction Electricity	Power supply during construction. Onsite =C Offsite =S	Contractor	S	S	S
Utility Company	Construction Telephone	Telephone service during construction.	Contractor	C	C	C
Building Department	Construction/Building Permit	Authorization to construct.	Seller	C	C	S
Fire Dept & Police Dept (Construction)	Construction Security and Safety Procedures and Equipment	Approval of site procedures. (If Required)	Contractor	C	C	C
Police Dept & Traffic Department	Construction Equipment and Materials Handling, Including Materials Disposal	Street transportation and delivery for Contractor supplied equipment. – Heavy Hauls	Contractor	C	C	C
Police Dept & Traffic Department	Construction Personnel Parking and Transportation	Traffic management.	Contractor	C	C	C
Fire Dept and Emergency Management Dept	Approval for On-site Storage of Chemicals, Fuels, Lubricants, etc. used during construction	Approval to allow storage and usage.	Contractor	C	C	C
Building Department	Certificate of Occupancy	Occupancy of structures.	Seller	C/S	C/S	S
Building Department	Soil Erosion & Sedimentation Control Plan (for construction only activities)	Soil Erosion and Sedimentation Control Plan during construction.	Contractor	C	C	S
County Traffic Dept & Local Police Dept & Fire Dept	Construction Access Roads and Permanent Access Roads and/or Driveways	Site access.	Seller	S	S	S
Police Dept & Fire Dept	Permits for Signs and Fencing – Construction	Authorization to erect.	Seller	C	C	C

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SCHEDULE OF PERMITS AND GOVERNMENTAL APPROVALS: APPROVALS, CERTIFICATES, PERMITS AND LICENSES - SAMPLE

POWER PLANT

AGENCY	PERMIT/CITATION/APPROVAL	REASON REQUIRED	PERMIT IN NAME OF	PREPARE	OBTAIN	FEE PAYMENT
Miscellaneous						
As Required **	Natural Gas Pipeline Permits	Includes ROWs, Easements, local, state and federal permits associated with construction and operation of a gas pipeline from either Questar or Kern Pipelines.	Seller	S	S	S
Kern/Questar/BPA **	Interconnection Agreement for gas Transportation Services	Interconnection with Kern or Questar or contract for services with BPA	Seller	S	S	S
PacifiCorp Transmission	Interconnection Study & Facilities Agreement	Interconnection of the Project to the transmission system. Seller pays for study fees.	Seller	S	S	S
PacifiCorp Transmission	Network Service Agreement	Buyer enters into Network Agreement with PacifiCorp Transmission to interconnect the generation into the PacifiCorp System	Buyer	B	B	B
As Required	Plant Policies and Procedures	Various policies and procedures which govern the operation and maintenance of the Plant. Some of these documents may be auditable by local or state agencies	Buyer	B	B	B

**** Seller to provide permits and scope indicated above in the event Buyer and Seller enter into a Change Order in accordance with Section 7.2 (a) of the Agreement**

B = Buyer
S = Seller
C = Contractor
X/Y = X primary responsibility and Y to provide reasonable efforts to support X.
* Seller prepares all of its supporting documentations for the Work on behalf of Buyer.

Appendix F:
Glossary of Terms
(EPC Contract)

"Additional Project Documents" means any contract, agreement, letter of intent, understanding, or instrument related to the ownership, construction, testing, maintenance, repair, operation, financing or use of the Project entered into by the Contractor and any other Person subsequent to the Effective Date and prior to the Closing Date; provided, however, that such contract or agreement shall not constitute an Additional Project Document if it (i) is entered into by the Contractor in the ordinary course of business in connection with the procurement of goods or the performance of services related to the Work and (ii) can be readily replaced by other contracts or agreements having substantially similar terms and conditions.

"Affiliate" means with respect to any Person, any other Person who, directly or indirectly, Controls such first Person or is Controlled by said Person or is under common Control with said Person.

"Agreement" shall have the meaning set forth in the preamble hereof.

"Approval Order" shall mean the approval order, if any, to be issued by UDAQ to Contractor in connection with the Project.

"Applicable Law" means all applicable laws (including applicable Environmental Laws), statutes, codes, acts, ordinances, orders, judgments, decrees, injunctions, rules, regulations, permits, licenses, authorizations, directions and requirements of any Governmental Authority having the force and effect of law, and as to any Person, the certificate of incorporation and bylaws or other organizational or governing documents of such Person.

"Approved/Preferred Suppliers" shall mean suppliers identified in Appendix Q attached hereto.

"ASME" means American Society of Mechanical Engineers.

"Assignment and Security Agreement" means the Assignment and Security Agreement, to be entered into by and between the Company and the Contractor.

"Authorized Officer" means for the Contractor, any [SPECIFY TITLES]. No Person shall be deemed to be an Authorized Officer unless named on a certificate of incumbency of such Person delivered to the Company as set forth in this Agreement.

"Bankruptcy Code" means the United States Bankruptcy Code, as in effect from time to time.

"Base Reference Conditions" means those conditions set forth in Appendix H.

"Business Day" means any day other than a Saturday, Sunday or other day on which banks are authorized or required to be closed in Salt Lake City, Utah.

"CCN" means a Certificate of Convenience and Necessity issued by the PSCU relating to the Project that is acceptable to the Company in its sole discretion.

"Change" means any alteration of the Work whether by way of addition, deletion, modification, substitution or omission as instructed by the Company but shall not include any instruction to the extent that such instruction is issued as a result of any breach by the Contractor of this Agreement or otherwise to require the Contractor to fulfill its obligations under this Agreement. Changes shall include but not be limited to changes to Scope of Work, Project Schedule, Payment Schedule, total price, changes total cost of ownership, performance, efficiency, reliability and any Specification or Work as defined in this Agreement. Re-performance of any Work required to rectify or recover Work that is necessary due to the Contractor's (or its Contractor's or any Subcontractor's) negligence or breach of this Agreement shall not constitute a Change.

"Change Order" means any order identified as a "Change Order" and issued to the Contractor by the Company pursuant to Article 13 and Appendix J, substantially in the form set forth in Exhibit D.

"Claim" means any indemnity, demand, demand letter, claim, cause of action, notice of noncompliance or violation, or other proceeding relating to the Project.

"Clean Water Act" shall mean the Federal Water Pollution Control Act, 33 U.S.C. §§1531 et seq., as amended, and the Utah Water Quality Act, Utah Code 19-5-101 et seq.

"Collateral" means all property and interests in property (including the Site and intangible property) now owned or hereafter acquired by the Contractor prior to the Closing Date, including any property or interest in or upon which a Lien has been or is purported or intended to have been granted to the Company under any of the Security Documents.

"Company" shall have the meaning set forth in the preamble hereof, and includes any of the Company's successors and permitted assigns.

"Company Governmental Approvals" shall have the meaning set forth in Section 4.5 ("Governmental Approvals and Consents").

"Company-Initiated Change" shall have the meaning set forth in Section 13.1 ("Changes").

"Company Senior Procurement Representative" shall mean the designated representative from Buyer's Procurement and Materials Planning Department responsible for the Project.

"Company's Default" shall have the meaning set forth in Section 28.2 ("Company's Default").

"Company's Drawings" or means all the drawings and information provided by the Company to the Contractor under this Agreement or in connection with any Request for Proposals issued by Company in anticipation of this Agreement, other than any drawings and information provided by or through PacifiCorp Transmission.

"Company's Representative" means the natural person designated as such by the Company pursuant to Section 8.5 ("Company's Representative").

"Computer Program" means a sequence of instructions, data, or equations in any form, and explanations thereof, intended to cause a computer, a control data processor or the like to perform any kind of operations. Computer Programs may at times be referred to herein generally as software or firmware.

"Computer Program License" means the license to use certain Computer Programs as contemplated by Section 7.13 ("Intellectual Property Rights and Computer Program Licenses").

"Condemnation Proceeding" shall have the meaning set forth in Section 7.29 ("Condemnation, Eminent Domain, Casualty Events").

"Confidential Information" shall have the meaning set forth in Section 34.1 ("Confidentiality").

"Confidentiality Affiliates" shall have the meaning set forth in Section 32.1(a) ("Confidentiality").

"Consents" means all authorizations and approvals required to be obtained by Contractor or Company, as the case may be, under the Project Documents, each of which shall be delivered to Company or Contractor, as the case may be, prior to or at the Closing or as required under this Contract.

"Construction Coordination Agreement" means the document to be entered into between the Contractor and the Company, substantially in the form attached hereto as Appendix S.

"Construction/Site Manager" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Contingent Obligation" means, with respect to any Person, (i) any indemnity or similar obligation of such Person under any agreement or instrument and (ii) any obligation of such Person guaranteeing or intended to guarantee any Indebtedness, leases, dividends or other obligations ("primary obligations") of any other Person (the "primary obligor") in any manner, whether directly or indirectly, including any obligation of such Person, whether or not contingent, (a) to purchase any such primary obligation or any property constituting direct or indirect security therefor, (b) to advance or supply funds (1) for the purchase or payment of any such primary obligation or (2) to maintain working capital or equity capital of the primary obligor or otherwise to maintain the net worth or solvency of the primary obligor, (c) to purchase property, securities or services primarily for the purpose of assuring the owner of any such primary obligation of the ability of the primary obligor to make payment of such primary obligation or (d) otherwise to assure or hold harmless the owner of such primary obligation against loss in respect thereof.

"Contract" has the meaning set forth in the preamble.

"Contract Price" shall have the meaning set forth in Section 3.1 ("Payment Milestones").

"Contractor" has the meaning set forth in the preamble.

"Contractor Drawings and Manuals" means all drawings and information developed by the Contractors and provided to the Contractor in connection with the Contractor's and any Subcontractor's obligations under the Primary Construction Contracts as set forth in Appendix D.

"Contractor Guaranties" means the collective guarantees provided by any Equipment supplier, Subcontractor, or Contractor in connection with the Work and the Plant.

"Contractor's Insurance" shall have the meaning assigned in Section 26.1 ("Effect of Force Majeure").

"Contractor Default" means any of the events specified in Section 28.1 ("Company's Obligation").

"Contractor-Initiated Change Order" shall have the meaning set forth in Section 13.1 ("Change").

"Contractor's Representative" means the natural person designated as such by the Contractor.

"Control" means the possession or ownership, directly or indirectly, of the following: (a) in the case of a corporation, 50% or more of the outstanding voting securities thereof; (b) in the case of a limited liability company, partnership, limited partnership or venture, manager, managing member or general partner status and the right to 50% or more of the distributions therefrom (including liquidating distributions); (c) in the case of a trust or estate, trustee, successor trustee or alternate trustee, or 50% or more of the beneficial interest therein; (d) in the case of any entity, 50% or more of the economic or beneficial interest therein; or (e) in the case of any entity, the power or authority, through the ownership of voting securities, by agreement or otherwise, to direct the management, activities or policies of the entity.

"Costs" means, insofar as each of the following is directly related to the Project, (i) the wages, salaries and related payroll burdens, direct and applied material costs, related handling and transportation charges, travel, outside services and other direct expenses, plus the applicable mark-up for allocated overheads and (ii) general and administrative expenses as set forth in Appendix J and not already included in the immediately preceding clause (i). All such Costs shall be recorded and applied consistent with GAAP.

"Critical Milestone" shall have the meaning set forth in Section 23.2(a) ("Critical Milestone Guarantee Liquidated Damages").

"Cure Period" means a period of 12 months following the Substantial Completion Date.

"Default Security" shall have the meaning set forth in Section 6.2 ("Security").

"Defect" means any defect in design, materials, Plant, manufacture or workmanship which adversely affects the operation, use or performance of the Work or any part thereof, or causes any increase in costs of maintenance or operation or any decrease in life expectancy or efficiency.

"Deferred Governmental Approvals" means, as of any date, all Governmental Approvals, other than the Company Governmental Approvals, (i) the procurement of which is not a Milestone that is scheduled to have occurred on or before such date and (ii) as to which there is a reasonable expectation on the part of a Contractor that such Governmental Approvals will be obtained in the ordinary course of business and the failure to procure such Governmental Approvals on or before such date would not result in a Material Adverse Change.

"Deposit Account Control Agreement" means the Deposit Account Control Agreement to be entered into by and among the Company, the Contractor and a banking or other financial institution acceptable to the Company.

"Dispatchable" means that the Project (i) is in a condition of readiness to generate power as demonstrated by, the most recent Preliminary Performance Test Report not disputed by the Company, (ii) has attained (x) at least 90% of the 1x1 Net Capacity but is otherwise meeting the Guaranteed Emissions and (y) 110% of the heat rate set forth in Section 3, Case 3 of Appendix H for purposes of calculating liquidated damages under Section 17.3 ("Company's Request for Earlier Completion"), (iii) the Project can be operated in accordance with Prudent Industry Practice and all applicable Requirements of Law, including the Emissions Approvals and (iv) the "Functional Tests" identified in the Substantial Completion Criteria shall have been performed based on the Project operating in a 1x1 configuration and such tests shall have demonstrated that the 1x1 Net Capacity achieved the Substantial Completion Criteria that would be applicable to the Project when operating in a 1x1 configuration.

"Dollars" and the "$" symbol means the lawful currency of the United States of America.

"Draft Manuals" shall have the meaning assigned in Section 7.10(d) ("Contractor Drawings and Manuals").

"Effective Date" means the date of this Agreement first above written.

"Emissions Approvals" means the air emissions permits, if any, required for construction and operation of the Plant, including those Governmental Approvals identified in Appendix E, as "Emissions Approvals."

"Emission Reduction Credits" or "ERCs" means emission reduction credits to be used as emission offsets for the Project that are registered in the State Emissions Registry by UDAQ pursuant to Section R-307-403-8 of the Utah Administrative Code more specifically set forth on Appendix M.

"Environmental Health and Safety Program" means a corporate program maintained by or on behalf of the Contractor that (i) provides a safe and healthful working environment for all employees, (ii) promotes the commitment to achievement of safety and health excellence, (iii) encourages employee and management involvement, (iv) is designed to prevent occupational injuries, illness, and damages to equipment, property, and the environment through implementation of cost effective safety and health plans that meet applicable Requirements of Law and consensus standards relating thereto including ASME, ANSI, NEC, and NFPA and is based on standards no less stringent than the Company's own safety and health policies.

"Environmental Law" means any federal, state or local law including statutes, regulations, rulings, orders, administrative interpretations and other governmental restrictions and requirements having the force and effect of law relating to (i) the discharge or disposal of any substance into the air, soil or water, including pollutants, water pollutants or process waste water, (ii) storage, emissions transportation or disposal of any Regulated Material, (iii) the environment or hazardous substances, all as amended from time to time, (iv) land use requirements pertaining to Regulated Materials, including laws requiring environmental impact studies or other similar evaluations, and (v) environmental issues pertaining to the development, construction or operation of the Project.

"Equipment" means the equipment relating to the Project as described in Appendix B, and, where indicated in Appendix B, manufactured or provided by Approved/Preferred Suppliers.

"Equivalent Operating Hours" or "EOH" means the number of hours of operation equivalent to continuous loading at rated capacity, including actual operating hours adjusted for loading plus a set number of equivalent hours for each start/stop, rapid start/stop, water/steam injection, and all other adjustments pursuant to this Agreement all as set forth in Appendix H.

"Equivalent Starts" shall have the meaning assigned thereto in the technical documentation issued by the manufacturer of the Gas Turbines.

"Final Acceptance" means the completion of all items set forth as conditions of Final Acceptance in Appendix H and completion of the Final Punch List.

"Final Completion" shall have the meeting set forth in Section 19.8 ("Notice of Final Acceptance of Work").

"Final Payment" means the final payment of the Contract Price made upon Final Acceptance.

"Final Performance Guarantees" means the (i) Guaranteed Net Heat Rate and the Guaranteed Incremental Net Heat Rate and (ii) Guaranteed Net Capacity and the Guaranteed Incremental Net Capacity that are required to be demonstrated during the Performance Tests as a condition to Final Acceptance, all set forth in Appendix H.

"Final Performance Test Report" shall have the meaning set forth in Section 17.7(b) ("Timing").

"Final Punch List" means the list of items and schedule for completion of the Project required to be completed by the Contractor following the Substantial Completion Date, which list shall be issued to the Contractor by the Company no later than five (5) Business Days after the Substantial Completion Date, all in accordance with Section 19.2 ("Care, Custody and Control; Punch List Items").

"Fired Hours" means the time, rounded up to the next whole hour, from the opening of the natural gas supply valve to a Combustion Turbine and natural gas begins to flow, until such valve is closed and natural gas no longer flows.

"Force Majeure" means an event not reasonably anticipated as of the date of this Agreement, which is not within the reasonable control of the party affected thereby, could not have been avoided by the exercise of due diligence or operation in accordance with Prudent Industry Practices, is not the result of the failure to act or the negligence of such party, and which by the exercise of due diligence, the affected party is unable to overcome or obtain or cause to be obtained a commercially reasonable substitute therefor. To the extent that such event satisfies the test set forth in the preceding sentence, Force Majeure includes: acts of God, fire, flood, explosion, civil disturbance, sabotage, terrorism, hurricanes, tornadoes, lightning, earthquakes, war, action or restraint by court order or public or Governmental Authority; provided that none of the following constitute Force Majeure: (i) strikes or labor disturbances occurring at the Site or Contractor's facilities, except to the extent such strikes or labor disturbances at the Site or Contractor's facilities are directly related to strikes or labor disturbances that are simultaneously disrupting other business operations in the geographic region covered by the WECC; (ii) shortages (real or perceived) of labor available for on-site Work; (iii) delay or failure by the Contractor to obtain any Governmental Approval, all of which should have been anticipated by the Contractor in connection with Contractor's reply to the RFP, other than the delay or failure to obtain Governmental Approvals occasioned by (x) revocation, stay, or similar action by a Governmental Authority of a Governmental Approval after issuance thereof by a Governmental Authority, (y) the failure of a Governmental Authority to comply with rules, procedures or Requirements of Law applicable to such Governmental Authority or (z) another Force Majeure; or (iv) economic hardship including lack of money or credit and changes in exchanges rates (v) utility interruptions; (vi) shipping accidents or unavailability of preferred shipping methods.

"GAAP" means United States generally accepted accounting principles. "Gas Turbines" or "GTs" means the gas turbines described in Appendix B to this Agreement.

"Governmental Approval" means any authorization, approval, consent, waiver, exception, variance, order, publication, license, filing, registration, ruling, permit, tariff, certification, exemption and other action, requirement by or with, and notice to and declarations of or with, any Governmental Authority that are required in connection with the development, construction, ownership and operation of the Project.

"Governmental Authority" means any supranational, federal, state or other political subdivision thereof, having jurisdiction over the Contractor, the Company, the Project or this Agreement, including any municipality, township and county, and any entity exercising executive, legislative, judicial, regulatory or administrative functions of or pertaining to government, including any corporation or other entity owned or controlled by any of the foregoing.

"Guaranteed Emissions" means the emissions guarantees when fired on natural gas in accordance with [*insert applicable Equipment manufacturer's specification*], adjusted to Base Reference Conditions, all in accordance with the Performance Tests all as more fully described in Appendix H.

"Guaranteed Net Capacity" means the continuous steady-state full load Plant net electrical power output produced when operating in a 2x1 configuration (two Gas Turbines operating at full load at normal firing temperatures with the steam produced by the heat recovery steam generators (HRSG) supplied to the steam turbine generator), with no duct firing in the HRSGs, corrected to the Base Reference Conditions as specified in

Section ________ in Appendix H while meeting the emissions requirements under Section 12.2 ("Contractor's Equipment on Site"). The net power output is the electrical power measured at the generator terminals, minus the Plant's auxiliary power consumption of the Equipment, including the transformer and isophase bus losses, fired with natural gas fuel in accordance with [*insert Equipment manufacturer's gas fuel specification*], corrected to the Base Reference Conditions.

"Guaranteed Net Heat Rate" means the net heat rate of the Plant when operated at the "Guaranteed Net Capacity", as further specified in Appendix H.

"Guaranteed Substantial Completion Date" means May 1, 2009.

"Guaranty" means that certain Guaranty, if required by Company pursuant to Section 6.2 ("Security"), by and among Company, Contractor, and Guarantor under which Guarantor guarantees each and every obligation of Contractor under the Transaction Documents.

"Guarantor" means an entity meeting the credit criteria set forth in Section 6.1 ("Credit Requirements") that guarantees, pursuant to a Guaranty acceptable to Company in is sole discretion, each and every obligation of Contractor under the Transaction Documents.

"ID Tag" shall have the meaning set forth in Section 9.2 ("Site Security").

"Indemnified Party" shall have the meaning set forth in Section 25.1 ("Indemnification for Third Party Claims").

"Indemnifying Party" shall have the meaning set forth in Section 25.1 ("Indemnification for Third Party Claims").

"Indemnity Period" shall have the meaning set forth in Section 25.3 ("Indemnification for Third Party Claims").

"Indebtedness" means, with respect to any Person, without duplication, (i) all obligations of such Person for borrowed money, or with respect to deposits or advances of any kind, (ii) all obligations of such Person evidenced by bonds, debentures, notes or similar instruments, (iii) all obligations of such Person upon which interest charges are customarily paid (other than trade payables incurred in the ordinary course of business consistent with past practice), (iv) all obligations of such Person under conditional sale or other title retention agreements relating to property purchased by such Person, (v) all obligations of such Person issued or assumed as the deferred purchase price of property or services (excluding obligations of such Person to creditors for raw materials, inventory, services and supplies incurred in the ordinary course of such Person's business), (vi) all lease obligations of such Person capitalized on the books and records of such Person, (vii) all obligations of others secured by a Lien on property or assets owned or acquired by such Person, whether or not the obligations secured thereby have been assumed, (viii) all obligations of such Person under interest rate or currency hedging transactions (valued at the termination value thereof, other than forward or spot foreign currency exchange contracts entered into in the ordinary course of business consistent with past practice), (ix) all letters of credit issued for the account of such Person (excluding letters of credit issued for the benefit of suppliers to support accounts payable to suppliers incurred in the ordinary course of business) and (x) all guarantees and arrangements having the economic effect of a guarantee of such Person of any Indebtedness of any other Person.

"Intellectual Property" means all patents, trademarks, copyrights and all computer software including the Computer Programs whether or not subject to statutory registration or protection, that are owned, used, filed by or licensed to the Contractor for the Project.

"Interface" means those physical interconnections and interfaces at the Site described in Appendix B.

"Judgment" means any judgment, order, award, injunction, writ or decree of any Governmental Authority.

"Late Payment Rate" means an amount equal to the Prime Rate of Interest plus 500 basis points.

"Latent Defects" has the meaning set forth in Section 22.10 ("Latent Defects").

"Latent Defects Liability Period" means the period which is five years calculated from the Substantial Completion date, subject in each case to Section 22.10 ("Latent Defects").

"Lead Electrical" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Lead Mechanical" hall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Letter of Credit" shall means an irrevocable standby letter of credit in a form reasonably acceptable to Company, naming Company as the party entitled to demand payment and present draw requests thereunder, which letter of credit:

(1) is issued by a U.S. commercial bank or a foreign bank with a U.S. branch, with such bank having a net worth of at least $1,000,000,000 and a credit rating on its senior unsecured debt of:

(a) "A2" or higher from Moody's; or

(b) "A" or higher from S&P;

(2) on the terms provided in the letter of credit, permits Company to draw up to the face amount thereof for the purpose of paying any and all amounts owing by Contractor hereunder;

(3) if a letter of credit is issued by a foreign bank with a U.S. branch, permits Company to draw upon a U.S. branch;

(4) permits Company to draw the entire amount available thereunder if such letter of credit is not renewed or replaced at least thirty (30) Business Days prior to its stated expiration date;

(5) permits Company to draw the entire amount available thereunder if such letter of credit is not increased, replaced or replenished as and when provided in Section 6.2 ("Security");

(6) is transferable by Company to any party to which Company may assign this Agreement; and

(7) shall remain in effect for at least ninety (90) days after the end of the Term.

"Liabilities" means all Claims including those relating to Environmental Laws, demands, damages, losses, liabilities or judgments, including all interest, penalties, fines and other sanctions, and any reasonable costs or expenses in connection therewith, including attorneys' and consultants' fees and expenses.

"Lien" means any mortgage, pledge, security interest, encumbrance, option, defect, lien, charge or other similar right of any Person of any kind, including any lien or charge arising by statute or other law.

"Material Adverse Change" means any change in condition that actually has, or is reasonably likely to have, a significant adverse effect on (i) the Company's ability to own, control, or operate the Project (financial or otherwise), (ii) the Project's ability to operate and deliver energy to the System, (iii) the Contractor's ability, the Contractor's ability, any Subcontractor's ability or the Guarantors' ability, to perform its respective obligations in accordance with the Transaction Documents to which it is, respectively, a party, (iv) the Contractor's and any Subcontractor's ability to perform its respective obligations in accordance with the Transaction Documents, (v) the validity, perfection and enforceability of the Liens granted to the Company under the Security Documents, (vi) the ability of the Company to enforce any of the Secured Obligations or any of its material rights and remedies under the Transaction Documents; or (vi) Contractor fails to meet the requirements of Section 6.1 ("Credit Requirements").

"Materials" means the Intellectual Property, the Equipment and other equipment, machinery, apparatus, materials, articles and things of all kinds to be provided and incorporated into the Project by the Contractor and the Contractors under this Agreement (including spare parts to be supplied hereunder) other than Non-Company Materials.

"Member" means each Person to whom Membership Interests have been issued, as identified on Schedule 4.2.

"Membership Interests" shall have the meaning set forth in Section 4.2(a) ("Capital Structure").

"Merit Shop" shall mean the construction philosophy which encourages open competition and a free-market approach that awards contracts to the lowest cost responsible bidder based solely on merit as determined by the Contractor, regardless of labor affiliation.

"Milestone" means a milestone for the development and construction of the Project as so designated on the list of schedule milestones set forth on Appendix I.

"Milestone Dates" means the date opposite each Milestone on or prior to which each such Milestone is anticipated to be achieved.

"MW" means megawatt.

"Necessary Governmental Approvals" means, as of any date, all Governmental Approvals, required under Requirements of Law in connection with (i) the due execution, delivery and performance by any Project Party of the Transaction Documents to which it is a party and (ii) the development, construction, operation and ownership of the Project as contemplated by the Transaction Documents on or prior to such date.

"Non-Company Materials" means any equipment, machinery, apparatus, materials, articles and things of all kinds that are not permanently incorporated into the Project.

"Notice of Final Acceptance" shall have the meaning set forth in Section 19.8 ("Notice of Final Acceptance of Work").

"Notice of Request for Progress Payment" shall mean a Notice of Request for Progress Payment in the form attached hereto as Exhibit A.

"Notice to Proceed" means the Notice to Proceed to be issued in accordance with Section 2.1 ("Notice to Proceed") in the form attached hereto as Exhibit C.

"OEM" means the original manufacturer of any Equipment comprising a portion of the Project.

"OEM Certified" means that the Equipment in question is certified by the manufacturer thereof as new and clean, not in need of repair, carrying full manufacturer's warranties and guarantees applicable to newly-manufactured equipment of that type, and all reliability and design technical notices have been implemented.

"1x1 Net Capacity" means the continuous steady-state full load Plant net electrical power output produced when operating in a 1x1 configuration (one Gas Turbine operating at full load at normal firing temperatures with the steam produced by one heat recovery steam generator (HRSG) supplied to the steam turbine generator, with no duct firing in the such HRSG, corrected to the Base Reference Conditions as specified in Section 3, Case 3 of Appendix H while meeting the emissions requirements under Section 17.2 ("Emissions Guarantee"). The net power output is the electrical power measured at the generator terminals, minus the Plant's auxiliary power consumption of the Contractor's supplied equipment and facilities, including the transformer and isophase bus losses, fired with natural gas fuel in accordance with [*insert Equipment manufacturer's specifications*], corrected to the Base Reference Conditions.

"Substantial Completion LD Commencement Date" means the calendar day immediately following the Guaranteed Substantial Completion Date.

"PacifiCorp Hazard Communication Program" shall mean Company's hazard communication program designated as such.

"PacifiCorp Transmission" means PacifiCorp, an Oregon corporation, acting in its transmission function capacity and any successor thereto.

"PacifiCorp Transmission Interconnection Agreement" means the interconnection agreement between the Contractor and PacifiCorp Transmission that is in conformance with the requirements of PacifiCorp's Open Access Transmission Tariff filed with the Federal Energy Regulatory Commission (or any successor thereto), as the same may be amended.

"Parties" shall have the meaning set forth in the preamble hereof.

"Performance Curves" means the performance correction curves described in Appendix H to this Agreement, as the same shall be adjusted to reflect the capability of the Plant expressed in terms of capacity as of the Substantial Completion Date and in terms of capacity and heat rate for the Performance Tests.

"Performance Guarantees" means the (i) Guaranteed Emissions, (ii) Guaranteed Net Heat Rate and (iii) Guaranteed Net Capacity that are required to be demonstrated during the Performance Tests as a condition to Substantial Completion, all set forth in Appendix H.

"Performance Test" or "Performance Tests" means the tests specified in Appendix H.

"Permits" has the meaning set forth in Section 7.36 ("Permits").

"Person" means any natural person, corporation, general or limited partnership, limited liability company, firm, joint venture, estate, association, trust, government, governmental agency or any other entity, whether acting in an individual, fiduciary or other capacity.

"Plant" means the combined-cycle electric generating facility, to be located on the Site and to be constructed in accordance with this Agreement, as described more fully in Appendix B.

"Preliminary Performance Test Report" shall have the meaning set forth in Section 17.7(a) ("Test Reports").

"Primary Construction Contracts" means the EPC Contract, any contract or agreement between the Contractor and any Subcontractor, and all agreements and documents referenced therein. "Prime Rate" means the rate per annum (rounded upwards to the nearest 1/100th of 1% per annum) equal to the rate of interest which JP Morgan Chase in New York, New York or its successor announces from time to time as its "prime lending rate" or equivalent rate or if such rate is not available, another rate published as the "prime rate" as agreed by the Company and a Contractor, with each change in such rate to be effective on the day on which such change is effective.

"Progress Report" shall have the meaning set forth in Section 10.8 ("Progress Reports").

"Project" means (i) the Plant, (ii) the Site, and (iii) those certain tangible and intangible rights and assets required to own and operate the Plant (including without limitation Project Water Rights and Emission Reduction Credits), all in accordance with the Project Documents, all Requirements of Law and Prudent Industry Practices following construction of the Plant in accordance with the Specifications and upon the Plant having attained the Performance Guarantees.

"Project Documents" means once executed and in full force and effect, the Primary Construction Contracts, the PacifiCorp Interconnection Agreement and any Additional Project Document.

"Project Engineer" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Project Manager" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Project Party" means each of the Contractor, the Contractor, any Subcontractor, and the Guarantor.

"Project Schedule" means the Project schedule contained in Appendix F, and any modification thereof made pursuant to this Agreement.

"Project Water Rights" means the Water Rights necessary and sufficient to operate the Project consistent with the Specifications, providing not less than ______________________ acre-feet of water annually.

"Prudent Industry Practice" means any of the practices, methods and acts engaged in or approved by a significant portion of the electrical utility industry in the geographic region covered by the WECC, or its successor for gas-fired combined cycle electric generation facilities which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, would have been expected to accomplish the desired result in a cost-efficient manner consistent with good business practices and reliability criteria, safety considerations and expediency. Prudent Industry Practice is not intended to be limited to the optimum practice, method or act to the exclusion of all others but, rather, to be acceptable industry practices, methods or acts for gas-fired combined cycle electric generating facilities in the geographic region covered by the WECC.

"PSCU" means the Public Service Commission of Utah.

"Real Property" means all real property and interests in real property required in connection with the Project, other than the Water Rights.

"Reduction Amount" shall have the meaning set forth in Section 23.2(c) ("Critical Milestone Guarantee Liquidated Damages").

"Regulated Materials" means any substance, material, or waste which is now or hereafter becomes listed, defined, or regulated in any manner by any United States federal, state or local law and includes any oil, petroleum, petroleum products and polychlorinated biphenyls.

"Release" with respect to any Regulated Materials and includes any release, deposit, discharge, emission, leaking, spilling, seeping, migrating, injecting, pumping, pouring, emptying, escaping, dumping, disposing or other movement of Regulated Materials.

"Remediation" includes any response, remedial, removal, or corrective action, any activity to cleanup, detoxify, decontaminate, contain or otherwise remediate any Regulated Material, any actions to prevent, cure or mitigate any Release of any Regulated

Material, any action to comply with any Environmental Laws or with any permits issued pursuant thereto, any inspection, investigation, study, monitoring, assessment, audit, sampling and testing, laboratory or other analysis, or evaluation relating to any Regulated Material.

"Required Change Order" shall have the meaning set forth in Section 13.1 ("Change").

"RFP" has the meaning assigned in the Recitals hereof.

"Safety Manager" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Scope of Work" means the scope of work presented by Company by Contractor in response to the RFP, on which the Purchase Price is based.

"Secured Obligations" means those obligations of the Contractor secured by the Liens granted in favor of the Company pursuant to the Security Documents.

"Security Documents" means (i) the Deposit Account Control Agreement, (ii) the Assignment and Security Agreement and (iii) any other documents or filings determined by Company, in its sole discretion, to be necessary to grant or maintain the Liens granted by the Contractor under the Assignment and Security Agreement that would affect the validity, perfection and enforceability thereof or for the exercise by the Company of its rights and remedies to enforce such Liens.

"Significant Defect" means a single or recurring Defect which occurs at any time within two years of Substantial Completion which results in the cessation of operation of the Plant or will not, unless corrected, allow the Company to operated the Plant within air quality or other emission limits or within parameters required to comply with any Requirements of Law for a period of either three (3) consecutive days or an aggregate of five (5) days in the case of a recurring Defect.

"Site" means the premises on which the Project is to be located in ____________ Utah, together with all easements appurtenant thereto or required for the operation of the Facility, the legal description of all of which is set forth on Appendix A.

"Specifications" means the specifications for the Works set forth in Appendix B and Appendix H and any modifications thereof made pursuant to the terms hereof.

"[STATE ORGANIZATIONAL LAW]" shall have the meaning assigned in Section 4.3(b) ("Authority; Execution and Delivery; Enforceability").

"Startup or Commissioning Manager" shall mean a representative of Contractor designated as such pursuant to Section 7.14 ("Contractor's Representatives").

"Subcontractor" means any Person, other than the Contractors, retained by the Contractor to perform a part of a Contractor's obligations under any Transaction Document.

"Subsidiary" means, with respect to any Person, any corporation, limited liability company, partnership, association or other business entity of which (i) if a corporation, a majority of the total voting power of shares of stock entitled (without regard to the occurrence of any contingency) to vote in the election of directors, managers or trustees thereof is at the time owned or Controlled, directly or indirectly, by that Person or one or more of the other Subsidiaries of that Person or a combination thereof, or (ii) if a limited liability company, partnership, association or other business entity, a majority of the partnership or other similar ownership interest thereof is at the time owned or Controlled, directly or indirectly, by any Person or one or more Subsidiaries of that Person or a combination thereof. For purposes hereof, a Person or Persons shall be deemed to have a majority ownership interest in a limited liability company, partnership, association or other business entity if such Person or Persons shall be allocated a majority of limited liability company, partnership, association or other business entity gains or losses or shall be or Control any director, managing member, manager, general partner, trustee or other controlling Person or member of such entity's governing body of such limited liability company, partnership, association or other business entity.

"Substantial Completion" means the Plant demonstrates the Substantial Completion Criteria.

"Substantial Completion Criteria" shall have the meaning set forth in Appendix H.

"Substantial Completion Date" means the date on which Substantial Completion is demonstrated.

"Supplier" means any supplier of Equipment or Materials which (i) has a right to place a Lien on the Project and (ii) provided notice of such right to Seller.

"System" means the electric transmission sub-station and distribution facilities owned, operated or maintained by PacifiCorp Transmission, which shall include, after construction and installation of the Project, the circuit reinforcements, extensions, and associated terminal facility reinforcements or additions required to complete the Project, all as set forth in the PacifiCorp Transmission Interconnection Agreement.

"Target Date" means a date on which a Critical Milestone is to occur, as set forth in the Project Schedule.

"Tax" or "Taxes" means any United States federal, state or local income tax, ad valorem tax, excise tax, sales tax, use tax, franchise tax, real or personal property tax, transfer tax, gross receipts tax or other tax assessment, fee, levy or other governmental charge, together with and including any and all interest, fines, penalties, assessments and additions to the Tax resulting from, relating to, or incurred in connection with any of the foregoing or any contest or dispute thereof.

"Time for Completion" means that period between the Effective Date and the Substantial Completion Date.

"Title Company" means ________________________, or such other title company acceptable to the Company, in its sole discretion.

"Title Policy" means a title insurance policy issued by Title Company covering the Real Property interests comprising the Property to be transferred by Contractor at Closing.

"Total Plant Capacity" means the Guaranteed Net Capacity. "Transaction Documents" means, once executed and in full force and effect, each of the following agreements: this Agreement, the Project Documents, the Security Documents and the Consents. "UDAQ" means the Division of Air Quality of the Utah Department of Environmental Quality.

"Unidentified Project Problem" shall have the meaning set forth in Section 10.8 ("Progress Reports").

"UPDES" means Utah Pollutant Discharge Elimination System and all Requirements of Law relating thereto.

"UST" means underground storage tanks.

"Water Rights" means the water rights acquired for use in connection with the Project and acceptable to the Company, designated by the Company as "Project Water Rights."

"WECC" means the Western Electricity Coordinating Council.

"Witness Point Events" shall have the meaning set forth in Section 14.3 ("Inspection").

"Witness Point Schedule" shall have the meaning set forth in Section 14.3 ("Inspection").

"Work" means the Materials to be supplied and the entire works and services to be performed, or caused to be performed, by the Contractor under this Agreement, together with any modifications thereto in accordance with the terms hereof.

"Year" means a calendar year.

Appendix G

(Reserved)

APPENDIX H

Substantial Completion, Final Acceptance, Performance Guarantees and Performance Tests

Appendix H

Performance Tests and Minimum Standards

1. Substantial Completion Criteria
2. Final Acceptance Criteria
3. Performance Guarantees
4. Performance Liquidated Damages

Section 1
Substantial Completion Criteria

The Parties recognize that the terms "Capacity", "capacity", "Power" and "power" are utilized interchangeably in this Appendix H and agree that such terms are synonymous as used herein.

Substantial Completion Criteria

The Plant will be deemed ready for Substantial Completion when all of the following have occurred:

1. The Plant is substantially and materially complete and has been fully designed, constructed and equipped in accordance with the Agreement (except as provided in the Final Punch List).

2. All Governmental Approvals can be assigned or transferred in accordance with Article 2 of this Agreement.

3. All Equipment and systems are operational in accordance with this Agreement, including its Appendices.

4. All Owner-specified Performance, Commissioning and Functional Tests as detailed in Appendix B have been successfully completed.

For the purposes of conducting Functional Tests , a "Start" shall be deemed to be the initiation of the start sequence. All activities required for these startup and shutdown tests shall be performed through the Plant's Distributed Control System ("DCS") with the exception of any normally expected and routine action taken by an operator. The Plant's DCS shall control, or shall cause to be controlled, all Equipment necessary for the safe and reliable operation of the Plant with the exception of Equipment normally controlled manually.

Section 2

Final Acceptance Criteria

Final Acceptance Criteria

The Plant will be deemed ready for Final Acceptance when all of the following has occurred:

1. Substantial Completion has occurred and (i) Seller has demonstrated Guaranteed Net Capacity or has paid the applicable liquidated damages as provided in Section 4 of this Appendix H, (ii) Seller has demonstrated the Guaranteed Incremental Net Capacity or has paid the applicable liquidated damages as provided in Section 4 of this Appendix H (iii) Seller has demonstrated Guaranteed Net Heat Rate or has paid the applicable liquidated damages as provided in Section 4 of this Appendix H and (iv) Seller has demonstrated Guaranteed Incremental Net Heat Rate or has paid the applicable liquidated damages as provided in Section 4 of this Appendix H.

2. The additional Functional Tests specified in Appendix B have been successfully completed:

3. Record drawings have been delivered to the Buyer in accordance with the Agreement.

4. Final Punch List items have been completed and any warranty problems are being diligently pursued by Seller and or its Contractors.

5. The Plant has demonstrated the Guaranteed Average Equivalent Availability of ninety two percent (92%) during the 168 hour test pursuant to Appendix B to the Agreement.

6. The Relative Accuracy Test ("RATA") results have been submitted to the Utah Department of Air Quality.

Section 3

Performance Guarantees

3. Performance Guarantees (to be adjusted based on CT used)

3.1 Thermal Performance Guarantees

2 x 1 Guaranteed Thermal Performance

Table 1 -Base Reference Conditions

	CASE 1	CASE 2
Load Level	BASE	BASE
Plant Equipment Condition	New & Clean	New & Clean
Ambient Temperature, °F	95	95
Ambient Relative Humidity , %	20	20
Barometric Pressure, psia	Bidder to Provide	Bidder to Provide
Fuel Type	Natural Gas	Natural Gas
Fuel Heating Value – Btu/lbm (LHV)	20,401	20,401
Fuel Composition	See note 8	See note 8
Fuel Temperature at Test Boundary, °F	Bidder to Provide	Bidder to Provide
Generator Power Factor	Bidder to Provide	Bidder to Provide
System Frequency, Hz	60	60
HRSG Blowdown, %	0	0
Evaporative Cooler Status, On/Off	On	On
Duct Burner Status, On/Off	Off	On
Power Augmentation, On/Off	Off	On

Table 2 - Guaranteed Performance Data

Net Capacity, kW		**(see note 6)**
Net Heat Rate, Btu/kWh (LHV)		**(see note 6)**
Water Consumption (gpm)		

NOTES:

1. The Guaranteed Performance Data must be verified in strict accordance with the provisions of ASME PTC-46, "Performance Test Code on Overall Plant Performance".
2. Net Heat Rate is the fuel input rate (in Btu/hr) on a lower heating value (LHV) basis, divided by the net power in kW.
3. The Guaranteed Performance Data for both the capacity and heat rate testing is based on the application of 0.5% test tolerance for capacity and heat rate. No other uncertainty, dead band, or test tolerance shall be applied.

4. Performance is based on new and clean condition. The above guaranteed values shall be those as determined by the Performance Test, without any allowance for degradation of the Equipment.
5. Fuel gas must comply with OEM Gas Fuel Specification, which identifies the allowable ranges of fuel gas constituents and the upper limits of contaminants.
6. Performance guarantees for duct fired and power augmented operation (Case 2) are defined on an incremental basis. Guarantee values represent the incremental heat input required for GT power augmentation and HRSG duct firing, divided by the incremental capacity obtained.
7. Regulated fuel gas pressure to be supplied at the plant boundary at a minimum pressure of 525 psig at a temperature no greater than 105°F at the Lake Side property. At the Currant Creek site, the minimum pressure is 525 psig and the temperature 80°F

1 x 1 Estimated Thermal Performance

Table 1 -Base Reference Conditions

	CASE 3
Load Level	BASE
Operation Mode	1x1
Plant Equipment Condition	New & Clean
Ambient Temperature, °F	95
Ambient Relative Humidity , %	20
Fuel Type	Natural Gas
Fuel Heating Value – Btu/lbm (LHV)	20,401
Generator Power Factor	0.9
System Frequency, Hz	60
HRSG Blowdown, %	0
Evaporative Cooler Status, On/Off	On
Duct Burner Status, On/Off	Off
Power Augmentation, On/Off	Off

Table 2 - Estimated Performance Data

Net Capacity, kW	________
Net Heat Rate, Btu/kWh (LHV)	________

NOTES:

1. The Guaranteed Performance Data must be verified in strict accordance with the provisions of ASME PTC-46, "Performance Test Code on Overall Plant Performance".
2. Net Heat Rate is the fuel input rate (in Btu/hr) on a lower heating value (LHV) basis, divided by the net power in kW.
3. The Guaranteed Performance Data for both the capacity and heat rate testing is based on the application of +/-0.5% test tolerance for capacity and heat rate. No other uncertainty, dead band, or test tolerance shall be applied.
4. Performance is based on new and clean condition. The above guaranteed values shall be those as determined by the Performance Test, without any allowance for degradation of the Equipment.
5. Fuel gas must comply with OEM Gas Fuel Specification, which identifies the allowable ranges of fuel gas constituents and the upper limits of contaminants.
6. Performance guarantees for duct fired and power augmented operation (Case 2) are defined on an incremental basis. Guarantee values represent the incremental heat input required for GT power augmentation and HRSG duct firing, divided by the incremental capacity obtained.
7. Regulated fuel gas pressure to be supplied at the plant boundary at a minimum pressure of 525 psig at a temperature no greater than 105°F at the Lake Side property. At the Currant Creek site, the minimum pressure is 550 psig and the temperature 80°F

3.2 Guaranteed Air Emissions

REFERENCE CONDITIONS		
Fuel Type	Natural Gas	Natural Gas
Mode	Combined Cycle	Combined Cycle
Ambient Temperature Range, °F	-16 to 105	52 to 105
Gas Turbine Load (%)	OEM Min to Base	Base
Injection – Power Augmentation	Off	Off
Duct Burner maximum heat input (MMBtu/hr, LHV)	Off	Seller Supplied
EMISSIONS DATA		
NO_X (ppmvd @ 15% O_2)	Permit Limits	Permit Limits
CO (ppmvd @ 15% O_2)	Permit Limits	Permit Limits
VOC as CH_4 (ppmvd @ 15% O_2)	Permit Limits	Permit Limits
Particulate (lbm/hr) (front and back half)	Permit Limits	Permit Limits
NH_3 Slip (ppmvd @ 15% O_2)	Permit Limits	Permit Limits

Stack tests will be performed in accordance with the reference test methods set forth in the Air Permit. To the extent the specific test methods are not set forth in the Approval Order, then for the purposes of demonstrating the guaranteed air emissions, such air emissions shall be demonstrated by performing testing at the exhaust stack in accordance with the following United States Environmental Protection Agency (USEPA) Test Methods.

3.3 Guaranteed Sound Emissions

FAR FIELD SOUND LEVEL GUARANTEE

Plant sound emissions shall be in compliance with all applicable Requirements of Law which shall take into account baseline data from the existing plant. In the absence of a more stringent regulatory noise requirement the Seller will meet the requirements specified in Section 1.2.5 of Appendix B to the Agreement.

Appropriate corrections, in accordance with the OEM's Sound Test Procedure Principles document and recognized industry standards, shall be made to the operating plant far field sound level measurements.

Section 4

Performance Liquidated Damages

1. **General**

Liquidated damages will be calculated for performance which fails to achieve the Performance Guarantees (i.e. less than Guaranteed Net Capacity; less than Guaranteed Incremental Net Capacity, greater than Guaranteed Net Heat Rate, greater than Guaranteed Incremental Heat Rate). Heat rates are in Higher Heating Value (HHV).

The following liquidated damage rates shall apply for deficient performance:

• Guaranteed Net Capacity ("GNCLD")	\$750.00/kW
• Guaranteed Incremental Net Capacity ("GINCLD")	\$250.00/kW
• Guaranteed Net Heat Rate ("GNHRLD")	\$300.00/Btu/kWh/kW
• Guaranteed Incremental Net Heat Rate ("GINHRLD")	\$75.00/Btu/kWh/kW

2. **Definitions**

8. Final Test Value shall mean the measured Performance Test values which are corrected to the Base Reference Conditions, without any allowance for degradation of the Equipment.

Test Tolerance ("TT") is expressed as the decimal 0.005, applicable to the net capacity, net incremental capacity, net heat rate and the incremental heat rate. The subscript letters "C", "IC", "HR" and "IHR" represent net capacity, incremental net capacity, net heat rate and incremental net heat rate respectively, in the following equations.

Ct = The Final Test Value of net capacity when the Plant is operating on Guarantee Fuel, in kilowatts.

ICt = The Final Test Value of incremental net capacity when the Plant is operating on Guarantee Fuel, in kilowatts.

HRt = The Final Test Value of net heat rate when the Plant is operating on Guarantee Fuel, in Btu/kWh, HHV.

IHRt = The Final Test Value of incremental net heat rate when the Plant is operating on Guarantee Fuel, in Btu/kWh, HHV.

Cg= The Guaranteed Net Capacity when the Plant is operating on Guarantee Fuel (Note 1), in kilowatts.

ICg= The Guaranteed Incremental Net Capacity when the Plant is operating on Guarantee Fuel (Note 1), in kilowatts.

HRg= The Guaranteed Net Heat Rate when the Plant is operating on Guarantee Fuel (Note 1), in Btu/kWh, HHV.

IHRg= The Guaranteed Incremental Net Heat Rate when the Plant is operating on Guarantee Fuel (Note 1), in Btu/kWh, HHV.

Note 1: These values are the guaranteed values shown in Section 3.1 above.

3. Calculation of Liquidated Damages Relative to Net Capacity

(Cg – [Ct x (1+TT)]) x GNCLD = A

The liquidated damage amount relative to net capacity shall equal the value of A if A is positive. If A is negative, no liquidated damages are applicable.

4. Calculation of Liquidated Damages Relative the Incremental Net Capacity

(ICg – [ICt x (1+TT)]) x GINCLD = B

The liquidated damage amount relative to incremental net capacity shall equal the value of B if B is positive. If B is negative, no liquidated damages are applicable

5. Calculation of Liquidated Damages Relative to Net Heat Rate

([HRt x (1 - TT)] –HRg) x GNHRLD x Cg = C

The liquidated damage amount relative to net heat rate shall equal the value of C if C is positive. If C is negative, no liquidated damages are applicable.

6. Calculation of Liquidated Damages Relative to the Incremental Net Heat Rate

([IHRt x (1 - TT)] –IHRg) x GINHRLD x ICg = D

The liquidated damage amount relative to Incremental net heat rate shall equal the value of D if D is positive. If D is negative, no liquidated damages are applicable.

Appendix I

(Reserved)

APPENDIX J

Change Order Costing

APPENDIX J
CHANGE ORDER COSTING

1. Unless otherwise agreed between the Parties or in this Appendix J, pricing and payments for Change Orders shall be based on mutually agreeable terms and conditions which will be on a fixed price basis.

2. Sellers shall be compensated by Buyer only on a time and material basis in connection with (a) the APSA and (b) activities which are directed by Buyer and for which Buyer and Seller cannot agree upon a firm, fixed price, schedule adjustments or other terms and conditions. Such time and material work shall be based on the following costing procedure:

2.1 Seller's personnel shall be billed at the then current published field service rates and project home office rates attached to this Appendix J. Seller shall provide revised rate sheets within the first 30 days of each new year.

2.2 Buyer shall pay Seller a mark-up of six percent (6.0%) (the "Mark Up") on third-party purchases (including Contractor and Subcontractor purchases), including materials, rental of equipment, and labor (including: craft labor, Site construction management, Site supervision and commissioning, field engineering, Site administration).

2.3 Seller shall provide Buyer with a reasonable breakdown of costs and time to support compensation and/or adjustments to the Schedule and any other adjustments to the terms and conditions of the Agreement in connection with Change Orders performed on a time and material basis.

3. Seller shall be entitled to request adjustments to the Schedule and the Guaranteed Substantial Completion Date equal to the amount of time incurred by Seller in performing the Work taking into account adjustments to the Project or to the methods or sequence of performing the Work (all as determined by Buyer) that can be reasonably taken by Seller. For Change Orders which Seller request an adjustment to the schedule or Guaranteed Substantial Completion Date, Seller will provide adequate justification of how the change order impacts the critical path of the Project Schedule.

Seller "Internal" Rates - 2007

Project Manager:	$XXX.XX per hour
Senior Engineer:	$ XXX.XX per hour
Engineer:	$ XXX.XX per hour
Drafter/Cad Operator:	$ XX.XX per hour
Administrative support:	$ XX.XX per hour

Travel expenses - at cost

Contractor Rates - 2004

Appendix K

(Reserved)

APPENDIX L
FINAL WAIVER AND RELEASE OF LIEN

APPENDIX L

SELLER FINAL WAIVER AND RELEASE OF LIEN

In consideration of the receipt by Seller of the final payment of $____________ in immediately available funds from Buyer, Buyer shall be fully and completely released from all claims for payment for Work performed and materials provided under the Agreement, which the undersigned has or may have as Seller arising out of the Work performed by the undersigned, pursuant to the Agreement. The undersigned further acknowledges that such payment, together with all payments heretofore made constitutes full payment of all amounts due to the undersigned for Work performed and materials provided under the Agreement, including all amounts due for extra Work.

The undersigned further states and represents that all bills, payrolls, expenses, costs, payroll and other employee related taxes, claims and other indebtedness incurred in connection with the Work performed under the Agreement have been paid in full; and further agrees to defend Buyer from and against all claims against Buyer pursuant to Section 26.2 ("Title Indemnity and Liens") of the Agreement for labor and material furnished by Contractor or any of its Subcontractors including liens of subcontractors, labors, and equipment and material suppliers arising from claims for payment for the Work performed under or in connection with the Agreement.

Seller

____
Name:

____
Title:

____
Date:

Appendix M

Project Water Rights
and
Emissions Reductions Credits

Seller to Supply If Applicable

Appendix N

Pre-Existing Regulated Materials

To be provided upon identification of Site

Appendix O

(Reserved)

Appendix P

(Reserved)

APPENDIX Q

APPROVED VENDORS LIST

Approved Vendors List

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Steam Turbine	*Toshiba ITBD)* **GE** Mitsubishi Siemens Alstom
Combined Main Stop and Control Valve/Actuator	Rexroth
Combined Reheat Valve Actuator	Rexroth
Gland Steam Condenser	Southern Heat Exchanger ITT Industries Struthers Industries Krueger Engineering & Mfg. Co.
Gland Steam Exhauster	Gardner Denver The New York Blower Co. Chicago Blower Co. or Equivalent
Main Oil Cooler	Tranter PHE (E) Southern Heat Exchanger ITT Industries GEA Ecoflex (E) Alfa Laval
Oil Conditioner	Kaydon TORE
Oil Mist Eliminator	Burgess-Miura Co. (E) Koch-Otto York
Actuator	**Limitorque - Preferred** Rotork
Steam Turbine Generator	GE Siemens Alstom *Toshiba (TBD)*
Turbine Supervisory Instrumentation Unit	Bently Nevada
Position Switch	Namco Co.
Position Transmitter	M-System
Flow Indicator	Yokogawa Electric Co.
Purity Analyser	**Yokogawa PacifiCorp Standard**
Solenoid Valve	Asco, Co.
Positioner	Fisher Co.
Instrument Valve	**Swagelok, Co. - Preferred** **Whitey Co. – Preferred Valves**
Instrument Fittings	**Swagelok, Co. - Preferred** Whitiey Co.
Control Valve	**Fisher Co. – Preferred**
I/P Converter	Yokogawa
Instrument Rack/Generator	**E-One – PacifiCorp Standard**
Seal Oil Gauge Panel	**E-One – PacifiCorp Standard**
Hydrogen Gas Measuring Rack	**E-One – PacifiCorp Standard**
Generator Condition Monitor	**E-One, GCMX – PacifiCorp Standard**
H2 Gas Dryer	LectroDryer
Combustion Turbine (	GE Siemens
Generator	GE Siemens
Cooling Tower	SPX (Marley) GEA Midwest Towers, Inc International Cooling Tower

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
HRSGs	Deltak Corporation Nooter/Ericksen Vogt Power Alstom
HRSG Duct Burners	Coen Forney John Zink
SCR and CO Systems	Peerless Mfg. Hitachi Vector
SCR Catalyst	Cormetech Hitachi (aka BHK) Argillon (formerly Siemens)
CO Catalyst	Engelhard EmeraChem
Auxiliary Boiler	Babcock & Wilcox Nebraska
Boiler Feed Pumps and Motors	**KSB, Inc. - Preferred** Sulzer Pumps Weir Pumps Ltd.
Condensate Pumps and Motors	Flowserve Johnston Pump Company Weir Pump Company Sulzer Pumps Goulds Pumps KSB
Circulating Water Pumps and Motors	Flowserve Johnston Pumps Weir Pump Company Sulzer Pumps Goulds Pumps
Condenser, Wet Surface	Alstom Graham TEI Yuba Holtec International SPX (Marley)
Condenser, Air Cooled (ACC)	SPX (Marley) GEA
Heat Exchangers, Plate & Frame	Alfa Laval APV Graham Tranter
Water Treatment Systems (Demin)	Graver Water Co. Hungerford & Terry, Inc. US Filter GE Water Technologies (Glegg) Water and Power Technologies Ecolochem
Oil Water Separators	Anderson Great Lakes Environmental Highland Tank PS International (E)
Air Compressors	**Atlas Copco – Preferred** Ingersoll Rand Gardner Denver Sullair Cooper/Joy Industries Dresser

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Air Dryers	Kemp **Atlas Copco - Preferred** Ingersoll Rand Pneumatic Productions Corporation Sullair GDI Deltech
Fuel Gas Treatment	Anderson Separator/Clark Reliance/National Filtration Burgess Manning Flowtronex Gas Packagers GTS Energy Hanover Smith Oil & Gas Systems Peerless Total Energy Resources Tran-Am Universal Compressors
Miscellaneous Horizontal Pumps	Aurora Pumps Flowserve Goulds Pumps Peerless Aurora Sulzer Johnston KSB
Pumps, Vertical	Aurora Pumps Goulds Pumps Flowserve Johnston
Vacuum Pumps	Graham Manufacturing Nash Nitech
Sump Pumps (Submersible)	Aurora Pumps Flygt Corporation Warman Nagel Goulds Flowserve Johnston Pumps
Pumps, Fire Water	Peerless ITT Allis Chalmers Pump Aurora Pumps Fairbanks Morse
Steam Conditioning Valves (attemporators)	CCI Emerson/Fisher-Rosemount Con-Tek
Fire Protection System	F.E. Moran **Delta Fire Protection – Salt Lake City -Preferred** Grinnell Fire Protection McDaniel Fire System Shambaugh S&S Sprinkler Dooley Tackaberry Securiplex International Fire Protection
GSU Transformers and Unit Auxiliary Transformers	ABB Alstom **GE/Prolec - Preferred** VA Tech **Waukesha – Preferred**

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Switchgear	**GE – Preferred 4160V** **Square D – Preferred 480V** Powell (Only if part of package) **Cutler-Hammer – 4160V and 480V**
Motor Control Centers	Powell (Only if part of package) **Allen Bradley – Preferred for 480V MCC, 4160V MCC** **Cutler-Hammer – Preferred for 480V MCC, 4160V MCC**
Variable Frequency Drives	Allen-Bradley Saftronics Cutler-Hammer Danfoss
Isolated Phase Bus Duct	ABB Calvert **Delta-Unibus - Preferred** **GE Canada - Preferred** Hitachi
Non Segregated Phase Duct	Calvert Square D **Delta-Unibus - Preferred** **Powell - Preferred**
Power Control and Instrumentation Cables	BICC Rockbestos Supernaut Tamaqua Pirelli **Okonite - Preferred** Furon/Dekoron Rome **Southwire - Preferred** **Belden – Communication Cable Preferred** Kerite
High and Medium Voltage Cable	Pirelli **Okonite - Preferred** Rome Kerite
Distributed Control System	**Emerson Ovation - PacifiCorp Standard**
Continuous Emissions Monitoring System	**KVB Enertec DAHS Software; and PacifiCorp specified instruments – PacifiCorp Standard**
Chemical Feed Systems	Liquitech, Inc. Neptune JCI Wadsworth Pumps Flowtronex **Milton Roy/LMI or Micro Pump – Preferred** Nalco Johnson March Systems, Inc. Sentry Equipment
Water Sample Panel	Delphi Control Systems Johnson March Systems Sentry Equipment Corp. Waters Equipment Co.
Instrumentation Analytical Measurements	
Chromatographs	ABB Daniel (Natural Gas) EG&G Rosemount
Conductivity	**Yokogawa – PacifiCorp Standard**
Oxygen	**Orbisphere/Hach or Yokogawa – PacifiCorp Standard**
Silica	**Hach – PacifiCorp Standard**
Sodium	**Orion – PacifiCorp Standard**

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
pH Probe	**Yokogawa – PacifiCorp Standard**
Vibration	**Bentley Nevada – PacifiCorp Standard**
Chlorinators	Advance Capital Controls Fischer & Porter Wallace & Tieman
Computers (Flow)	Daniel Omni Fisher
Controllers, Field Mounted, Pneumatic	Fisher
Flame Supervisory Systems	Fireye Forney Honeywell Allen Bradley Iris (E)
Indicators Manometers	**Dwyer – preferred** Meriam
Indicators Press/Receiver Gauge	**Ashcroft – Preferred (Except in the case of pre-packaged equipment)**
PLC	**Allen Bradley - PacifiCorp Standard (Except in the case of pre-packaged equipment) Control Logix or SLC 5/05 (Ethernet Version)**
Transmitters, Electronic	
Differential Pressure	**Rosemount - PacifiCorp Standard (Except in the case of pre-packaged equipment)**
Level Measurement	
Capacitance, Etc.	Drexelbrook Fisher
Displacement	Fisher
Process Radar	Rosemount Ohmart-Vega
Custody Transfer/Radar/Displacement	Enraf Saab
Radioactive	Kay-Ray Ohmart-Vega Texas Nuclear
Ultrasonic	Endress & Hauser Inc. Kistler Morse Magnetrol Millitronics
TDR	Magnetrol **Rosemount – preferred**
Magnetic Flow	**Rosemount – preferred**
Mass Flow	ABB/Bailey **Rosemount – preferred**
Pressure	Foxboro Honeywell Yokogawa **Rosemount – preferred**
Target Meter	Foxboro Hersey Measurement
Temperature	Foxboro Moore Industries **Fisher-Rosemount – preferred** Honeywell Yokogawa
Turbine	Daniel Foxboro

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Transmitters, Pneumatic	
Differential Pressure	**Fisher – preferred**
Level Displacement	Fisher Magnetrol
Pressure	Fisher Foxboro
Target Meter	Foxboro
Temperature	Fisher-Rosemount Foxboro
UPS	Best SCI
Valves and Regulators	
Actuators, Diaphragm	**Fisher – PacifiCorp Standard (Except in the case of pre-packaged equipment)**
Actuators, Piston	Automax Bettis Contromatics George-Fischer Hills-MC Canna Neles-Jamesbury Posacon Valtek Vanton Whitey XACT
Control Valves – ON/OFF or Throttling Ball	**Fisher – preferred** Atwood & Morrill (E) Copes Vulcan Masoneilan Neles-Jamesbury TYCO (E) Valve Technologies Watts WKM
Positioners, Electric	**Limitorque, MX – Preferred** Fisher-Rosemount Auma
Butterfly/ECC Disk	AMRI Continental Durco Fisher-Rosemount Masoneilan Moisten Neles-Jamesbury Valtek
Valves, Butterfly <24-inch	Bray Valves & Controls Dezurik Flowseal Henry Pratt Co. Jamesbury Keystone Valve KSB-AMRI
Valves, Butterfly >24-inch	Atwood & Morrill Dezurik Flowseal Grinnell Corp. Henry Pratt Co. Keystone Valve Watts

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Valves, Globe	Atwood & Morrill Edwards Newco Valves Pacific Valves Whitey Yarway
Valves, Cast Steel	Atwood & Morrill Crane Edwards Pacific Valves Tyco Velan Valve Co. WM Powell Co.
Control Valves, Severe Duty, (Bypass, Recirculation, Drum level control, ACC spargers)	**CCI – PacifiCorp Standard**
Valves, Forged Steel	Edwards Valves, Inc. Conval, Inc. Dresser Industrial Valve Yarway Velan Valve Corp Vog Newco Bonney Forge
Valves, High Pressure	Atwood & Morrill Crane Edwards Pacific Valves Tyco Velan Valve Co.
Valves, Knifegate	Warman Dezurik Newcon Clarkson
Valves, Check	APCO Crane Edward Valves Pacific Valves Stockham Valves & Fittings Yarway/Tyco
Globe / Cage (No Split Body) 300#	Collins Instrument (Plastic) Fisher Masoneilan Samson Valke Control Component, Inc. (CCI)
Miniature / Special	Collins Instrument Research Controls Whitey
Pinch, Weir, Diaphragm	ASAHI Fisher-Rosemount Grinnell Red Valve RKL
Plug	Durco Tufline
Regulators	Air Service Fisher-Rosemount Process Service Cashco

Equipment / Construction Package	Approved Subcontractors / Equipment Suppliers
Strainers, Automatic Flushing	Hayward Strainers Hellan SP Kinney Engineers
Valves, Ball	ITT Engineered Valves Mogas Neles Jamesbury NIBCO, Inc Stockham Valves & Fittings Whitey
Relief or Safety Valves	**Consolidated – PacifiCorp Standard for Steam Service** Crosby Ferris Dresser
Installation Hardware	
Boxes or Cabinets – Instrument and Junctions Metal	Appleton **Hoffman – preferred**
Boxes or Cabinets – Instrument and Junctions Fiberglass or Plastic	**Hoffman – preferred** Stahlin
Cable Tray and Tubing Support Tray Metal	B-Line OBO Betterman PW
Cable Tray and Tubing Support Tray Nonmetallic	Channel Way Enduro Fibergrate Seagate Stahlin
Instrument Manifolds and Valving Assemblies	Anderson Greenwood PGI Rosemount
Tubing Metal	Dekoron Thermoelectric
Tubing NonMetallic	Dekoron Thermoelectric
Fittings (Compression) Metal	Gyrolok **Swagelok – Preferred**
Fittings (Compression) Non-metallic	JACO (Kynar)
Fittings (Compression) Valves, Metal	Anderson Greenwood Hoke PGI **Whitey - Preferred**
Wire Signal	Alpha Belden Dekoron
Wire Thermocouple	Dekoron
Other	
Expansion Joints	Bachmann Industries Effox Pathway Wahlco Engineered Products
Fluid Couplings	Voith
Pipe, Circulating Water	Ameron La Barge Pipe McAbee Construction Northwest Pipe Company Dixie Southern
Pipe, Fabricated LP	Bendtec International Piping Systems McAbee Construction Team Industries

Equipment / Construction Package	**Approved Subcontractors / Equipment Suppliers**
	Scott Process
Pipe, Supports	Froneck Lisega Bergen PTP
Tanks, Field Erected	CBI Columbian Tank Matrix Pittsburgh Tank Fisher Tank HMT, Inc
Tanks, Shop Fabricated	Arrow Tanks Eaton Modern Welding Palmer Dixie Southern
Equipment/Construction Package	**Approved Subcontractors**
Fittings (Compression) Metal	Gyrolok **Swagelok– preferred** Nonmetallic JACO (Kynar)
Fittings (Compression) Valves, Metal	Anderson Greenwood Hoke PGI **Whitey – preferred**
Tubing NonMetallic	Dekoron Thermoelectric
Wire Signal	Alpha Belden Dekoron
Wire Thermocouple	Dekoron
Protective Relaying Devices and Systems	**Schweitzer Engineering Labs, Inc.300 Series – Preferred**
Lockout Relays	**Electroswitch – PacifiCorp Standard**
Test Switches	**ABB – Preferred** States
Revenue Meters	**Landis & Gyr 2510 – PacifiCorp Standard**

Appendix R

Price Options

Seller to Supply

Appendix S

Construction Coordination Agreement

CONSTRUCTION COORDINATION AGREEMENT

BETWEEN

PACIFICORP

AND

TABLE OF CONTENTS

Page

CONSTRUCTION COORDINATION AGREEMENT

THIS CONSTRUCTION COORDINATION AGREEMENT ("Agreement") is made and entered into as of the Effective Date (as defined below), by and between PacifiCorp, an Oregon corporation ("PacifiCorp"), and ____________________, a ____________________ [limited liability company] ("[NAME]") (PacifiCorp and [NAME] are individually referred to herein as a "Party" and collectively as the "Parties").

RECITALS

WHEREAS, PacifiCorp is an investor owned electric utility company subject to regulation by the Public Service Commission of Utah;

WHEREAS, PacifiCorp owns, operates and maintains Unit 1 at its generation facility located in ________________________, Utah.

WHEREAS, [NAME] desires to construct Unit 2, to be located adjacent to Unit 1 at the Facility;

WHEREAS, PacifiCorp and [NAME] have entered into an [Asset Purchase and Sale Agreement ("APSA") / Engineering, Procurement and Construction Contract ("EPC Contract")] providing for the [purchase / construction] by PacifiCorp of Unit 2;

WHEREAS, there is a need to coordinate the activities of [NAME] and its contractor(s) and subcontractors during construction of Unit 2 to avoid potential interference with the operation of Unit 1 and the construction of Unit 2;

NOW, THEREFORE, in consideration of the foregoing, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged by each Party, the Parties hereto agree as follows:

ARTICLE I
Definitions; Headings

1.1 Definitions

Unless the context shall otherwise require, capitalized terms used in this Agreement shall have the meanings assigned to them in the Glossary of Defined Terms attached hereto as Exhibit "A", which also contains rules as to usage that shall be applicable herein.

ARTICLE II
Term and Governing Provisions

2.1 Term.

The Term of this Agreement shall become effective on the Effective Date and, unless earlier terminated pursuant to provisions hereof, shall continue in effect until PacifiCorp has accepted the [APSA/EPC CONTRACT] or has achieved Final Acceptance as provided in the [APSA/EPC CONTRACT].

2.2 Governing Provisions.

As a matter of general priority, in the event of any conflict between the provisions of this Agreement or the [APSA/EPC CONTRACT], the provisions of the [APSA/EPC CONTRACT] shall govern. Disputes related to the matters to be performed pursuant to this Agreement and not involving the [APSA/EPC CONTRACT] or work performed by or at the direction of the [APSA/EPC CONTRACT], shall nonetheless be governed by [Article 32 / 31 ("Claims, Claim Notice and Dispute Resolution")] in the [APSA/EPC CONTRACT].

ARTICLE III
Construction Interfaces

3.1 Construction Control.

Except as provided in the [APSA/EPC CONTRACT], until the Substantial Completion Date [NAME] and its contractors shall be responsible for and have sole control over the construction of Unit 2, except for interconnections with Unit 1 and the Common Facilities. Beginning on the Substantial Completion Date, PacifiCorp shall have control over the Facility in accordance with the terms and conditions of the [APSA/EPC CONTRACT]. The [NAME] shall coordinate with PacifiCorp all activities to be performed under the [APSA/EPC CONTRACT] pursuant to this Agreement, particularly if such activities may require taking Unit 1 off-line or have a substantial possibility of causing an outage at Unit 1.

[NAME] shall be responsible for erecting a temporary and movable construction fence (the "Construction Fence") on the Site for the purpose of separating the Unit 2 construction area (the "Construction Area"), which is initially depicted by the cross-hatched area on Exhibit "C" attached hereto, from the rest of the Facility, including Unit 1, the switchyard and the Common Facilities. The Construction Fence may be moved and relocated as necessary with the prior written consent of PacifiCorp following the completion of certain phases of construction for the purpose of accessing other areas of the Facility, all as set out in the Project Schedule. During the Term, [NAME] will be in control of the Construction Area and will maintain a separate gate for access to the Construction Area. At the time of Substantial Completion, the Construction Area will be reduced to [NAME]'s staging and laydown area and separate gate, and shall not include any Facilities necessary for operation of Unit 1, Unit 2 or the Common Facilities.

[NAME] shall at all times utilize and cause its contractors, subcontractors, personnel and other persons allowed at any part of the Facility by Contractor to utilize only [NAME]'s separate gate to the Construction Area.

3.2 [NAME]'s Access to PacifiCorp's Area.

[NAME] shall provide PacifiCorp with reasonable notice of its need to access PacifiCorp's Area for performance of work activities associated with the Common Facilities. [NAME] and PacifiCorp shall agree on a schedule for the performance of all work activities in PacifiCorp's Area consistent with the Project Schedule. PacifiCorp shall arrange for any safety instruction and workplace policy training deemed appropriate by PacifiCorp for [NAME]'s personnel prior to [NAME]'s personnel being allowed in PacifiCorp's Area. PacifiCorp shall arrange for escorts for [NAME]'s personnel accessing PacifiCorp's Area to the extent PacifiCorp reasonably deems such escorts necessary. In the event [NAME] needs to work on a system that could be used by PacifiCorp for the operation of Unit 1, [NAME] shall provide PacifiCorp with written notice and receive authorization from PacifiCorp that the system has been deactivated before commencing work on the system and [NAME] shall notify PacifiCorp once it completes work on the system so PacifiCorp can inspect and reactivate the system in accordance with PacifiCorp's Tagging and Safety Program.

3.3 PacifiCorp Access to the Construction Area.

At all times prior to the Substantial Completion Date [NAME] shall provide PacifiCorp and PacifiCorp's personnel access to the Construction Area upon PacifiCorp's request. [NAME] and PacifiCorp shall agree on a schedule for the performance of work activities by PacifiCorp's personnel in the Construction Area. PacifiCorp's personnel shall comply with [NAME]'s published safety program requirements while in the Construction Area. [NAME] may arrange for escorts for any PacifiCorp personnel accessing the Construction Area to the extent [NAME] reasonably deems such escorts necessary. The above notwithstanding, PacifiCorp may access the Construction Area without notice for the purpose of carrying out activities required for the operation of Unit 1 or responding to an Emergency.

3.4 Project Schedule and Coordination of PacifiCorp Support.

[NAME] shall (a) schedule all activities that will require or may result in the shutdown of or inability to dispatch Unit 1, and all Work activities performed on or affecting the Common Facilities in accordance with the Project Schedule, (b) notify PacifiCorp I writing of such schedule(s) a the earliest practicable time, and (c) update such schedules in writing as necessary. [NAME] shall not undertake the foregoing Work activities until PacifiCorp has agreed in writing with such schedule and plan for performing the identified Work.

3.5 Unit 1 and PacifiCorp's Area Control.

PacifiCorp shall have sole control over the operation of Unit 1 and the remainder of PacifiCorp's Area at all times.

3.6 Restrictions During Construction.

(a) Except as otherwise provided in this Agreement, [NAME] shall perform or cause to be performed all construction activities with respect to Unit 2 in a manner that will avoid interference with PacifiCorp's operation of Unit 1.

(b) [NAME] shall restrict construction workers and other personnel not employed by PacifiCorp from access to PacifiCorp's Area except as authorized in advance by PacifiCorp's Representative. Upon the reasonable request of [NAME], PacifiCorp shall authorize access to PacifiCorp's Area for the purpose of undertaking activities necessary to integrate Unit 2 into the Common Facilities, and after the Substantial Completion Date to perform any work activities required under the [APSA/EPC CONTRACT], in accordance with the Project Schedule and the Work plan required under Section 3.4 above.

3.7 Transportation Routes and Lay-Down Areas.

[NAME] shall designate adequate transportation routes and lay-down areas for the construction work and materials for Unit 2.

3.8 Employee Discipline.

[NAME] shall adopt and enforce policies for disciplining construction employees if the employees' actions affect or are likely to affect Unit 1 or the Common Facilities other than as provided in the Work plan and in Section 3.4 above. Without limiting the provisions of the [APSA/EPC CONTRACT], any construction employee found to have violated Unit l's security requirements regarding escorting and physical access to certain PacifiCorp's Areas described in the attached Exhibit "D" shall, at the request of PacifiCorp be assigned to work outside PacifiCorp's Area and shall be disciplined to the full extent permissible under [NAME]'s project labor agreement (if any), including without limitation terminated at PacifiCorp's request.

3.9 Security and Safety Requirements.

In addition to the requirements of [APSA/EPC CONTRACT] [NAME] shall, consistent with good and generally accepted construction practices, undertake all commercially reasonable efforts to protect any and all parallel, converging and intersecting electric lines and poles, telephone lines and poles, highways, waterways, railroads, sewer lines, natural gas pipelines, drainage ditches, culverts, Unit 1 existing facilities and any and all property of others related to the Facility, and shall indemnify PacifiCorp from any and all Claims with respect to [NAME]'s actions or failures to act in connection with such facilities and property in connection with the Work.

3.8 Transition from Construction to Operation.

(a) PacifiCorp shall provide oversight and consent of activities necessary for the connection of the Unit 2 systems with the Common Facilities and the activities necessary for the commissioning and Startup of Unit 2 as provided in the [APSA/EPC CONTRACT]. PacifiCorp shall provide [NAME] and its employees and contractors with reasonable controlled access to all Common Facilities, including the control room, to enable [NAME] and its contractors to interconnect Unit 2 with the Common Facilities, all in accordance with the Work Project Schedule, and upon receipt of notice from [NAME].

(b) Prior to Substantial Completion of Unit 2, PacifiCorp shall provide [NAME] with on-staff operating personnel for Startup, testing (including Performance Testing) and operation of Unit 2 in accordance with the [APSA/EPC CONTRACT]. The operating personnel shall perform this work under the supervision and direction of [NAME]. [NAME] shall remain responsible and liable for the actions of the on-staff operating personnel while under the supervision, direction and control of [NAME].

(c) In accordance with the [APSA/EPC CONTRACT], all work performed by [NAME] and materials stored within the boundaries of the Facility during the construction, tie-in related work and work on the distributed control system in the existing control room shall comply with PacifiCorp's Tagging and Safety Program.

ARTICLE IV
Construction Damage

4.1 Construction Damage.

In the event any activities undertaken in connection with the development, construction, commissioning or testing of Unit 2 cause any physical damage ("Construction Damage") to Unit 1, to the Common Facilities or to any portion of PacifiCorp's Area:

(a) [NAME] shall be responsible for the full cost of rebuilding, restoring and/or repairing all Construction Damage.

(b) [NAME] shall promptly, and in any event no later than one (1) day after the date on which the Construction Damage occurred, consult with PacifiCorp regarding the extent of the Construction Damage and possible approaches to remedying the Construction Damage.

(c) [NAME] shall promptly, and in any event no later than five (5) days after the date on which the Construction Damage occurred, submit to PacifiCorp a detailed written proposal for rebuilding, restoring or replacing, at [NAME]'s expense, such Construction Damage.

(d) PacifiCorp shall promptly evaluate any proposal submitted by [NAME] for, rebuilding, restoring or replacing, at [NAME]'s expense, such Construction Damage.

(e) If PacifiCorp determines that [NAME] possesses the demonstrated qualifications and capability to timely perform the remedial actions set out in the proposal, PacifiCorp will cooperate with [NAME] to promptly undertake the rebuilding, restoration or replacement of the Construction Damage set out in the proposal to PacifiCorp's satisfaction, subject to such terms, conditions and restrictions as PacifiCorp may deem appropriate to ensure that the proposed activities comply with PacifiCorp's safety programs and practices and that the remedial actions will not result in further damage or loss of generation with respect to Unit 1 operations.

(f) If PacifiCorp concludes that [NAME] lacks the demonstrated qualifications and capability or otherwise is not in a position to timely perform the remedial actions set out in the proposal, if [NAME] does not agree with PacifiCorp's terms, conditions and restrictions described in paragraph (d) above, or if [NAME] does not promptly undertake such remedial actions, then PacifiCorp shall be entitled to promptly commence repairs to any Construction Damage to Unit 1 or the Common Facilities at [NAME]'s sole expense.

(g) In the event that [NAME] does not reimburse PacifiCorp for any cost of rebuilding, restoration or replacement activities related to the Construction Damage incurred by PacifiCorp (including without limitation the reasonable cost of PacifiCorp's consultants and internal personnel and resources) within thirty (30) days of PacifiCorp's invoice for the same, then PacifiCorp may set off any amounts owing to PacifiCorp from [NAME] from the next Progress Payment (as defined in the [APSA/EPC CONTRACT]);

(h) Nothing in this Article IV is intended to be nor shall operate as a limitation on PacifiCorp's right or ability to recover damages from [NAME] pursuant to the [APSA/EPC CONTRACT], this Agreement or otherwise at law or in equity.

ARTICLE V
Shutdowns

5.1 Scheduled Shutdowns of Unit 1.

The Parties recognize that Unit 1 must be temporarily shut down for interconnection of Unit 2 to the Common Facilities and for other defined construction-related activities as identified in the Project Schedule. All scheduled shutdowns shall be scheduled, to the extent possible, during weekends and holiday periods.

IN NO EVENT SHALL ANY SCHEDULED SHUTDOWNS BE SCHEDULED DURING THE MONTHS OF JUNE, JULY, AUGUST OR SEPTEMBER, except and to the extent that Unit 1 has scheduled maintenance outages scheduled during such period.

[NAME] shall schedule and provide to PacifiCorp, at least 7 days prior to any necessary shutdown, written notice of the next upcoming outage and of any proposed changes to the outage periods set out in the Project Schedule.

[NAME] shall coordinate with PacifiCorp to balance the need to reduce these shutdown periods and to utilize other times of economic shutdown of Unit 1 to perform the required work under the [APSA/EPC CONTRACT] with the need to utilize these shutdown periods to perform work activities that have a reasonable probability of causing an unplanned shutdown of Unit 1.

5.2 Unscheduled Shutdowns of Unit 1.

(a) [NAME] shall be responsible for conducting its development, construction, commissioning, testing and startup activities in a manner that minimizes the impact of Unit 2 construction on the operation of Unit 1.

(b) In the event activities performed by [NAME] or its contractors causes Unit 1 to experience an unscheduled shutdown or loss of power generation capability (each an "Unscheduled Shutdown"), [NAME] shall be liable to PacifiCorp for all damages incurred by PacifiCorp in connection with such Unscheduled Shutdown. Damages associated with an Unscheduled Shutdown shall include, without limitation, (i) $12,000, multiplied by the OEM's equivalent start ratio for the affected unit(s) per Unscheduled Shutdown occurrence, (ii) the cost of all physical damage to any Unit 1 equipment that is demonstrated to have occurred due to the Unscheduled Shutdown, and (iii) the cost of replacement power ("Replacement Power Costs") for the period of the Unscheduled Shutdown.

(c) Replacement Power Costs shall be calculated as follows, and shall be payable whether or not PacifiCorp actually purchases replacement power for the applicable period as liquidated damages for the lost generation portion of damages only:

(i) If an Unscheduled Shutdown occurs during Work scheduled pursuant to Section 5.2(e)(i) while Unit 1 is operating, replacement power costs shall be calculated as the product of **(1) the Dow Jones SP15 Daily Firm On-Peak Index for the day of delivery, expressed in $/MWh, multiplied by (2) the provided Hourly Scalar for each hour, multiplied by (3) the loss factor of 1.112, plus (4) the basis of $13/MWh** during each hour or portion of hour of the Unscheduled Shutdown, **minus** (5) Unit 1's incremental cost of generating power (i.e., the product of a given plant's then effective net heat rate multiplied by midpoint of the Kern River, Opal Plant Platt's Daily Gas Index at the time of the Unscheduled Shutdown expressed in units of $/mmBtu)

____________________ = Market Price – Incremental Cost

Replacement Power = (1x2x3+4)-5

(d) After an Unscheduled Shutdown of Unit 1, any such future work that is to be performed by [NAME] or its contractors of the same or similar nature to that which caused the Unscheduled Shutdown shall proceed as follows:

(i) PacifiCorp and [NAME] shall develop a plan designed to accomplish the necessary work in a manner that will avoid reoccurrence of the Unscheduled Shutdown.

(ii) Such work plan shall provide that such work may, at PacifiCorp's election:

(1) be rescheduled to begin within, and end not less than five (5) hours before the end of, a subsequent Off-Peak Hourly Periods, during which Unit 1 may continue to operate; or

(2) PacifiCorp may elect to schedule a shutdown of Unit 1 during any subsequent Off-Peak Hourly Periods and such work may be performed during such shutdown beginning within, and ending no less than two (2) hours before the end of, such Off-Peak Hourly Periods.

(e) PacifiCorp shall provide [NAME] with not less than eight (8) hours' advance notice (to be confirmed in writing) of any election to schedule a shutdown of Unit 1 pursuant to Section 5.2(d)(ii)(2).

(f) Nothing in this Article V is intended to be nor shall operate as a limitation on PacifiCorp's right or ability to recover damages from [NAME] pursuant to the [APSA/EPC CONTRACT], this Agreement or otherwise at law or in equity.

5.3 Testing and Initial Firing of Combustion Turbines.

[NAME] shall conduct testing and initial firing of the Unit 2 combustion turbine generator during Off-Peak Hourly Periods.

ARTICLE VI
Notices and Miscellaneous Provisions

6.1 Notices, Consents and Approvals

Contact information for notices, requests, demands and other communications required or permitted hereunder is as follows:

if to [NAME], to:

with copies to:

or to such other person or address as [NAME] shall furnish to PacifiCorp;

if to PacifiCorp, to:

PacifiCorp
825 NE Multnomah, Suite 600
Portland, Oregon 97232-2315
Attn: ___________________

Tel: __________________
Fax: __________________

with copies, in connection with default notices, to:

or to such other person(s) or address(es) as PacifiCorp furnishes to [NAME] from time to time.

All notices, including, acceptances, consents, approvals, agreements, deliveries of information, designations, requests, demands and other communications required or permitted hereunder shall be in writing, properly addressed as provided in paragraph (a) above, and given by (i) hand delivery, (ii) a national overnight courier service, (iii) confirmed facsimile transmission, followed by a hard copy, or (iv) certified or registered mail, return receipt requested, and postage prepaid. Any such notice or other communication shall be deemed to have been duly given as of the date delivered if by hand delivery, national overnight courier service or confirmed facsimile transmission (provided a hard copy promptly follows by other means provided herein), or five (5) calendar days after mailing if by certified or registered mail.

6.2 Entire Agreement

This Agreement contains the entire agreement and understanding of the Parties with respect to the subject matter hereof and supersedes all prior agreements and understandings, whether written or oral, of the Parties relating to the subject matter hereof. Any oral or written representation, warranty, course of dealing or trade usage not contained or referenced herein shall not be binding on either Party.

6.3 Amendment; Waiver

No amendment or other modification of any provision of this Agreement shall be valid or binding unless it is signed by each of the Parties. No waiver of any provision of this Agreement shall be valid or binding unless it signed by the Party waiving compliance with such provision. No delay on the part of either Party in exercising any right, power or privilege hereunder shall operate as a waiver thereof, nor shall any waiver or any partial exercise of any such right, power or privilege preclude any further exercise thereof or the exercise of any other such right, power or privilege. No waiver of any breach, term or condition of this Agreement by any Party shall constitute a subsequent waiver of the same or any other breach, term or condition.

6.4 Successors and Assigns

Each and all of the covenants, terms, provisions and agreements herein contained shall be binding upon and inure to the benefit of the Parties hereto and, to the extent permitted by this Agreement, their respective successors and assigns.

6.5 Third Party Beneficiaries

The provisions of this Agreement shall only be for the benefit of, and enforceable by, the Parties hereto and shall not inure to the benefit of or be enforceable by any third party.

6.6 Severability

In the event any one or more of the provisions contained in this Agreement should be held invalid, illegal or unenforceable in any respect, the validity, legality and enforceability of the remaining provisions contained herein shall not in any way be affected or impaired thereby.

6.7 Further Assurances

Each Party shall, at the request of the other, execute and deliver or cause to be executed and delivered such documents and instruments not otherwise specified herein, and take or cause to be taken all such other reasonable actions, as may be necessary or desirable to more fully and effectively carry out the intent and purposes of this Agreement.

6.8 Publicity

Except as required by law, [NAME] agrees that they will not issue or release for external publication any press release, article, advertising or other publicity matter in any form (including print, electronic, or interview) relating to the Project, or to this Agreement without first consulting with and obtaining the prior consent of PacifiCorp, which consent shall not be unreasonably withheld or delayed. Except as required by law, PacifiCorp agrees that it will not issue or release for external publication any press release, article, advertising or other publicity matter in any form (including print, electronic, or interview) relating to this Agreement without first consulting with and obtaining the prior consent of [NAME], which consent shall not be unreasonably withheld or delayed. To the extent reasonably possible, the releasing Party will accommodate the concerns of the other Party. This requirement does not, however, restrict [NAME] from identifying its involvement in the Project in its marketing of products and services to others.

6.9 Independent Contractor

[NAME] is an independent contractor with respect to the Work, and each part thereof, and in respect of all work to be performed hereunder. Neither [NAME], the contractor, nor any subcontractor, the employees of any of such entities, employed in connection with the Work shall be deemed to be agents, representatives, joint ventures, employees or servants of PacifiCorp by reason of their performance hereunder or in any manner dealt with herein. Neither Party shall perform any act or make any representation to any Person to the effect that [NAME], or any of its agents, representatives, the Contractor or subcontractors, is the agent of PacifiCorp.

6.10 Survival

The provisions of Article 4 ("Construction Damage"), Article 5 ("Shutdowns"), and Sections 2.2 ("Governing Provisions"), 3.1 ("Construction Control"), 3.3 ("PacifiCorp Access to the Construction Area"), 3.9 ("Security and Safety Requirements"), 6.9 ("Independent Contractor") and 6.11 ("Governing Law; Waiver of Jury Trial") of this Agreement shall survive the expiration or earlier termination of this Agreement indefinitely, provided that the foregoing enumeration shall not be interpreted to bar survival of any other provision hereof which would otherwise be deemed to survive by operation of law.

6.11 Governing Law; Waiver of Jury Trial

THIS AGREEMENT SHALL BE GOVERNED BY, CONSTRUED IN ACCORDANCE WITH THE LAWS OF THE STATE OF UTAH (WITHOUT GIVING EFFECT TO THE PRINCIPLES THEREOF RELATING TO CONFLICTS OF LAW).

EACH PARTY HEREBY IRREVOCABLY WAIVES ALL RIGHT OF TRIAL BY JURY IN ANY ACTION, PROCEEDING OR COUNTERCLAIM ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT OR ANY OTHER TRANSACTION DOCUMENT OR ANY MATTER ARISING HEREUNDER OR THEREUNDER. EACH PARTY HEREBY WAIVES ANY RIGHT TO CONSOLIDATE ANY ACTION, PROCEEDING OR COUNTERCLAIM ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT OR ANY OTHER TRANSACTION DOCUMENT OR ANY MATTER ARISING HEREUNDER OR THEREUNDER IN WHICH A JURY TRIAL HAS NOT OR CANNOT BE WAIVED.

6.12 Counterparts

This Agreement may be executed by the Parties in two or more separate counterparts (including by facsimile transmission), each of which shall be deemed an original, and all of said counterparts taken together shall be deemed to constitute one and the same instrument.

6.13 Captions

The captions for Articles and Sections contained in this Agreement are for convenience and reference only and in no way define, describe, extend or limit the scope or intent of this Agreement or the intent of any provision contained herein.

6.14 Costs and Expenses.

All Parties have jointly drafted this Agreement. Presumptions regarding the interpretation of documents against the persons drafting same shall not apply to this Agreement. Each Party hereto will pay all costs and expenses incident to its negotiation and preparation of this Agreement and, except as set forth herein, to its performance and compliance with all agreements and conditions contained herein on its part to be performed or complied with, including the fees, expenses and disbursements of its counsel and accountants. In the event of default hereunder, the Parties agree that the defaulting Party shall pay the fees, expenses and disbursements of counsel for the non-defaulting Party in enforcing this Agreement.

6.14 No Waiver.

Except as otherwise provided herein, no provision of this Agreement may be waived except in writing. No failure by either Party to exercise, and no delay in exercising, any right, power, or remedy under this Agreement shall operate as a waiver thereof. Any waiver at any time by a Party of its right with respect to default under this Agreement, or the respect to other matter arising in connection therewith, shall not be deemed a waiver with respect to any subsequent default or matter.

6.15 Liquidated Damages.

TO THE EXTENT ANY PAYMENT REQUIRED TO BE MADE UNDER THIS AGREEMENT IS AGREED BY THE PARTIES TO CONSTITUTE LIQUIDATED DAMAGES, THE PARTIES ACKNOWLEDGE THAT THE DAMAGES ARE DIFFICULT OR IMPOSSIBLE TO DETERMINE AND THAT SUCH PAYMENT CONSTITUTES A REASONABLE APPROXIMATION OF SUCH DAMAGES, AND NOT A PENALTY.

IN WITNESS WHEREOF the parties hereto have executed this Agreement.

By [NAME]:

Title:

By:

Title:

EXHIBIT A TO
CONSTRUCTION COORDINATION AGREEMENT
Glossary of Defined Terms

Except as otherwise defined in the body of this Agreement, of which this Exhibit is a part, capitalized terms shall have the meanings set forth below:

(1) "Action" shall mean any lawsuit, action, proceeding, investigation or complaint before any Governmental Authority, mediator or arbitrator.

(2) "Agreement" shall have the meaning given to it in the Recitals of this Agreement.

(3) "[APSA/EPC CONTRACT]" shall have the meaning set forth in the Recitals.

(4) "PacifiCorp's Area" means the entirety of the Site that is not included in the Construction Area, as the same may exist from time to time.

(5) "Claims" shall have the meaning set forth in the [APSA/EPC CONTRACT].

(6) "Common Facilities" means those tangible assets, contracts, and permits owned by PacifiCorp in connection with Unit 1 and utilized in common by PacifiCorp and [NAME] for the construction, startup, commissioning and operation of Unit 2, identified on Exhibit "B".

(7) "Construction Area" shall have the meaning given to it in Section 3.2 of this Agreement

(8) "Construction Damage" shall have the meaning given to it in Section 4.1 of this Agreement.

(9) "Construction Fence" shall have the meaning given to it in Section 3.2 of this Agreement.

(10) "Effective Date" has the meaning set forth in the [APSA / EPC Contract]

(11) "Emergency" means any situation which is likely to impose an immediate threat of injury to any Person or of material property damage or material economic loss to all or any part of the Facility.

(12) "Facility" or "Facilities" shall mean the combined generation facility consisting of Unit 1, Unit 2 and the Common Facilities, and all energy producing equipment and auxiliary equipment, fuel storage and handling facilities and equipment, electrical transformers, interconnection facilities and metering facilities, as may be required for receipt of fuel and for delivery of electricity, and all other improvements related solely to the Units and located on the Site.

(13) "Governmental Authority" means any court, tribunal, arbitrator, authority, agency, commission, official or other instrumentality of the United States, any foreign country or any domestic or foreign state, county or other political subdivision.

(14) "NERC" shall mean the North American Electric Reliability Council, and any successor entity.

(15) "Off-Peak Hourly Period" means those periods of time measured by hours ending 0100 through 0600 and hours ending 2300 through 2400 Monday through Saturday, and all hours on Sunday and NERC Holidays.

(16) "PacifiCorp" shall have the meaning set forth in the Recitals..

(17) "PacifiCorp's Area" shall have the meaning given to it in Section 3.2 of this Agreement.

(18) "Party" shall have the meaning given to it in the Recitals of this Agreement.

(19) "Performance Testing" shall have the meaning given to it in the [APSA/EPC CONTRACT].

(20) "Person" means any individual, partnership, limited liability company, joint venture, corporation, trust, unincorporated organization or Governmental Authority.

(21) "Prudent Industry Practice" shall have the meaning given to it in the [APSA/EPC CONTRACT].

(22) "Project Schedule" shall have the meaning given to it in the [APSA/EPC CONTRACT].

(23) "Replacement Power Costs" shall have the meaning given to it in Section 5.2(b) of this Agreement.

(24) "Shutdown Periods" shall have the meaning given to it in Section 6.1 of this Agreement.

(25) "Site" means the real property on which the Facilities are located.

(26) "Substantial Completion" and "Substantial Completion Date" shall have the meanings given to them in the [APSA/EPC CONTRACT] and shall be the time at which PacifiCorp takes possession and control over the constructed Unit 2 pursuant to the terms of the [APSA/EPC CONTRACT].

(27) "Tagging and Safety Program" shall mean that tagging and safety program in effect and maintained by PacifiCorp at the Facility from time to time and provided to [NAME].

(28) "Term" shall have the meaning given to it in Section 2.1 of this Agreement.

(29) "Unit" shall mean an individual generating facility consisting of the gas turbine, heat recovery system generator, steam turbine, auxiliary boilers and other associated facilities and equipment not included as Common Facility.

(30) "Unit 1" means the power plant located in __________, Utah, owned by PacifiCorp and the related facilities, real property and property rights related thereto including all necessary permits and licenses, but excluding the Common Facilities.

(31) "Unit 2" means the proposed power plant to be located in __________ under development by [NAME] adjacent to Unit 1 and the related facilities, real property and property rights related thereto including all necessary permits and licenses, but excluding the Common Facilities.

(32) "Unscheduled Shutdown" shall have the meaning given to it in Section 6.2(b) of this Agreement.

(33) "Work" shall have the meaning set forth in the [APSA/EPC Contract].

Rules as to Usage

1. The terms defined above have the meanings set forth above for all purposes, and such meanings are equally applicable to both the singular and plural forms of the terms defined.

   (i) The singular includes the plural and vice versa;

   (ii) Reference to any Person includes such Person's successors and assigns but, if applicable, only if such successors and assigns are permitted by this Agreement;

   (iii) Reference to a Person in a particular capacity excludes such Person in any other capacity;

   (iv) Any gender reference includes the other gender;

   (v) Reference to any agreement (including this Agreement), document or instrument means such agreement, document or instrument as amended or modified and in effect from time to time in accordance with the terms thereof and, if applicable, the terms hereof;

   (vi) References used in any Article, Section, Schedule, Exhibit or clause refer to this agreement;

   (vii) "Hereunder," "hereof," "hereto," "herein," and words of similar import are references to this Agreement as a whole not any particular part of provision hereof or thereof;

   (viii) "Including" ("include") means including without limiting the generality of any description preceding such term;

   (ix) Relative to any period of time, "from" means "from and including," "to" means "to but not including," and "through" means "through and including;" and

(x) Reference to any law (including statutes and ordinances) means such law as amended, modified, codified or reenacted, in whole or in part, and in effect from time to time, including rules and regulations promulgated thereunder.

EXHIBIT B TO
CONSTRUCTION COORDINATION AGREEMENT

Common Facilities

EXHIBIT C
CONSTRUCTION COORDINATION AGREEMENT

Site Plan Designation of Construction Area

EXHIBIT D
CONSTRUCTION COORDINATION AGREEMENT

Security Requirements

Appendix T

Witness Point Schedule

APPENDIX T

WITNESS POINT SCHEDULE

In accordance with Section 14.3 of the Agreement, Seller shall provide Buyer and Buyer's Representative with at least fourteen (14) days' advance notice of the following pre-mechanical completion shop operations:

1. Combustion and Steam Turbine/Generators

    a. Overspeed test and vibration measurement on bladed combustion turbine rotors and on bladed HP, IP and LP steam turbine rotors
    b. Check key clearances during CT & ST manufacture as defined in the [OEM] Project Inspection & Test Shop Program
    c. Inspect CT & ST generator stator casings prior to welding and brazing operations if such operations are still outstanding
    d. Insulation tests, field rotation tests & HV tests on generator stators
    e. Overspeed test, vibration measurement, insulation resistance measurement & HV test on generator rotor assemblies
        i. 120% over-speed test during high speed balance (new field). Used field at 110%. High speed balance conducted at 3600 rpm.
    f. Check key clearances during assembly of generators as defined in the [OEM] Project Inspection & Test Shop Program
    g. Hydrostatic tests on HP & IP steam turbine casings and live steam valves

2. For Transformers

    a. Winding Inspection and core inspection (before windings are nested and before windings are installed on the core).
    b. Pre-tanking inspection, and the tanking of the core-and-coil assembly.
    c. Testing
    d. Final Inspection before shipment.

FORM OF NOTICE OF REQUEST FOR PAYMENT

[________________, 20__]*

PacifiCorp
825 NE Multnomah, Suite 600
Portland, Oregon 97232-2315
Attention: Director of Contract Administration, C&T

Ladies and Gentlemen:

Reference is made to the Engineering, Procurement and Construction Contract, dated as of ________________, as amended, as further amended, restated, supplemented or otherwise modified from time to time (the "*Contract*") between PacifiCorp, an Oregon corporation (the "*Company*") and ____________, a _________ [limited liability company] (the "*Contractor*" and together with Company, collectively, the "*Parties*"). Capitalized terms used herein but not otherwise defined shall have the respective meanings set forth in the Contract.

1. Contractor hereby requests payment of a payment on the date (which is a Business Day) and in the aggregate amount indicated below (the "*Requested Progress Payment*"):

Payment Milestone Date:	_____________
Payment Number	_____________
Requested Payment:	$____________

2. Pursuant to Section 3.2(d) of the Contract, the undersigned, an Authorized Officer of Contractor, hereby certifies on behalf of Contractors that:

(a) As of the date of this request and as of the date of the payment, Contractor has achieved (i) all of the Milestones with Milestone Dates prior to the payment date and (ii) the Milestones for which the payment is requested.

(b) As of the date of this request and as of the date of the requested payment, (i) the representations and warranties made by Contractor in each Transaction Document to which it is a party (other than representations and warranties which

* Must be submitted not less than 30 days prior to the date Contractors expect to be paid (*i.e.*, payment, net 30 days).

expressly speak only as of a different date) are true and correct in all material respects, and (ii) to Contractor's knowledge, the representations and warranties made by each Project Party other than Contractors in the Transaction Documents (other than representations and warranties which expressly speak only as of a different date) are true and correct in all material respects.

(c) As of the date of this request and as of the date of the requested payment (i) no circumstance, event or condition exists which either immediately or with the passage of time or the giving of notice, or both, permits Contractor to withhold payment to any Subcontractor; (ii) no breach, violation or default has occurred and is continuing under (A) this Contract (B) any Guaranty; (C) any Consent or (D) the Security Documents and (iii) to the extent not already set forth in this paragraph 2(c), no circumstance, event or condition exists which either immediately or with the passage of time or the giving of notice, or both, permits Contractors' counterparty to terminate any Transaction Document.

(d) As of the date of this request and as of the date of the requested payment, no action, suit, proceeding or investigation by or before any Governmental Authority or any arbitrator is pending or to Contractor's knowledge threatened against or affecting a Project Party or the Project which would result in a Material Adverse Change [other than _________________].[†]

(e) As of the date of this request and as of the date of the requested payment, no Material Adverse Change has occurred [other than _________________].[‡]

(f) As of the date of this request and as of the date of the requested payment, except with respect to the Deferred Governmental Approvals, all Necessary Governmental Approvals have been obtained and are in full force and effect.

(g) As of the date of this request and as of the date of the requested payment, each Additional Project Document, together with all amendments, supplements, and exhibits thereto and the ancillary documents relating thereto has been delivered to you prior to the date hereof or are attached hereto and each such Additional Project Document (i) has been duly authorized, executed and delivered by each Person that is a party thereto, (ii) is in full force and effect, and (iii) has become subject to the Lien of the Security Documents.

3. The commercial invoice of Contractor properly substantiating the amounts requested to be paid in connection with the requested payment is attached hereto as Annex 1.

4. The Progress Report is attached hereto as Annex 2.[§]

[†] Insert if any action, suit, proceeding or investigation has been threatened by the Company.

[‡] Insert if any Material Adverse Change is the result of an act or omission by the Company.

[§] Progress Reports to be prepared monthly.

(a) The requested payment set forth in paragraph 1 of this request will be applied for the purposes specified in the Progress Report.

(b) The Project is proceeding in accordance with the Project Schedule.

(c) As of the date hereof, Contractor has reviewed the Work to the extent performed or rendered and the Materials, Equipment or supplies that have been delivered for which payment is being requested, and the amounts which have been paid or are to be paid are proper.

(d) No work shown in Progress Report has been paid for from the proceeds of any payment made prior to the date hereof.

5. Contractor hereby requests that the requested payment be paid in the amounts and to the payees, in each case as set forth on Annex 3.

[THE NEXT PAGE IS THE SIGNATURE PAGE]

Very truly yours,

By: ______________________________
Name:
Title:

Annex 1 to Exhibit A

COMMERCIAL INVOICE

Annex 2 to Exhibit A

PROGRESS REPORT

PAYMENT INSTRUCTIONS

Payee	Amount	Wire Instructions

Exhibit B to
Engineering, Procurement and Construction Contract

FORM OF NOTICE TO PROCEED

_________________, 200_

CONTRACTOR
Street
City, State Zip Code

Attention: ____________

This Notice to Proceed is delivered pursuant to that certain Engineering, Procurement and Construction Contract, dated as of ______, 200_, (as further amended, restated, supplemented or otherwise modified from time to time, the "*Contract*") by and among PacifiCorp, an Oregon corporation (the "*Company*"), ______________, a _______________ ("*Contractor*"). Capitalized terms used herein but not otherwise defined shall have the respective meanings set forth in the Contract.

1. Company hereby acknowledges that each of the conditions precedent set forth in Section 2.1(b) of the Contract has been satisfied or waived.

2. Pursuant to, and in accordance with, Section 2.1(a) of the Contract, Company hereby issues this Notice to Proceed to Contractor.

Very truly yours,

PacifiCorp,
an Oregon corporation

By: ___________________________________
Name:
Title:

cc: Company's cc's
Contractor's cc's

Exhibit C

CREDIT MATRIX

Size of Nameplate bid in MW ==>	100-125	126-150	151-175	176-200	201-225	226-250	251-275	276-300	301-325	326-350	351-375	376-400	401-425	426-450	451-475	476-500	501-525
Credit Rating																	
AAA/Aaa and above	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AA+/Aa1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AA/Aa2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
AA-/Aa3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
A+/A1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
A/A2	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
A-/A3	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
BBB+/Baa1	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$4,944,880	$12,671,255	$20,397,630
BBB/Baa2	$0	$0	$0	$0	$0	$0	$0	$0	$5,562,990	$13,289,365	$21,015,740	$28,742,115	$36,468,490	$44,194,865	$51,921,240	$59,647,615	$67,373,990
BBB-/Baa3 and below	$38,631,875	$46,358,250	$54,084,625	$61,811,000	$69,537,375	$77,263,750	$84,990,125	$92,716,500	$100,442,875	$108,169,250	$115,895,625	$123,622,000	$131,348,375	$139,074,750	$146,801,125	$154,527,500	$162,253,875

Exhibit D

D1 - CHANGE ORDER REQUEST FORM

D2 - CHANGE ORDER NOTICE FORM

D3 - CHANGE ORDER FORM

EXHIBIT D1

CHANGE ORDER REQUEST FORM

PACIFICORP

CHANGE ORDER REQUEST

[Seller/Contractor]: Change Request No.: *

[Agreement/Contract] No.: ******** Date:

Date of [Agreement/Contract]: *********

Pursuant to Article 13 (Change Orders), the following change is requested and modifies the [Agreement/Contract] as follows:

Adjustment to Scope of Work

Adjustment to Project Schedule

Adjustment to Pricing

[Seller/Contractor]	PACIFICORP
By ______________________	By ______________________
Authorized Signature	Authorized Signature
______________________	______________________
Name	Name
______________________	______________________
Title	Title
______________________	______________________
Date	Date

EXHIBIT D2

CHANGE ORDER NOTICE FORM

PACIFICORP

CHANGE NOTICE

[Seller/Contractor] Change Notice No.: *

[Agreement/Contractor] No.: ******** Date:

Date of [Agreement/Contract]: *********

Pursuant to Article 13 (Change Orders), we are issuing this form to notify you of a change to the [Agreement/Contract] as follows:

Adjustment to Scope of Work

Adjustment to Project Schedule

Adjustment to Pricing

	PACIFICORP
By ______________	By ______________
Authorized Signature	**Authorized Signature**
______________	______________
Name	**Name**
______________	______________
Title	**Title**
______________	______________
Date	**Date**

EXHIBIT D3

CHANGE ORDER FORM

PACIFICORP

CHANGE ORDER

[Seller/Contractor]:

Change Order No.: *

******** Date:

[Agreement/Contract] No.:

Date of [Agreement/Contract]: *********

Pursuant to Article 13 (Change Orders), this Change Order is issued to modify the [Agreement/Contract] as follows:

<u>Adjustment to Scope of Work</u>

<u>Adjustment to Project Schedule</u>

<u>Adjustment to Pricing</u>

Existing Price	$____________
Adjustment due to Change Order No.	$____________
Total Adjusted Price	$____________

The above adjustment sets forth the total compensation for performing the work described in this Change Order, and any effect this Change Order has on the performance of any other work under the [Agreement/Contract].

Except as provided herein, all other terms of the [Agreement/Contract] remain in full force and effect.

	PACIFICORP
By ______________________	By ______________________
Authorized Signature	**Authorized Signature**
______________________	______________________
Name	**Name**
______________________	______________________
Title	**Title**
______________________	______________________

PACIFICORP

FORM OF

CERTIFICATE OF AUTHORIZED OFFICER OF

[CONTRACTOR]

(A [_________] __________________)

The undersigned, as a ______________ of [Contractor], a [_________] __________________ ("Contractor"), does hereby certify, represent and warrant that:

1. The undersigned is a duly authorized ______________ of Contractor, and as such is familiar with the matters set forth below.

2. The undersigned acknowledges that Company is relying on this certificate (this "Certificate") in connection with the issuance of the Notice to Proceed under the Engineering, Procurement and Construction Contract, dated as of________, 200__ as amended , restated, supplemented or otherwise modified from time to time, between Contractor and PacifiCorp, an Oregon corporation (the "Contract") and the consummation of the transactions described therein.

3. Attached hereto as Exhibit "A" are true, correct and complete copies of all environmental reports, assessments and audits, including reports, assessments and audits relating to air and emissions, prepared by or on behalf of Contractor in connection with the Project.

4. Attached hereto as Exhibit "B" are true, correct and complete copies of all Contracts, contracts or other instruments providing for the sale, lease, transfer or other disposition of the Site (including any options). To the extent such Contracts have not been executed on or prior to the date hereof, true, correct and complete copies of all drafts of such Contracts are attached hereto as Exhibit "B".

5. Attached hereto as Exhibit "C" is Contractor's Disclosure Letter, as updated and modified to reflect such information required to be set forth thereon as of the date hereof.

6. The copies of the Transaction Documents delivered pursuant to Section 2.1(b) of the Contract, and as identified on, and attached hereto as, Exhibit "D", are true, correct and complete copies of such documents, and such Transaction Documents are in full force and effect and no term or condition thereof has been amended from the form thereof delivered to Company, or waived. Contractor and the other parties to the Transaction Documents attached hereto as Exhibit "D" have performed or complied with all Contracts and conditions contained in such Transaction Documents and any Contracts or documents referred to therein required to be performed or complied with by each of them on or before the issuance of the Notice to Proceed. Subject to the foregoing, neither Contractor nor any such other party to such Transaction Documents is in default in the performance or compliance with any of the terms or provisions thereof.

7. All conditions precedent to the issuance of the Notice to Proceed have been satisfied or have been waived by Company in writing (other than to the extent the satisfaction of a condition is dependent on the judgment of Company).

8. As of the date hereof and as of the date of the issuance of the Notice to Proceed, Contractor has achieved (i) all of the Milestones with Milestone Dates prior to the date hereof.

9. The representations and warranties made by Contractor in each Transaction Document to which it is a party (other than representations and warranties which expressly speak only as of a different date) are true and correct in all material respects and will be true and correct on and as of the date of the issuance of the Notice to Proceed, (ii) to Contractor's knowledge, the representations and warranties made by each Project Party other than Contractor in the Transaction Documents (other than representations and warranties which expressly speak only as of a different date) are true and correct in all material respects and will be true and correct on and as of the date of the issuance of the Notice to Proceed.

10. As of the date hereof and as of the date of the issuance of the Notice to Proceed, (i) no circumstance, event or condition exists which either immediately or with the passage of time or the giving of notice, or both, permits Contractor to withhold payment under any Primary Construction Contract; (ii) no breach, violation or default has occurred and is continuing under (A) the Contract (B) any Guaranty; (C) any Consent or (D) the Security Documents and (iii) to the extent not already set forth in this paragraph 10, no circumstance, event or condition exists which either immediately or with the passage of time or the giving of notice, or both, permits Contractor's counterparty to terminate any Transaction Document.

11. As of the date hereof and as of the date of the issuance of the Notice to Proceed, no action, suit, proceeding or investigation by or before any Governmental Authority or any arbitrator is pending or to Contractor's knowledge threatened against or affecting a Project Party or the Project which would result in a Material Adverse Change.

12. As of the date hereof and as of the date of the issuance of the Notice to Proceed, no Material Adverse Change has occurred.

13. As of the date hereof and as of the date of the issuance of the Notice to Proceed, except with respect to the Deferred Governmental Approvals, all Necessary Governmental Approvals have been obtained and are in full force and effect.

14. Schedule 2.1(b)(viii) to the Contract lists all filings or recordings or equivalent standard made under the Uniform Commercial Code in each jurisdiction in which Contractor was formed, have an office or in which assets of either Contractor are located. There are no such filings or recordings with respect to any of the Collateral (except such filings and recordings with respect to Permitted Liens) in favor of any Person other than Company. Attached hereto as Exhibit "E" are copies of the search reports or equivalent standard received as a result of such search.

15. Attached hereto as Exhibit "F" are the insurance certifications and certificates that comply with the requirements of Article 26 of the Contract.*

* To be attached, if required.

Capitalized terms used herein and not otherwise defined herein are used herein with the meanings ascribed thereto in the Contract.

[THE NEXT PAGE IS THE SIGNATURE PAGE]

IN WITNESS WHEREOF, I have executed and delivered this Certificate this ___ day of _____________, 2004.

[Contractor]
a [___________]

By: ______________________________
Name: ______________________________
Title: ______________________________

ENVIRONMENTAL REPORTS, ASSESSMENTS, AUDITS

1. [*Contractor, please list and attach*]
2. [*others*]

CONTRACTS, CONTRACTS OR OTHER INSTRUMENTS PROVIDING FOR THE SALE, LEASE, TRANSFER OR OTHER DISPOSITION OF THE SITE (INCLUDING ANY OPTIONS)

1. [*Contractor, please list and attach*]

CONTRACTORS' DISCLOSURE LETTER

TRANSACTION DOCUMENTS

1. Engineering, Procurement and Construction Contract and Waiver
2. EPC Contract*
3. Construction Coordination Contract*
4. Assignment and Security Contract
5. Deposit Account Control Contract
6. UCC-1 Financing Statements
7. Guaranty*
8. [*others*]

RECORD SEARCHES

INSURANCE CERTIFICATES†

† To be attached, if required pursuant to the Contract.

PacifiCorp
Letter Of Credit Language

The following are the terms and conditions required by PacifiCorp when establishing a Letter Of Credit

- PacifiCorp must approve the issuing bank.
- Applicant (Supplier) name appearing in the Letter Of Credit and Agreement must be EXACTLY the same.
- If issuing bank is located outside USA it must be confirmed by US bank approved by PacifiCorp
- It is to be an irrevocable standby Letter Of Credit in favor of PacifiCorp.
- Drafts are payable at sight.
- The expiry date must be no earlier than 12 months from issuance.
- Partial drawings are permitted.
- The LOC is available by PacifiCorp's draft (s) at sight when accompanied by a copy of an invoice and one of the two following statements and signed by a representative of PacifiCorp, reading as follows:

  1. We hereby certify that Applicant has violated the terms of the Purchase Agreement dated ____________
  2. Applicant has not renewed or provided a satisfactory security deposit to Beneficiary within 10 days of expiration of the Letter Of Credit no. XXXXX, dated XXXX
- Invoice (s) in excess of the amount of this Letter Of Credit are acceptable; however payment is not to exceed the aggregate amount of this letter of credit.
- In all events the issuing bank will fund the draw of the beneficiary within 24 hours of presentment.
- The LOC will provide for the beneficiary to deliver the required documents to fund the draw by either mail or courier with the address of the issuing bank stated as the point of delivery.

Planning Consents

To be completed upon site selection

Insurance Certificates

To be completed upon site selection

RESERVED

Contract No. ____________

PARTIAL RELEASE AND CERTIFICATE OF PROGRESS PAYMENT

With reference to that certain EPC Contract, Contract No. ________________, dated __________, ____________, as amended, between [Company/Seller] ("Company") and [Contractor], ("Primary Contractor").

The Primary Contractor hereby certifies represents, and warrants that, each of its subcontractors and materialmen has made full payment of all costs, charges and expenses incurred by them or on their behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by them in connection with the Contractor's work related to the Contract up to the date of this progress payment.

Primary Contractor further certifies, represents and warrants that it has made full payment of all costs, charges and expenses incurred by it or on its behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by it in connection with the Contractor's work related to the Contract up to the date of this progress payment.

In consideration of $___________ as payment for all work relating to this progress payment, the Primary Contractor hereby unconditionally remises, releases and forever discharges [___________] premises and property from all claims, liens and obligations of every nature arising out of or in connection with the performance of Primary Contractor's work relating to the Contract up to the date of this progress payment.

The foregoing shall not relieve Contractor of its other obligations arising from its work performed relating to the Contract, which by their nature survive completion of this portion of the work, including, without limitation, warranties, guarantees and indemnities.

Executed this ____ day of __________, _______.

Primary Contractor: ________________

By: ______________________________

Title: ____________________________

Contract No. ____________

PARTIAL RELEASE AND CERTIFICATE OF PROGRESS PAYMENT

With reference to that certain EPC Contract, Contract No. ________________, dated __________, ____________, by and between [PacifiCorp/Seller] and [Contractor], ("Primary Contractor") and related to which the undersigned party, [Subcontractor] ("Subcontractor"), has performed certain work for Primary Contractor.

Subcontractor hereby certifies, represents, and warrants that it has received full payment of all costs, charges and expenses incurred by it or on its behalf for work, labor, services, materials and equipment supplied to the foregoing project and/or used in connection with its work related to the Contract up to the date of this progress payment.

Subcontractor further certifies represents, and warrants that, each of its subcontractors and materialmen has made full payment of all costs, charges and expenses incurred by them or on their behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by them in connection with the Subcontractor's work related to the Contract up to the date of this progress payment.

Subcontractor further certifies, represents and warrants that it has made full payment of all costs, charges and expenses incurred by it or on its behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by it in connection with the Subcontractor's work related to the Contract up to the date of this progress payment.

In consideration of $___________ as payment for all work relating to this progress payment, the Subcontractor hereby unconditionally remises, releases and forever discharges [_________]'s premises and property from all claims, liens and obligations of every nature arising out of or in connection with the performance of Subcontractor's work relating to the Contract up to the date of this progress payment.

The foregoing shall not relieve Subcontractor of its other obligations arising from its work performed relating to the Contract, which by their nature survive completion of this portion of the work, including, without limitation, warranties, guarantees and indemnities.

Executed this ____ day of __________, ______.

Subcontractor: ____________________

By: ______________________________

Title: ____________________________

Contract No. _____________

PARTIAL RELEASE AND CERTIFICATE OF PROGRESS PAYMENT

With reference to that certain EPC Contract, Contract No. _________________, dated __________, _____________, by and between [PacifiCorp/Seller] and [Contractor], ("Primary Contractor") and related to which the undersigned party, [Supplier] ("Supplier"), has supplied materials for Primary Contractor or subcontractors of Primary Contractor.

Supplier hereby certifies, represents, and warrants that it has received full payment of all costs, charges and expenses incurred by it or on its behalf for work, labor, services, materials and equipment supplied to the foregoing project and/or used in connection with its work related to the Contract up to the date of this progress payment.

The Supplier further certifies represents, and warrants that, each of its subcontractors and materialmen has made full payment of all costs, charges and expenses incurred by them or on their behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by them in connection with the Supplier's work related to the Contract up to the date of this progress payment.

Supplier further certifies, represents and warrants that it has made full payment of all costs, charges and expenses incurred by it or on its behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by it in connection with the Supplier's work related to the Contract up to the date of this progress payment.

In consideration of $___________ as payment for all work relating to this progress payment, the Supplier hereby unconditionally remises, releases and forever discharges [__________________'s] premises and property from all claims, liens and obligations of every nature arising out of or in connection with the performance of Supplier's work relating to the Contract up to the date of this progress payment.

The foregoing shall not relieve Supplier of its other obligations arising from its work performed relating to the Contract, which by their nature survive completion of this portion of the work, including, without limitation, warranties, guarantees and indemnities.

Executed this ____ day of __________, ______.

Supplier: ___________________________

By: ________________________________

Title: ______________________________

Attachment 19

RFP 2009
ATTACHMENT 19
DUE DILIGENCE ITEMS FOR THE ACQUISITION OF AN EXISTING FACILITY
September 2005

PacifiCorp
Draft RFP 2009
Responses due December 1, 2005

The follow is not to be considered a complete listing of due diligence items. The final listing shall be determined, in PacifiCorp's sole discretion, based on the Facility offered by the Bidder.

Due Diligence Items:

Technical Assessment

1.0 Plant General

- 1.1 Request plant organization charts.
- 1.2 Request the Annual Plant Budget (total) Actual for *5 years_*. Projected for *5 years*
- 1.3 Request a summary of the budget. Last *5* years and next *5* years.
  - 1.3.1 Labor expenses
  - 1.3.2 Maintenance expense
  - 1.3.3 Equipment expense
  - 1.3.4 Insurance expense
  - 1.3.5 Operations expense
  - 1.3.6 Administrative expense
  - 1.3.7 Capital escrow
  - 1.3.8 Major Maintenance Escrow
  - 1.3.9 Inventory Purchase. Total Value of Inventory. Inventory Value for each division.
  - 1.3.10 Fuel by component
- 1.4 Request a summary of the maintenance expenses
  - 1.4.1 Major Maintenance (annual)
  - 1.4.2 Consumables
  - 1.4.3 Inventory draws

1.4.4 Maintenance contracts.

1.4.5 Building and grounds

1.4.6 Other.

1.5 Request a summary of equipment expenses.

1.5.1 Shop equipment maintenance

1,5.2 Equipment rental

1.5.3 Power tools (Leased).

1.5.4 Rolling stock fuel.

1.5,5 Rolling stock maintenance.

1.5.6 Other.

1.6 Request a summary of insurance expenses.

1.6.1 Business Interruption

1.6.2 Property

1.6.3 General liability.

1.6.4 Vehicle liability.

1.7 Request a summary of operating expenses.

1.7.1 Regeneration Cost.

1.7.2 Clarifier Cost.

1,7.3 Boiler water chemicals.

1.7.4 Lubricants

1.7.5 Consumables.

1.7.6 Electricity purchased.

1.7.7 Hazardous material disposal.

1.7.8 Discharge treatment chemicals

1.7.9 Laboratory supplies

1.7.10 Emission testing

1.7.11 Hydrogen and C02 for generator

1.7.12 Ammonia, lime, limestone, other

1.8 Request a summary of administrative expenses.

1.8.1 Telephone expenses

1.8.2 Postage

1.8.3 Computer hardware

1.8.4 Computer software

1.8.5 Office supplies

1.8.6 Permits and licenses.

1.8.7 Professional Services

1.9 Request a summary of capital escrow accounts.

1.9.1 Equipment purchases.

1.9.2 Balance of Plant capital.

1.9.3 Dispersion schedule of escrow accounts.

2.0 Plant Personnel

2.1 Request a personnel roster.

2.1.1 Complete list of Classifications.

2.1.2 Number in each classification. Remaining years before retirement.

2.1.3 Annual base salary.

2.1.4 Hourly wage rate.

2.1.5 Straight time additions (%).

2.1.6 Straight time Hourly cost (Hourly rates + additions)

2.1.7 Overtime hourly costs.

2.1.8 Total overtime (% of annual base salary).

2.1.9 Employee age demographics chart

2.2 Request a summary of payroll additions.

2.2.1 Payroll taxes.

2.2.2 Workman's compensation

2.2.3 Retirement Account

2.2.4 Insurance

2.2.5 Employee Savings

2.2.6 Vacation and Sick Leave

2.2.7 Indirect Additions

2.2.8 Other (Pensions, benefits and welfare Plans)

2.3 Labor

2.3.1 Labor contracts

2.3.2 Organizing initiatives

3.0 Major maintenance

3.1 Request a summary of maintenance cost and schedules

3.1.1 Annual, major and frequency of major outages for:

3.1.1.1 Turbine valves

3.1.1.2 Coal feeders and scales

3.1.1.3 Pulverizes

3.1.1.4 Boiler pressure parts.

3.1.1.5 Boiler auxiliaries

3.1.1.6 Boiler draft system.

3.1.1.7 Casing and ductwork.

3.1.1.8 Boiler insulation and lagging

3.1.1.9 Turbine

3.1.1.10 Condenser

3.1.1.11 Generator

3.1.1.12 Pumps.

3.1.1.13 Switchgear.

3.1.1.14 Demineralizer

3.1.1.15 Precipitators

3.1.1.16 Flue Gas Desulphurization system

3.1.1.17 SCR

3.2 Major maintenance escrow.

3.2.1 Request a major maintenance analysis (summary of planned majors and dispersions for the last *5* years and projected for the next *5* years)

4.0 Capital expense items.

4.1 Capital expense escrow.

4.1.1 Request a capital escrow analysis (summary of planned capital expenditures and dispersion for the last *5* years and projected for the next *5* years).

5.0 Operations

5.1 How do you track efficiency?

5.2 How do you calculate availability?

5.3 In your opinion what are the major strengths of you department?

5.4 What are the major weaknesses?

5.5 What equipment presents the most problems?

5.6 Are you satisfied with the maintenance efforts?

5.7 Are the existing controls satisfactory?

5.8 How would you rate the knowledge level of your personnel?

5.8.1 Would you be receptive to additional training for your people?

5.8.2 Do you think the training would be cost effective?

5.8.3 What are the existing training methods?

5.8.4 Give a rough estimate of the average experience level of your department (years of experience).

5.8.5 How are operations people utilized during outages?

5.8.6 How would you rate relations with the various unions?

5.9 What is your occurrence of "Operator error"?

5.10 If you owned this plant what would you do to improve it?

5.11 Do you help prioritize and plan work required for efficient plant operation?

6.0 Maintenance

6.1 How heavy is the workload for your department?

6.1.1 Do you have all the resources needed to complete the defined tasks?

6.1.2 How is your maintenance work prioritized?

6.1.3 How much maintenance backlog work do you have?

6.2 How successful have you been in maintaining the plant within budget forecasts?

6.3 How much input do you have in budgeting for maintenance?

6.4 How often do you schedule major maintenance outages?

6.4.1 Are you allowed sufficient time to complete planned tasks during outages?

6.4.2 Do you have adequate inventories of spare parts?

6.4.3 Do you have enough tools?

6.5 What are the major strengths of your department?

6.6 What are the major weaknesses of your department?

6.7 How would you rate the skills level of your technicians?

6.7.1 Would you be receptive to additional *training* for your people? What areas?

6.8 What are the boundaries of your responsibilities?

6.9 Do you feel that you have sufficient latitude to perform your job efficiently?

6.10 Do you have an extended plan for Capital improvements?

6.10.1 How long is the time span for forecasted equipment replacement?

6.10.2 Do you have contingency plans for equipment failure?

6.103 Are there any problems with excessive lead-time for equipment purchase?

6.11 Do you perform non-destructive testing on you major boiler parts and steam lines?

6.12 Have you conducted a comprehensive review of your HT/HP piping systems?

6.13 When were the last overhauls of you turbines?

6.13.1 What were the major problems found?

6.13.2 How were these problems corrected?

6.13.3 Do you perform bore inspections?

6.13.4 How often are overspeed trip tests conducted?

6.13.5 Are there any generator problems that you are aware of?

6.14 What is the condition of your electrical switchgear?

6.14.1 Do you perform scheduled switchgear inspections?

6.14.2 Are parts available for the switchgear?

6.15 What is the condition of your water treatment plant?

6.15.1 Are any major maintenance activities planned for the water treatment plant in the foreseeable future?

6.16 Are there any major problems with any existing environmental protection equipment?

6.16.1 Does existing environmental equipment require an inordinate amount of your people's time?

6.17 Do you have adequate on-site transportation to prevent loss of efficiency by your people?

7.0 Controls

7.1 What type of control systems do you have?

7.2 How old are these systems?

7.3 Do you consider them obsolete?

7.3 Are parts readily available?

7.4 Who sets your work priorities?

7.5 How heavy is your workload and how much "backlog" do you have?

7.6 How would you rate the knowledge of your workforce?

7.6.1 Would you be receptive to additional training for your technicians?

7.6.2 Do you think additional training could be cost justified?

7.7 Do you have sufficient test equipment and tools?

7.8 Are there any plans to make major controls system changeouts in the foreseeable future?

7.9 Is your plant equipped for fire protection?

7.9.1 Who is responsible for testing of fire fighting equipment?

7.9.2 Is there a need for more fire equipment or do you think the existing equipment is sufficient?

7.10 How do you handle injuries?

7.11 Do you have dangerous chemicals on the plant site? If so, please identify.

7.11.1 Do you have contingency plans for emergencies?

8.0 Safety

8.1 Do you have an on-going safety program?

8.2 Please describe your approach to safety?

8.3 In you opinion, does the program work?

8.4 How could the program be improved?

8.5 Provide a description of the health and safety compliance program with respect to the Facility. Include a description of any safety management systems that have been put in place and any safety policies that have been implemented at the Facility.

8.6 All OSHA citations or orders issued to the Facility, or settlements entered into by the Facility, in the last ten (10) years in each case with respect to the Facility.

8.7 All worker-related or third-party lawsuits or claims, including worker's compensation claims, filed within the last ten (10) years or now threatened, pending, or reasonably anticipated by the Facility regarding human exposure to toxic or carcinogenic substances or materials at the Facility.

8.8 All documents describing the Facility's current and past annual employee medical screening and monitoring programs at the Facility, including but not limited to, documents pertaining to current and former employees that have been diagnosed with: (a) asbestosis or any other lung related illness; (b) elevated blood lead levels; or (c) elevated blood PCB levels.

8.9 Provide information on safety performance experienced at the Facility within the last five years. Include OSHA recordable, Lost Time Accident and Restricted Work Day statistics in this information.

9.0 Environmental

9.1 What is the prevailing attitude toward environmental matters?

9.2 Do you think environmental concerns should receive more attention?

9.3 Provide any copies of environmental audits that have been performed.

9.4 Is there any known or suspected environmental contamination of the plant site?

9.5 What is your environmental exceedance record for the last 5 years?

9.6 Copies of all Phase I, Phase II and other environmental site assessments, risk assessments, site investigations, site remediation plans, closure reports, compliance audits, etc.

9.7 Copies of any environmental management systems ("EMS") policies and procedures (including any documents pertaining to the implementation of the EMS at the facility), EHS compliance policy statement and implementation documents and voluntary disclosure policy statement and implementation documents.

9.8 Copies of all current Environmental Health an Safety permits, licenses, consents, registrations or approvals (collectively, "EHS Permits") that are required by any governmental authorities and necessary ownership/operation of the Facility, including, but not limited to those associated with any types of air emissions, wastewater discharges, storm water runoff, water use, solid waste management, recycling, and/or hazardous materials generation, storage, treatment and/or disposal. In the event that there are applications (including notices/applications for permit renewals) pending for any EHS Permits, provide copies of such applications and any relevant correspondence.

9.9 Documents (including EHS Permits) pertaining to the use, development, conservation or disturbance of land, wetlands, natural resources, biota and/or ecologically sensitive receptors.

9.10 A list and description of all landfills, disposal areas, surface impoundments, ponds, diversions, dams and other similar structures located at or related in any way to the Facility, together with copies of all associated EHS Permits.

9.11 Documents pertaining to compliance with applicable federal, state and local EHS laws and its EHS permits (including but not limited to emission statements, compliance monitoring data, compliance inspection reports, plans and correspondence with governmental authorities) and/or reports and submissions made pursuant to applicable federal, state and local EHS laws.

9.12 Documents identifying or describing anticipated capital expenditures required to control pollution, investigate/remediate any environmental conditions, manage waste or achieve/ensure compliance with applicable EHS permit conditions or EHS laws at the Facility.

9.13 Documentation of (1) hazardous waste generator status for the Facility; (2) the types(s) and amounts of waste generated; (3) a list and description of all solid waste and hazardous waste transporters used; (4) a list of all off-site treatment, storage or disposal facilities ("TSDFs") that have received or are receiving solid and/or hazardous waste from the Facility; and (5) copies of all manifests for off-site hazardous waste disposal.

9.14 (1) A list and description of current and former surface impoundments, underground storage tanks ("USTs") and above-ground storage tanks ("ASTs") located on any properties used, owned or leased in connection with the Facility as well as any information concerning the size, content, age and compliance of such impoundments/tanks; (2) any reports prepared in connection with any leaks or releases from such impoundments or tanks; and (3) closure reports prepared in connection with any closure, removal or abandonment of such impoundments, USTs or ASTs.

9.15 Documents relating to: (1) the maintenance, handling, storage or disposal of mercury or mercury-containing equipment; or (2) the testing, disposal and/or abandonment of any pipes, transformers, structures or other PCB-containing equipment or materials, particularly as those relate to compliance with the PCB Mega Rule in connection with the Facility.

9.16 Incident reports, notifications and/or other documents relating to any spill or release of hazardous materials, wastes or chemicals at the Facility or as a result of operations at the Facility.

9.17 Documents pertaining to: (1) the indoor air quality of the Facility; or (2) the presence, management, removal or abatement of asbestos-containing materials or lead-based paint.

10.0 What natural perils could affect this site?

10.1 Give a cost analysis of the last 2 such occurrences.

11.0 What licenses, permits or certificates are required at this site? (Air? Noise? Water usage? Storm water discharge? Waste water discharge? Air discharge? Business? Power production? Others?

12.0 Give nameplate data for all units.

12.1 Give start up times, ramp rates for synchronization and total event costs to full load for hot, warm and cold start conditions.

12.2 Give heatrate, reduced load heatrates, availability, forced outage rates, capacity factors, environmental performances, catastrophic failures, obsolescence, etc for each unit.

13.0 Request a copy of all collective bargaining units' agreements.

14.0 What other contracts, sub-contracts or leases exist for maintenance services, labor, professional services, materials, parts or other?

15.0 Supply details of all fuel purchase, transportation and storage contracts.

16.0 Supply details of any waste disposal procedures or contracts.

16.1 What opportunities do you see for "revenues" from your various waste streams?

17.0 Title

17.1 Real property

17.2 UCC Filings

18.0 Claims history (both by and against Seller in connection with the Facility)_

18.1 Litigation (including arbitration and other forms of alternative dispute resolution.

18.2 Labor issues

18.3 Warranty claims

18.4 Copies of all auditor's letters prepared by law firms with respect to the Facility or with respect to Seller's liability in connection with the Facility.

19.0 Contracts

19.1 Copies of all contracts

20.0 Permits/Licenses

20.1 Copies of all permits, licenses, easements, etc.

21.0 Organizational Documents

22. Insurance

22.1 Copies of all insurance policies that have been in effect at any time with respect to the Facility or under which coverage may have at any time been provided with respect to the Facility.

PacifiCorp
Draft RFP 2009
Responses due December 1, 2005

Technical Evaluation of Potential Acquisition
Questions, Documents & Data to be Reviewed

- O&M contract.
- Power Purchase contract.
- Interconnect agreements and terms.
- Fuel purchase, transportation and storage contracts.
- Ash storage, transportation and disposal contracts.
- Production by product sales contracts.
- Steam sales contracts.
- Water supply/sewer agreements.
- All other contracts, subcontracts and leases for maintenance services, labor, professional services, materials, parts or other at each plant.
- Collective bargaining agreements, if any.
- Pension, benefit and welfare plans.
- O&M and capital budgets vs. actuals for last five years. Budgets or budget forecasts for next five years. Status of maintenance escrow accounts,
- Operating & Maintenance plan, and capital improvement plan, for last five years and next five years.
- Staffing plan including organizational chart and salary levels.
- Environmental permits including air, noise, water usage, stormwater discharge and wastewater discharge. Provide documentation to show compliance with permits and/or any violations or citations. Provide reports of any Environmental Audits or Assessments of the projects/sites. Is there any known or suspected environmental contamination of the site of facilities? We may wish to conduct a site assessment.
- A listing of hazardous and non-hazardous wastes which are stored on-site or off-site, or have been disposed of.
- Any federal, state or local licenses, permits and certifications

- Major maintenance requirements at each plant: historical as well as recommended and/or planned major maintenance activities. Maintenance schedules from last five years and projections for next five years.
- Maintenance records - preventative maintenance, corrective maintenance, major niaintenance and scheduled maintenance.
- Spare parts inventory - item description, quantity and value.
- Written procedures, programs, policies, records and logs relative to operations, maintenance, safety, environmental, training and others.
- Capacity Factor, EAF and EFOR for each of the last five years. Define terms and method of calculation. History of all scheduled maintenance outages and all significant forced outages.
- Heat rate at each plant: design heat balance; curves of heat rate vs. load; actual average monthly heat rate based on fuel purchases and net energy produced; and results of any heat rate tests.
- Results of tests of Net Maximum Capacity tests.
- Startup times and ramp rates from synchronization to full load for hot, warm, and cold start conditions.
- Data to show compliance with QF requirements (if applicable) for last five years.
- Interviews with Plant Manager and supervisors at each plant.
- Are there any remaining warranties? Are there any warranty claims or issues outstanding?
- Is there potential for efficiency improvement? expansion? repowering?
- Assess the technology employed. Is it proven?
- What are the risks associated with this technology? i.e. startup times, heat rate, heat rate at reduced load, availability, force outage rate, capacity factor, environmental performance, catastrophic failure, obsolescence, etc.
- What Natural perils could affect this site?

Any federal, state or local licenses, permits and certifications.

Form 1

RFP 2009
FORM 1
PRICING INPUT SHEET
September 2005

Form 1 Pricing Input Sheet

PACIFICORP RFP 2009: CONFIDENTIAL and PROPRIETARY

Directory

Filename

Bid Number:	
Project Name:	
Applicable Eligible Resource Category:	Tolling Agreement
Delivery to PPW Start Date: (mm/dd/yyyy)	6/1/2009
Delivery to PPW End Date: (mm/dd/yyyy)	5/31/2029
Point of Interconnection:	Oquirrh, UT
Point of Power Delivery:	Mona 345 kV
Point of Gas Delivery (or index, if applicable):	Questar Gas Daily Index
PPW or Counterparty to Deliver Gas (if applicable)?	PPW
Resource Type (NG, Coal, Hydro, etc.)	NG
New or Existing Resource?	Existing
Economic Life of Plant? (years)	35
Beginning of Plant Life/Commercial On-Line Date for New or Existing Plant: (mm/dd/yyyy)	6/1/2009
Firm or Unit Contingent?	Firm
Transmission Interconnection Costs:	$1,500,000
Transmission Integration Costs:	$69,000,000
Third Party PTP Transmission ($/KW-mo) Charge to PPW	$0.00
Third Party Losses Transmission (%) Charge to PPW	0%
Capital Expenditures by PPW, Inc. Ongoing Capital Estimates (if applicable) : See CapEx Table	

	Load Curtailment Option
Capacity Level - Fixed Charges Applicator (MW)	25
Capacity PMT ($/KW-mo)	$5.25
Capacity PMT Annual Calendar Esc % (or index, if applicable)	CPI
Bidder's Incremental Energy Retail Rate ($/MWh)	$32.77
Hours Per Day Dispatch Limitation (if applicable)	4
Hours Per Month Dispatch Limitation (if applicable)	40
Hours Per Year Dispatch Limitation (if applicable)	450

	Combined Cycle	Simple Cycle	Duct Fire	Power Augmentation
Capacity Level - Fixed Charges Applicator (MW)	420	280	70	30
Optionality (Hourly, Day Of, Day Ahead, Monthly)	Day Ahead	Day Ahead	Hourly	Hourly
Fixed Energy PMT ($/MWh, if applicable)	NA	NA	NA	NA
Fixed Energy Pmt Annual Calendar Esc % (or index, if applicable)	NA	NA	NA	NA
Heat Rate (Btu/KWh) - For Gas Index PPA/Tolling Structures (if applicable)	7,150	10,500	9,400	12,000
VOM PMT ($/MWh)	$0.30	$0.30	$0.10	$0.10
VOM PMT Annual Calendar Esc % (or index, if applicable)	CPI	CPI	CPI	CPI
Start-Up Costs ($/MWh) 8 hours per run	$5.00	$5.00	$0.00	$0.00
Start-Up Costs ($/MWh) 16 hours per run	$2.50	$2.50	$0.00	$0.00
Start-Up Costs Annual Calendar Esc % (or index (needs to be VOM index), if applicable)	CPI	CPI	CPI	CPI
FOM PMT ($/KW-mo)	$1.00	$1.00	$1.00	$1.00
FOM PMT Annual Calendar Esc % (or index, if applicable)	CPI	CPI	CPI	CPI
Capacity PMT ($/KW-mo)	$6.00			
Capacity PMT Annual Calendar Esc % (or index, if applicable)	0.0%			
Percentage of Capacity PMT that is Executory Costs (%):	25%			
Cost to Build ($/kW):	$700			
Gas Capacity (DT/day)	48,048	47,040	10,528	3,840
Gas Demand Charge ($/DT-mo)	$0.25	$0.25	$0.25	$0.25
Gas Distribution Charges Above Commodity Rate or Index Adder ($/MMBtu)	$0.05	$0.05	$0.05	$0.05
Gas Adder Calendar Annual Esc % (or index, if applicable)	0.0%	0.0%	0.0%	0.0%
Fuel Multiplier (%, if applicable)	102.5%	102.5%	102.5%	102.5%
Hours Per Day Dispatch Limitation (if applicable)	NA	NA	NA	NA
Hours Per Year Dispatch Limitation (if applicable)	NA	NA	3500	3500
Ramp Rates - Warm Start (MW/min.)	15	57	6	3
Runup Rates - Cold Start (MW/min.)	8.5	57	N/A	N/A
Min. Up (hours)	6	0	N/A	N/A
Min. Down (hours)	6	0	N/A	N/A
Spinning Reserve Amounts (Max that can be used for Spin) (MW)	180	120	0	0
Non-Spinning Reserve Amounts (Max that can be used for Non-Spin from Cold Start) (MW)	85	570	70	30

Mechanical Availability by Month: (Expected, or Guaranteed if Applicable)	Combined Cycle %	Simple Cylce %	Duct Firing %	Power Augmentation %
January	100%	100%	99%	98%
February	91%	91%	90%	89%
March	76%	76%	75%	74%
April	78%	78%	78%	77%
May	78%	78%	78%	77%
June	95%	95%	94%	93%
July	100%	100%	99%	98%
August	100%	100%	99%	98%
September	96%	96%	95%	95%
October	95%	95%	95%	94%
November	97%	97%	96%	96%
December	99%	100%	99%	98%

	Planned Outages by Month:	Combined Cycle %	Simple Cylce %	Duct Firing %	Power Augmentation %
YEAR 1	January	0%	0%	0%	0%
	February	0%	0%	0%	0%
	March	50%	50%	50%	50%
	April	0%	0%	0%	0%
	May	0%	0%	0%	0%
	June	0%	0%	0%	0%
	July	0%	0%	0%	0%
	August	0%	0%	0%	0%
	September	0%	0%	0%	0%
	October	0%	0%	0%	0%
	November	0%	0%	0%	0%
	December	0%	0%	0%	0%
YEAR 2	January	0%	0%	0%	0%
	February	0%	0%	0%	0%
	March	50%	50%	50%	50%
	April	0%	0%	0%	0%
	May	0%	0%	0%	0%
	June	0%	0%	0%	0%
	July	0%	0%	0%	0%
	August	0%	0%	0%	0%
	September	0%	0%	0%	0%
	October	0%	0%	0%	0%
	November	0%	0%	0%	0%
	December	0%	0%	0%	0%
AR 3	January	0%	0%	0%	0%
	February	0%	0%	0%	0%
	March	50%	50%	50%	50%
	April	0%	0%	0%	0%
	May	0%	0%	0%	0%
	June	0%	0%	0%	0%

Degradation Table: (Expected, or Guaranteed if Applicable)

Calendar Year	Combined Cycle Heat Rate (% Increase from Undegradated Value)	Combined Cycle Capacity (% Decrease from Undegradated Value)	Simple Cycle Heat Rate (% Increase from Undegradated Value)	Simple Cycle Capacity (% Decrease from Undegradated Value)	Duct Firing Heat Rate (% Increase from Undegradated Value)	Duct Firing Capacity (% Decrease from Undegradated Value)	Power Augmentation Heat Rate (% Increase from Undegradated Value)	Power Augmentation Capacity (% Decrease from Undegradated Value)
2009	0.9%	1.9%	0.8%	1.5%	0.0%	0.0%	0.0%	0.0%
2010	1.6%	3.3%	1.5%	3.0%	0.0%	0.0%	0.0%	0.0%
2011	1.8%	3.9%	1.8%	3.6%	0.0%	0.0%	0.0%	0.0%
2012	1.4%	2.9%	2.0%	4.0%	0.0%	0.0%	0.0%	0.0%
2013	1.7%	3.5%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%
2014	1.9%	4.0%	2.2%	4.5%	0.0%	0.0%	0.0%	0.0%
2015	0.9%	1.9%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%
2016	1.6%	3.3%	1.7%	3.4%	0.0%	0.0%	0.0%	0.0%
2017	1.8%	3.9%	1.8%	3.7%	0.0%	0.0%	0.0%	0.0%
2018	1.4%	2.9%	2.0%	4.0%	0.0%	0.0%	0.0%	0.0%
2019	1.7%	3.5%	2.2%	4.3%	0.0%	0.0%	0.0%	0.0%
2020	1.9%	4.0%	2.3%	4.7%	0.0%	0.0%	0.0%	0.0%
2021	0.9%	1.9%	2.5%	5.0%	0.0%	0.0%	0.0%	0.0%
2022	1.6%	3.3%	2.6%	5.1%	0.0%	0.0%	0.0%	0.0%
2023	1.8%	3.9%	0.8%	1.5%	0.0%	0.0%	0.0%	0.0%
2024	1.4%	2.9%	1.5%	3.0%	0.0%	0.0%	0.0%	0.0%
2025	1.7%	3.5%	1.8%	3.6%	0.0%	0.0%	0.0%	0.0%
2026	1.9%	4.0%	2.0%	4.0%	0.0%	0.0%	0.0%	0.0%
2027	0.9%	1.9%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%
2028	1.6%	3.3%	2.2%	4.5%	0.0%	0.0%	0.0%	0.0%
2029	1.8%	3.9%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%
2030	1.4%	2.9%	1.7%	3.4%	0.0%	0.0%	0.0%	0.0%
2031	1.7%	3.5%	1.8%	3.7%	0.0%	0.0%	0.0%	0.0%
2032	1.9%	4.0%	2.0%	4.0%	0.0%	0.0%	0.0%	0.0%
2033	0.9%	1.9%	2.2%	4.3%	0.0%	0.0%	0.0%	0.0%
2034	1.6%	3.3%	2.3%	4.7%	0.0%	0.0%	0.0%	0.0%
2035	1.8%	3.9%	2.5%	5.0%	0.0%	0.0%	0.0%	0.0%
2036	1.4%	2.9%	2.6%	5.1%	0.0%	0.0%	0.0%	0.0%
2037	1.7%	3.5%	0.8%	1.5%	0.0%	0.0%	0.0%	0.0%
2038	1.9%	4.0%	1.5%	3.0%	0.0%	0.0%	0.0%	0.0%
2039	0.9%	1.9%	1.8%	3.6%	0.0%	0.0%	0.0%	0.0%
2040	1.6%	3.3%	2.0%	4.0%	0.0%	0.0%	0.0%	0.0%
2041	1.8%	3.9%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%
2042	1.4%	2.9%	2.2%	4.5%	0.0%	0.0%	0.0%	0.0%
2043	1.7%	3.5%	2.1%	4.3%	0.0%	0.0%	0.0%	0.0%

Heat Rate (Btu/KWh Undegradated @ Avg. Temp.) at:	Combined Cycle	Simple Cycle	Duct Fire	Power Augmentation
20% of Capacity	12,421	26,551	12,773	15,967
40% of Capacity	9,225	15,967	11,466	14,332
60% of Capacity	8,161	12,698	10,158	12,698
80% of Capacity	7,629	11,258	9,583	11,978
100% of Capacity	7,311	10,550	9,007	11,258

Undegradated Heat Rate & Capacity	Combined Cycle Undegradated Heat Rate Temperature Adjusted for Specific Site (Btu/KWh)	Combined Cycle Undegradated Capacity Temperature Adjusted for Specific Site (MW)	Simple Cycle Undegradated Heat Rate Temperature Adjusted for Specific Site (Btu/KWh)	Simple Cycle Undegradated Capacity Temperature Adjusted for Specific Site (MW)	Duct Fire Undegradated Heat Rate Temperature Adjusted for Specific Site (Btu/KWh)	Duct Fire Undegradated Capacity Temperature Adjusted for Specific Site (MW)	Power Augmentation Undegradated Heat Rate Temperature Adjusted for Specific Site (Btu/KWh)	Power Augmentation Undegradated Capacity Temperature Adjusted for Specific Site (MW)
January	7,191	429	10,415	294	9,302	65	11,825	30
February	7,185	426	10,430	291	9,319	66	11,804	30
March	7,179	420	10,457	287	9,340	66	11,777	30
April	7,176	407	10,494	278	9,357	67	11,756	30
May	7,179	398	10,542	273	9,366	68	11,745	29
June	7,189	402	10,526	276	9,395	67	11,709	29
July	7,206	397	10,562	273	9,511	67	11,565	28
August	7,201	398	10,555	273	9,483	67	11,599	28
September	7,188	404	10,518	277	9,374	67	11,734	29
October	7,177	403	10,514	276	9,362	68	11,749	30
November	7,179	415	10,453	284	9,338	66	11,780	30
December	7,188	422	10,420	289	9,308	65	11,818	30
Min. Capacity & Corresponding Heat Rate	7,975	268	12,850	164	N/A	N/A	N/A	N/A

Capital Expenditures (see definition)	
Calendar Year	$ Nominal
2006	
2007	
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	
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2036	
2037	
2038	
2039	
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2042	
2043	

YE	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 4	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 5	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 6	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 7	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 8	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 9	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 10	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 11	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 12	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 13	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 14	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
EAR 15	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%

YE	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 16	January		0%	0%	0%	0%
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	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 17	January		0%	0%	0%	0%
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	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 18	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 19	January		0%	0%	0%	0%
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	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 20	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 21	January		0%	0%	0%	0%
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	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 22	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 23	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 24	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 25	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 26	January		0%	0%	0%	0%
	February		50%	50%	50%	50%
	March		0%	0%	0%	0%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 27	January		0%	0%	0%	0%
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	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%

	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 28	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 29	January		0%	0%	0%	0%
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	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 30	January		0%	0%	0%	0%
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	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 31	January		0%	0%	0%	0%
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	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 32	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 33	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 34	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%
YEAR 35	January		0%	0%	0%	0%
	February		0%	0%	0%	0%
	March		50%	50%	50%	50%
	April		0%	0%	0%	0%
	May		0%	0%	0%	0%
	June		0%	0%	0%	0%
	July		0%	0%	0%	0%
	August		0%	0%	0%	0%
	September		0%	0%	0%	0%
	October		0%	0%	0%	0%
	November		0%	0%	0%	0%
	December		0%	0%	0%	0%

Form 2

RFP 2009
FORM 2
PERMITTING AND CONSTRUCTION MILESTONES
September 2005

RFP 2009
FORM 2
PERMITTING AND CONSTRUCTION MILESTONES

Milestone	Date
Notice to Proceed	
Secure Property	
Secure Water Rights	
Secure ERCs	
Secure Permits	
Natural Gas Interconnection Agreement	
Complete LGIA with PacifiCorp	
Break Ground	
P/O for CTs, Xfrmr's, Cooling Tower/Condenser/ACC HRSGs and ST	
Begin Pouring of Foundations	
Delivery of HRSG1	
Delivery of HRSG2	
Set ST	
Set CT1	
Set CT2	
Complete Natural Gas Interconnect	
Set Main Transformers	
Backfeed (at Transmission Level)	
First Fire of CT1	
First Fire of CT2	
Synchronization to Grid	
Complete installation of Cooling Towers/ACC	
Completion of Steam Blows	
Roll ST	
Begin Performance Testing	
Substantial Completion	
Final Acceptance	

Attachment 20

RFP 2009
ATTACHMENT 20
WASHINGTON AVOIDED COST INFORMATION
July 2005

PacifiCorp's Avoided Cost Calculation

Washington – July 2005

The starting point for the avoided cost calculation is the load and resource balances developed in conjunction with the Company's Integrated Resource Plan (IRP) filed in Washington in January 2005. It should be noted that the input assumptions for the IRP were fixed in August 2004, in order to enable completion of the IRP in early 2005. Due to the age of the input assumptions, many of the inputs have been updated for known changes for purposes of this avoided cost calculation.

Loads and Resources

The load forecast included in the 2004 IRP was developed in early 2004. Due to the age of the forecast, it was replaced with a more current forecast dated February 2005.

Long-term sales and purchase contracts were also updated to include information available as of April 2005. These changes include the addition or revision of several long-term purchase contracts[1].

Table 1 presents the Company's loads and resource balance. Table 1 shows an energy surplus of 29 aMW in 2005 increasing to 146 aMW in 2008 and falling to a deficit of 315 aMW in 2010. Summer peak capacity shows a growing deficit throughout the test period, increasing from a deficit of 561 MW in 2005 to 2,406 MW in 2010. The winter peak capacity varies over the test period with a maximum capacity surplus of 513 MW in 2008 and a minimum capacity surplus of 65 MW in 2010.

Avoided Cost Calculation

Based on the loads and resource balance shown in Table 1, the avoided cost calculation is separated into two distinct periods: (1) the Short Run – a period of resource sufficiency (2005-2009) in which the avoided costs are based on the marginal production cost of existing resources plus the cost of purchasing summer capacity; and (2) the Long Run – a resource deficit period (2010 and beyond) in which new resources are required to provide both summer and winter capacity and energy to meet the Company's resource requirements. Avoided costs during the deficit period are based on the cost of a combined cycle combustion turbine.

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[1] Significant additions and revisions to the long-term contracts portfolio include Purchase Power Agreement with Duke Energy Trading & Marketing, Arizona Public Services, Constellation Power Source Inc., UBS AG, Deseret Power LP (QF), ExxonMobil Production Co. (QF), Kennecott Utah Copper Corp. (QF), Magnesium Corporation of America (QF), PowerEx and Tesoro Refining (QF).

1. Short Run Avoided Costs

During periods of resource sufficiency, the Company's avoided energy costs are based on the displacement of purchased power and existing thermal resources calculated by the Company's GRID model. The model input data includes the monthly load and resource data, which are the basis for the annual summary of loads and resources shown in Table 1. To calculate short-run avoided costs, two production cost studies are prepared. The only difference between the two studies is an assumed fifty (50) average megawatt increase, zero running cost system resource. The 50 average megawatt resource is a proxy for qualifying facility generation. The avoided energy cost is the difference between the studies. The outputs of the production cost model run are provided as Table 2.

Summer capacity costs in this period are based on three-month capacity purchases. The annual value as shown in Table 3 is one-fourth of the capacity cost of a simple cycle combustion turbine (SCCT).

2. Long Run Avoided Costs

During periods of resource deficit, the avoided costs are the fixed and variable costs of the planned resource that could be avoided or deferred. For this purpose, the Company uses a combined cycle combustion turbine (CCCT) as a proxy of future resource costs.

Since CCCTs are built as base load units that provide both capacity and energy, it is appropriate to split the fixed costs of this unit into capacity and energy components. The fixed cost of a SCCT, which is usually acquired as a capacity resource, defines the portion of the fixed cost of the CCCT that is assigned to capacity. Fixed costs associated with the construction of a CCCT which are in excess of SCCT costs are assigned to energy and are added to the variable production (fuel) cost of the CCCT to determine the total avoided energy costs. Table 3 shows this calculation.

The fuel cost of the CCCT defines the avoided variable energy costs. The gas price forecast used as the basis for the CCCT fuel cost is discussed later in this document. Table 4 shows the CCCT fuel cost, the addition of capitalized energy costs at an assumed 48% capacity factor and the total avoided energy costs.

Also, because energy generated by a qualifying facility may vary, we have prepared total avoided costs at 75%, 85% and 95% capacity factor to illustrate the impact of differing generation levels. This calculation is shown in Table 5.

Avoided energy costs can be differentiated between on-peak and off-peak periods. To make this calculation, the Company assumed that all capacity costs are incurred to meet on-peak load requirements. On an annual basis, approximately 57% of all hours are on-peak and 43% are off-peak. Table 6 shows the calculation of on-peak and off-peak avoided energy prices.

For informational purposes, Table 7 shows a comparison between the avoided costs currently in effect in Washington and the proposed avoided costs in this filing.

Table 8 shows the calculation of the total fixed costs and fuel costs that are used in Table 3 and Table 4.

Gas Price Forecast

Gas prices used in this filing were developed by the Company's Market Price Steering Committee and represent the Company's "Official Market Price Projections." The Market Price Steering Committee developed three different scenarios that represent a reasonable range of future market prices. The medium future titled "Base Case" was used in this calculation.

The Official Forward Gas Curve consists of a blend of the March 31, 2005 market gas curve and the gas prices used in the Company's market price clearing model (Midas) to produce the power curve. (The Midas curve prices were completed on March 18, 2005.) The proportions used in this blending are shown in the table below.

	Market	Midas
Through April, 2011	100%	0%
May 2011-April 2012	50%	50%
After May 2012	0%	100%

Table 9 shows the natural gas price used in this avoided cost calculation.

Table 1
Loads and Resources
Calendar Years 2005 through 2010

	2005	2006	2007	2008	2009	2010
aMW						
Net Load	6,324	6,509	6,669	6,827	6,991	7,129
Long Term Sales	562	498	359	331	261	226
Short Term Firm Sales	1,536	819	556	37	-	-
Total Requirements	8,422	7,827	7,585	7,195	7,252	7,355
Long Term Purchases	1,483	1,493	1,346	933	923	837
Short Term Firm Purchase	1,066	225	28	-	14	-
Thermal Generation	5,563	5,779	6,003	6,102	6,087	6,008
Other Generation	502	536	541	536	528	526
Reserves	(163)	(136)	(238)	(231)	(233)	(331)
Total Resources after Reserves	8,451	7,898	7,680	7,340	7,319	7,040
Surplus / (Deficit)	29	71	95	146	66	(315)
Percent Surplus / (Deficit)	0.3%	0.9%	1.2%	2.0%	0.9%	-4.3%
Peak (Summer)	August	July	July	July	July	July
Net Load	8,430	8,841	9,094	9,424	9,718	10,072
Long Term Sales	844	839	556	518	409	373
Short Term Firm Sales	969	475	312	37	-	-
Total Requirements	10,244	10,154	9,962	9,979	10,127	10,445
Long Term Purchases	2,089	1,957	1,648	1,473	1,482	1,391
Short Term Firm Purchase	1,025	575	200	-	100	-
Thermal Generation	6,478	6,697	7,193	7,009	7,009	7,009
Other Generation	645	639	639	630	621	616
Reserves	(553)	(577)	(935)	(889)	(889)	(977)
Total Resources after Reserves	9,683	9,290	8,745	8,223	8,323	8,039
Surplus / (Deficit)	(561)	(864)	(1,217)	(1,756)	(1,804)	(2,406)
Percent Surplus / (Deficit)	-5.5%	-8.5%	-12.2%	-17.6%	-17.8%	-23.0%
Peak (December)						
Net Load	7,771	8,027	8,247	8,457	8,651	8,909
Long Term Sales	817	503	500	465	356	320
Short Term Firm Sales	944	1,100	312	37	-	-
Total Requirements	9,532	9,630	9,060	8,960	9,007	9,230
Long Term Purchases	2,516	2,542	2,149	2,370	2,317	2,284
Short Term Firm Purchase	513	300	-	-	-	-
Thermal Generation	6,537	6,768	7,303	7,113	7,113	7,113
Other Generation	880	857	893	885	885	879
Reserves	(523)	(576)	(937)	(895)	(891)	(982)
Total Resources after Reserves	9,923	9,892	9,408	9,473	9,424	9,294
Surplus / (Deficit)	391	261	349	513	416	65
Percent Surplus / (Deficit)	4.1%	2.7%	3.8%	5.7%	4.6%	0.7%

Table 2
Avoided Costs ($/MWH)
Non-Firm Energy

Year	Winter Season					Summer Season				Winter Season		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Non-Firm Energy												
2005	43.38	42.73	46.94	51.75	50.28	54.99	62.63	66.16	64.58	60.06	62.76	63.22
2006	70.31	66.79	58.60	51.62	43.24	39.88	57.12	64.14	63.94	55.16	57.24	61.37
2007	64.08	62.01	55.82	50.38	38.17	35.67	53.60	62.43	59.35	51.89	53.93	58.68
2008	60.10	57.42	51.26	46.55	36.53	34.25	49.82	58.09	55.67	47.87	49.79	54.92
2009	56.96	54.88	48.19	43.41	33.40	31.40	46.68	54.95	52.53	44.73	46.66	51.78

Annual Seasonal Average

	Winter Season	Summer Season	Annual Average
2005	$52.64	$62.09	$55.79
2006	$58.04	$56.27	$57.45
2007	$54.37	$52.76	$53.83
2008	$50.55	$49.46	$50.19
2009	$47.50	$46.39	$47.13

Source GRID Production Cost Study

Table 3
Capitalized Energy Costs

Year	Combined Cycle CT Fixed Costs ($/kW-yr)	Simple Cycle CT Fixed Costs ($/kW-yr)	Months Included in Capacity Costs	Capitalized Energy Costs ($/kW-yr)	Capitalized Energy Costs 48% CF ($/MWH)
	(a)	(b)	(c)	(d) ((a) - (b))	(d) (d)/(8.760 x 48%)
Avoided Resource					
2005		$18.16	3		
2006		$18.53	3		
2007		$18.90	3		
2008		$19.28	3		
2009		$19.67	3		
Combined Cycle					
2010	$84.18	$80.27		$3.91	$0.93
2011	$86.66	$82.63		$4.02	$0.96
2012	$89.20	$85.06		$4.14	$0.98
2013	$91.83	$87.56		$4.26	$1.01
2014	$94.53	$90.14		$4.39	$1.04
2015	$97.31	$92.79		$4.52	$1.07
2016	$100.17	$95.52		$4.65	$1.11
2017	$103.11	$98.33		$4.79	$1.14
2018	$106.14	$101.22		$4.93	$1.17
2019	$109.26	$104.19		$5.07	$1.21
2020	$112.48	$107.26		$5.22	$1.24
2021	$116.91	$111.48		$5.43	$1.29
2022	$121.51	$115.87		$5.64	$1.34
2023	$126.30	$120.44		$5.86	$1.39
2024	$131.28	$125.18		$6.09	$1.45
2025	$136.45	$130.12		$6.33	$1.51
2026	$141.83	$135.24		$6.58	$1.57
2027	$147.41	$140.57		$6.84	$1.63
2028	$153.22	$146.11		$7.11	$1.69

Columns

(a) Table 8 Column (f)
(b) Table 8 Column (f)
(c) Three Month Summer Purchase
(d) 48% CF - Table 8 (CCCT Statistics (Utah S Mona))

Table 4
Total Avoided Energy Cost

Year	Combined Cycle Gas Price ($/MMBtu)	Combined Cycle Energy Cost ($/MWH)	Capitalized Energy Costs 48% CF ($/MWH)	Total Avoided Energy Cost ($/MWH)
	(a)	(b)	(c)	(d) (b) + (c)
Avoided Resource				
2005				$55.79
2006				$57.45
2007				$53.83
2008				$50.19
2009				$47.13
Combined Cycle		(a) x 7.599		
2010	$5.54	$42.10	$0.93	$43.03
2011	$5.89	$44.76	$0.96	$45.71
2012	$6.59	$50.08	$0.98	$51.06
2013	$6.90	$52.43	$1.01	$53.45
2014	$6.93	$52.66	$1.04	$53.70
2015	$7.03	$53.42	$1.07	$54.49
2016	$7.21	$54.79	$1.11	$55.89
2017	$7.39	$56.16	$1.14	$57.29
2018	$7.56	$57.45	$1.17	$58.62
2019	$7.76	$58.97	$1.21	$60.17
2020	$7.96	$60.49	$1.24	$61.73
2021	$8.16	$62.01	$1.29	$63.30
2022	$8.37	$63.60	$1.34	$64.94
2023	$8.58	$65.20	$1.39	$66.59
2024	$8.79	$66.80	$1.45	$68.24
2025	$9.02	$68.54	$1.51	$70.05
2026	$9.25	$70.29	$1.57	$71.86
2027	$9.48	$72.04	$1.63	$73.67
2028	$9.72	$73.86	$1.69	$75.55

Columns

(a) Table 9 Column (d)
(c) Table 3 Column (d)
(d) For 2005-2010 Table 2

Table 5
Total Avoided Cost

Year	Avoided Firm Capacity Costs	Total Avoided Energy Cost	Total Avoided Costs At Stated Capacity Factor		
			75%	85%	90%
	($/kW-yr)	($/MWH)	($/MWH)	($/MWH)	($/MWH)
	(a)	(b)	(c)	(d)	(e)
			(b)+((a)/8.76 x 0.75)	(b)+((a)/8.76 x 0.85)	(b)+((a)/8.76 x 0.9)
Avoided Resource					
2005	$18.16	$55.79	$58.55	$58.23	$58.09
2006	$18.53	$57.45	$60.27	$59.94	$59.80
2007	$18.90	$53.83	$56.71	$56.37	$56.23
2008	$19.28	$50.19	$53.12	$52.78	$52.63
2009	$19.67	$47.13	$50.12	$49.77	$49.62
Combined Cycle					
2010	$80.27	$43.03	$55.25	$53.81	$53.21
2011	$82.63	$45.71	$58.29	$56.81	$56.20
2012	$85.06	$51.06	$64.01	$62.49	$61.85
2013	$87.56	$53.45	$66.77	$65.21	$64.55
2014	$90.14	$53.70	$67.42	$65.81	$65.14
2015	$92.79	$54.49	$68.62	$66.96	$66.26
2016	$95.52	$55.89	$70.43	$68.72	$68.01
2017	$98.33	$57.29	$72.26	$70.50	$69.77
2018	$101.22	$58.62	$74.03	$72.21	$71.46
2019	$104.19	$60.17	$76.03	$74.17	$73.39
2020	$107.26	$61.73	$78.05	$76.13	$75.33
2021	$111.48	$63.30	$80.27	$78.27	$77.44
2022	$115.87	$64.94	$82.58	$80.51	$79.64
2023	$120.44	$66.59	$84.93	$82.77	$81.87
2024	$125.18	$68.24	$87.30	$85.06	$84.12
2025	$130.12	$70.05	$89.85	$87.52	$86.55
2026	$135.24	$71.86	$92.44	$90.02	$89.01
2027	$140.57	$73.67	$95.06	$92.54	$91.50
2028	$146.11	$75.55	$97.79	$95.18	$94.09

Columns
- (a) Table 3 Column (b)
- (b) Table 4 Column (d)

Table 6
On- & Off- Peak Energy Prices

Year	Avoided Firm Capacity Costs	Total Avoided Energy Cost	Capacity Cost Allocated to On-Peak Hours	On-Peak 4,993 Hours	Off-Peak 3,767 Hours
	($/kW-yr)	($/MWH)	($/MWH)	($/MWH)	($/MWH)
	(a)	(b)	(c)	(d)	(e)
			(a) /(8.76 x 84.2% x 57%)	(b) + (c)	(b)
Avoided Resource					
2005	$18.16	$55.79	$4.32	$60.11	$55.79
2006	$18.53	$57.45	$4.41	$61.86	$57.45
2007	$18.90	$53.83	$4.50	$58.33	$53.83
2008	$19.28	$50.19	$4.59	$54.77	$50.19
2009	$19.67	$47.13	$4.68	$51.81	$47.13
Combined Cycle					
2010	$80.27	$43.03	$19.09	$62.12	$43.03
2011	$82.63	$45.71	$19.65	$65.37	$45.71
2012	$85.06	$51.06	$20.23	$71.29	$51.06
2013	$87.56	$53.45	$20.83	$74.27	$53.45
2014	$90.14	$53.70	$21.44	$75.14	$53.70
2015	$92.79	$54.49	$22.07	$76.57	$54.49
2016	$95.52	$55.89	$22.72	$78.61	$55.89
2017	$98.33	$57.29	$23.39	$80.68	$57.29
2018	$101.22	$58.62	$24.07	$82.69	$58.62
2019	$104.19	$60.17	$24.78	$84.96	$60.17
2020	$107.26	$61.73	$25.51	$87.24	$61.73
2021	$111.48	$63.30	$26.52	$89.81	$63.30
2022	$115.87	$64.94	$27.56	$92.51	$64.94
2023	$120.44	$66.59	$28.65	$95.24	$66.59
2024	$125.18	$68.24	$29.78	$98.02	$68.24
2025	$130.12	$70.05	$30.95	$101.00	$70.05
2026	$135.24	$71.86	$32.17	$104.02	$71.86
2027	$140.57	$73.67	$33.44	$107.10	$73.67
2028	$146.11	$75.55	$34.75	$110.31	$75.55

Columns
- (a) Table 3 Column (b)
- (b) Table 4 Column (d)
- (c) Table 8 84.2% is the on-peak capacity factor

Table 7
Comparison between Proposed and Current Avoided Costs

Year	Total Avoided Costs at 85% CF		
	Proposed Avoided Costs ($/MWH)	Washington Approved Avoided Costs ($/MWH)	Difference ($/MWH)
	(a)	(b)	(c) (a) - (b)
2005	$58.23	$36.25	$21.98
2006	$59.94	$36.59	$23.34
2007	$56.37	$43.28	$13.09
2008	$52.78	$44.23	$8.55
2009	$49.77	$43.97	$5.81
2010	$53.81	$42.01	$11.80
2011	$56.81	$41.30	$15.51
2012	$62.49	$42.52	$19.97
2013	$65.21	$43.75	$21.46
2014	$65.81	$41.12	$24.69
2015	$66.96	$42.07	$24.89
2016	$68.72	$44.25	$24.47
2017	$70.50	$46.29	$24.21
2018	$72.21	$47.53	$24.68
2019	$74.17	$48.86	$25.31
2020	$76.13	$50.25	$25.89
2021	$78.27	$50.70	$27.57
2022	$80.51	$52.03	$28.47
2023	$82.77	$53.43	$29.34
2024	$85.06	$54.86	$30.19
2025	$87.52	$56.42	$31.10
2026	$90.02	$57.99	$32.03
2027	$92.54	$59.57	$32.97
2028	$95.18		

Columns

(a) Table 5 Column (d)

(b) Avoided Costs Approved by the Commission 3/22/2004

Table 8
Total Cost of Gas Turbine Resources

Year	Estimated Capital Cost $/kW	Fixed Capital Cost at Real Levelized Rate $/kW-yr	Fixed O&M $/kW-yr	Variable O&M $/MWH	Total O&M at Expected CF $/kW-yr	Total Resource Fixed Costs $/kW-yr	Fuel Cost $/MMBtu	Fuel Cost $/MWH	Total Avoided Costs $/MWH
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Simple Cycle (UT IC Aero SCCT)									
2004	$590	$52.98	$8.11	$7.21	$18.22	$71.20			
2005		$54.05	$8.27	$7.36	$18.58	$72.64			
2006		$55.14	$8.44	$7.50	$18.96	$74.10			
2007		$56.26	$8.61	$7.66	$19.34	$75.60			
2008		$57.39	$8.79	$7.81	$19.73	$77.13			
2009		$58.55	$8.96	$7.97	$20.13	$78.68			
2010		$59.74	$9.14	$8.13	$20.54	$80.27			
2011		$61.49	$9.41	$8.37	$21.14	$82.63			
2012		$63.30	$9.69	$8.61	$21.76	$85.06			
2013		$65.16	$9.97	$8.87	$22.40	$87.56			
2014		$67.08	$10.27	$9.13	$23.06	$90.14			
2015		$69.05	$10.57	$9.40	$23.74	$92.79			
2016		$71.08	$10.88	$9.67	$24.44	$95.52			
2017		$73.17	$11.20	$9.96	$25.16	$98.33			
2018		$75.32	$11.53	$10.25	$25.90	$101.22			
2019		$77.53	$11.87	$10.55	$26.66	$104.19			
2020		$79.81	$12.22	$10.86	$27.44	$107.26			
2021		$82.96	$12.70	$11.29	$28.52	$111.48			
2022		$86.23	$13.20	$11.73	$29.65	$115.87			
2023		$89.63	$13.72	$12.20	$30.81	$120.44			
2024		$93.16	$14.26	$12.68	$32.03	$125.18			
2025		$96.83	$14.82	$13.18	$33.29	$130.12			
2026		$100.64	$15.41	$13.70	$34.60	$135.24			
2027		$104.61	$16.01	$14.24	$35.96	$140.57			
2028		$108.73	$16.64	$14.80	$37.38	$146.11			

Table 8
Total Cost of Gas Turbine Resources

Year	Estimated Capital Cost $/kW	Fixed Capital Cost at Real Levelized Rate $/kW-yr	Fixed O&M $/kW-yr	Variable O&M $/MWH	Total O&M at Expected CF $/kW-yr	Total Resource Fixed Costs $/kW-yr	Fuel Cost $/MMBtu	Fuel Cost $/MWH	Total Avoided Costs $/MWH
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
Combined Cycle									
2004	$587	$46.55	$5.66	$5.34	$28.11	$74.66			
2005		$47.49	$5.77	$5.45	$28.68	$76.17	$ 7.62	$ 57.90	76.02
2006		$48.45	$5.89	$5.56	$29.26	$77.71	$ 7.40	$ 56.23	74.71
2007		$49.43	$6.01	$5.67	$29.85	$79.28	$ 6.80	$ 51.67	70.53
2008		$50.43	$6.13	$5.78	$30.45	$80.88	$ 6.30	$ 47.87	67.11
2009		$51.44	$6.26	$5.90	$31.07	$82.51	$ 5.91	$ 44.91	64.53
2010		$52.48	$6.38	$6.02	$31.70	$84.18	$ 5.54	$ 42.10	62.12
2011		$54.03	$6.57	$6.20	$32.63	$86.66	$ 5.89	$ 44.76	65.37
2012		$55.61	$6.76	$6.38	$33.59	$89.20	$ 6.59	$ 50.08	71.29
2013		$57.25	$6.96	$6.57	$34.58	$91.83	$ 6.90	$ 52.43	74.27
2014		$58.93	$7.17	$6.76	$35.59	$94.53	$ 6.93	$ 52.66	75.14
2015		$60.67	$7.38	$6.96	$36.64	$97.31	$ 7.03	$ 53.42	76.56
2016		$62.45	$7.59	$7.16	$37.72	$100.17	$ 7.21	$ 54.79	78.61
2017		$64.29	$7.82	$7.37	$38.83	$103.11	$ 7.39	$ 56.16	80.68
2018		$66.18	$8.05	$7.59	$39.97	$106.14	$ 7.56	$ 57.45	82.69
2019		$68.12	$8.28	$7.81	$41.14	$109.26	$ 7.76	$ 58.97	84.95
2020		$70.12	$8.53	$8.04	$42.35	$112.48	$ 7.96	$ 60.49	87.24
2021		$72.89	$8.86	$8.36	$44.02	$116.91	$ 8.16	$ 62.01	89.81
2022		$75.76	$9.21	$8.69	$45.75	$121.51	$ 8.37	$ 63.60	92.50
2023		$78.74	$9.57	$9.03	$47.56	$126.30	$ 8.58	$ 65.20	95.24
2024		$81.85	$9.95	$9.39	$49.43	$131.28	$ 8.79	$ 66.80	98.02
2025		$85.07	$10.34	$9.76	$51.38	$136.45	$ 9.02	$ 68.54	100.99
2026		$88.42	$10.75	$10.14	$53.40	$141.83	$ 9.25	$ 70.29	104.02
2027		$91.91	$11.18	$10.54	$55.51	$147.41	$ 9.48	$ 72.04	107.10
2028		$95.53	$11.62	$10.96	$57.69	$153.22	$ 9.72	$ 73.86	110.30

Table 8
Total Cost of Gas Turbine Resources

Sources, Inputs and Assumptions

Source: (a)(c)(d) Plant Costs - IRP Table C.28 (January 2005)
(b) = (a) x Payment Factor - IRP Table C.28 (January 2005)
(e) = (d) x (8.76 x 'Capacity Factor') + (c)
(f) = (b) + (e)
(g) Natural Gas Price Forecast ($/MMBtu)
(h) = 7599 x (g) / 1000
(i) = (f) / (8.76 x 'Capacity Factor') + (h)

SCCT Statistics	MW	Percent	Cap Cost	Fixed	Var	Heat Rate
Greenfield Intercooled Aero SCCT	87	100%	590	8.11	7.21	8,907

CCCT Statistics (Utah S Mona)	MW	Percent	Cap Cost	Fixed
Brownfield CCCT (Dry Cooling 2x1)	420	80%	682	6.01
Brownfield CCCT Duct Firing for Dry	105	20%	207	4.28
Capacity Weighted	525	100%	587	5.66

CCCT Statistics (Utah S Mona)	MW	CF	aMW	Percent	Var	Heat Rate
Brownfield CCCT (Dry Cooling 2x1)	420	56%	235	93%	5.50	7,462
Brownfield CCCT Duct Firing for Dry	105	16%	17	7%	3.06	9,512
Energy Weighted	525	48%	252	100%	5.34	7,599

SCCT	CCCT	
8.98%	7.93%	Payment Factor - IRP Table C.28 (January 2005)
16%	48%	Capacity Factor - IRP Table C.28 (January 2005)
	84.2%	Capacity Factor - On-peak 48% / 57% (percent of hours on-peak)
8,907	7,599	Heat Rate in btu/kWh - IRP Table C.28 (January 2005)

2.02%	2004-2010 Inflation Rate - 2004 IRP, Appendix C, Table C.1
2.94%	2011-2020 Inflation Rate - 2004 IRP, Appendix C, Table C.1
3.94%	2021-2030 Inflation Rate - 2004 IRP, Appendix C, Table C.1

Table 9
Natural Gas Price Forecast ($/MMBtu)

Year	PacifiCorp			
	Raw Fuel	Transport Cost	Distribution Cost	Combined Cycle CT Fuel Cost
	(a)	(b)	(c)	(d)
		(a) x .016 + 0.13	((a)+(b))x.015+0.09	(a) + (b) + (c)
2005	$7.18	$0.24	$0.20	$7.62
2006	$6.96	$0.24	$0.20	$7.40
2007	$6.38	$0.23	$0.19	$6.80
2008	$5.90	$0.22	$0.18	$6.30
2009	$5.51	$0.22	$0.18	$5.91
2010	$5.16	$0.21	$0.17	$5.54
2011	$5.49	$0.22	$0.18	$5.89
2012	$6.17	$0.23	$0.19	$6.59
2013	$6.48	$0.23	$0.19	$6.90
2014	$6.51	$0.23	$0.19	$6.93
2015	$6.60	$0.24	$0.19	$7.03
2016	$6.77	$0.24	$0.20	$7.21
2017	$6.95	$0.24	$0.20	$7.39
2018	$7.12	$0.24	$0.20	$7.56
2019	$7.31	$0.25	$0.20	$7.76
2020	$7.50	$0.25	$0.21	$7.96
2021	$7.70	$0.25	$0.21	$8.16
2022	$7.90	$0.26	$0.21	$8.37
2023	$8.10	$0.26	$0.22	$8.58
2024	$8.31	$0.26	$0.22	$8.79
2025	$8.53	$0.27	$0.22	$9.02
2026	$8.75	$0.27	$0.23	$9.25
2027	$8.98	$0.27	$0.23	$9.48
2028	$9.21	$0.28	$0.23	$9.72

Columns

(a) Official Price Forecast March 31, 2005 - Opal Index

		Shrinkage	Fees
(b)	Transport Cost	0.016	0.13
(c)	Distribution Cost	0.015	0.09