APPENDIX 2C

Project Design Basis

1. DESIGN BASIS

The Project Technical Requirements provide specific criteria for the Vacaville Energy Center Project. These criteria are minimum requirements.

1.1 Overall Facility Configuration

The project will be a 2 x 1 combined cycle facility consisting of two (2) combustion turbine generators (CTG's), two (2) heat recovery steam generators (HRSG's) equipped with duct burners, one (1) steam turbine generator (STG) with a multi-cell mechanical draft cooling tower, and associated auxiliary systems and equipment.

The CTG's and STG will be located outdoors with water proof enclosures provided by the respective supplier.

The combustion turbine generators utilized will be General Electric 7F, Siemens or other acceptable technology.

The CTG's and duct burners will be fueled by pipeline-quality natural gas only. Three, 50% natural gas compressors will be provided for pressure augmentation.

Power will be generated in the CTG's and stepped up through a individual two-winding main transformer to the utility grid at 230 kV. Low side generator breakers will be supplied for both CT generators.

The CTG's will be equipped with dry low-NOx (DLN) combustors and inlet air evaporative coolers.

The CTG's will exhaust to Heat Recovery Steam generators (HRSG) which include aqueous ammonia type SCR systems for NOx and CO control. Catalysts for both NOx and CO will be included in the HRSG system for the reduction of harmful air emissions at the stack. Two (2) Continuous Emissions Monitoring (CEMs) systems will be provided.

The project will be designed as an outdoor plant with major equipment located outdoors. The following buildings are included.

- Water Treatment Building
- Switchyard Control Building
- ZLD System Building
- Administration/Warehouse Building
- Cooling Tower Chemical Feed Building
- Power Distribution Centers (PDC)

- (2) CEMS buildings

The plant will be designed for an expected reliability of 92-96 percent over a 30-year life.

Site layout and design, including underground utilities, will be done to accommodate future noise barrier walls along with their foundations, to be located at exhaust duct inlet transition, and all four sides of the gas compressor.

1.2 Operating Mode and Basic Philosophy

- Operational flexibility and high reliability are of paramount importance.
- The plant will be designed to run on a continuous basis between maximum plant output and the minimum load at which emissions guarantees are met which is typically 50% of a CTG output. In other words, to be emissions compliant, each of the CTG's will be required to generate at least 50% of the machine capability to be emissions compliant.
- The plant will be designed to achieve short duration starts from initiation of starting sequence to full load.
- The plant will not be designed to generate electricity while isolated from the utility grid. The anticipated number of operating hours per year is 5,000.
- The BOP equipment and systems will be designed to support the start up times listed above.
- The plant control system design will be based on a Distributed Control System (DCS) utilizing both discrete I/O as well as dedicated packaged equipment PLCs such as separate PLC's for gas compressors, CEMS, and air compressors.
- The CTG's, STG, and other BOP equipment will be operated primarily from a work station in the main plant control room located in the administration building.
- The power block will be designed so that it can be started and operated at any load by a single operator.

1.3 Redundancy in Design

Standby components will be provided for key auxiliary components that would cause an electrical production shut down by their failure. The stand by component will be installed and kept in a ready status for immediate service.

Specific Minimum Redundancy Requirements for Equipment:

COMPONENT	NUMBER OF COMPONENTS REQUIRED
Aux Cooling Water Pump	1 x 100%
Steam Jet Air Ejectors	1x100% Hogger 2x100% Holding Trains
Ammonia Tanks	1 x 24,000 gal
Ammonia Forwarding Pumps	N/A
Auxiliary Boiler and Feed Pump	1 x 100%
Boiler Feedwater Pumps	2 x 100% per HRSG (based on non-duct fired performance)
Closed Cooling Water Pumps	2 x 100%
Closed Cooling Water Heat Exchangers	2 x 100%
Condensate Pumps	3 x 50%
Circulating Water Pumps	2 x 50%
Demineralized Water Pumps	3 x 50%
Dew Point Heater (if required)	1 x 100%
Primary Fuel Gas Scrubber/Filter-Separator/Drains Tank Skids	1 x 100%
Final Performance Heater/ KO Drum Skid (by OEM)	1 x 100% per CTG
Filter-Separator Skids (main and pilot filters) (by OEM)	2 x 50% (main)/CTG 2 x 50% (pilot)/CTG
Diesel Fire Pump	1 x 100%
Electric Fire Pump	1 x 100%
Jockey Fire Pump	1 x 100%
Air Compressors/Dryers	2 x 100%
Service Water Pumps	3 x 50%
Oil/Water Separator	1 x 100%
Sump Pumps	2 x 100% Per Sump
Lubricating Oil Pumps (AC)	2 x 100% per Turbogenerator (Part of OEM Package)
Lubricating Oil Pump (DC)	1 x 100% per Turbogenerator (Part of OEM Package)

COMPONENT	NUMBER OF COMPONENTS REQUIRED
Lube Oil Coolers	2 x 100% per Turbogenerator (Part of OEM Package)
Unit Auxiliary Transformers	2 x 100%
Battery Chargers	2 x 100% per Battery Bank
Uninterruptible Power Supply	1 x 100%
Station Battery (CTGs come with their own)	1 x 100% (covers STG, DCS, BOP, etc.)

1.4 Site-Specific Design Conditions

Location	Vacaville, CA
Project Name	Competitive Power Ventures, Vacaville
Site Conditions	
Max Dry Bulb (based on 1%)	94.9
Coincident Wet Bulb (based on 1%)	66.9
Design Wet Bulb (based on 1%)	68.6
Winter Dry Bulb (based on 1%)	34.4
Elevation (feet above mean sea level)	63
Precipitation	
Annual Average, in	25.3
Maximum Monthly Average, in	5.57
Minimum Monthly Average, in	0.03
24 hr. Maximum, 100 Year Storm, in	7.5
Monthly Average (April through September), inches	0.43
Wind Loading	
Design Code	CBC 2007
Basic Wind Speed, V (Figure 1609, CBC 2007)	85 mph[1]
Occupancy Category (Table 1604.5, CBC 2007)	III
Exposure Category (Section 1609.4, CBC 2007)	C
Importance Factor, I (Table 6-1, ASCE 7-05)	1.15
Seismic	
Design Code	CBC 2007
Site Class (Table 1613.5.2, CBC 2007)	D[2]
Occupancy Category (Table 1604.5, CBC 2007)	III
Maximum Considered Earthquake Ground Motion, Short Period (CBC 2007)	Ss = 1.91g [2]
Maximum Considered Earthquake Ground Motion, 1 Second Period (CBC 2007)	S_1 = 0.60g [2]

Site Coefficient, F_a (Table 1613.5.3(1), CBC 2007)	$F_a = 1.00$[2]
Site Coefficient, F_v (Table 1613.5.3(2), CBC 2007)	$F_v = 1.50$[2]
Seismic Design Category (Tables 1613.5.6(1) and 1613.5.6(2), CBC 2007)	D[2]
Seismic Importance Factor, I (Table 11.5-1, ASCE 7-05)	1.25[3]

[1] To be confirmed by the Solano County Building Department
[2] To be confirmed by final Geotechnical Report
[3] Except for structures related to Fire safety and Hazardous material, Importance Factor should be 1.25

1.5 Air Emission Limitations

The plant design is based on being able to meet the following proposed emission limits for the CTG/SCR excluding startup and shutdown periods. Final emissions limits for continuous operation, startup and shutdown of the CTG, as well as emissions limits for the emergency generator, will be defined in the site-specific air permits.

Controlled Constituent	Units	Stack Permit Limit for Natural Gas Operation
NOx	ppmvd @15% 02	2.0
CO	ppmvd @15% 02	3.0
VOC	ppmvd @15% 02	2.0
NH_3 slip	ppmvd @15% 02	5.0
Particulates (PM10)	Lb/hr	5.0

1.6 Fuel Gas

Pipeline-quality natural gas will be provided by PG&E, with site-specific tie in points to be determined. The gas piping from the gas utility interconnection point to the generating equipment will be part of power plant design and construction scope.

1.7 Water Supply

1.7.1 Raw Water Supply

Raw water for each site will be “Title 22” water obtained from the local water treatment plant located adjacent to the power plant.

1.7.2 Plant Wastewater

The facility waste water streams will be collected at various locations throughout the plant and transferred to the Recovered Waste Water Tank. The Recovered Waste Water Tank then discharges to the cooling tower as make up water. Cooling tower blow down is then sent to be treated at the Zero Liquid Discharge System (ZLD) within the facility. The effluent of the ZLD's clean/purge water is then returned to the Westerly Waste Water Treatment Facility.

1.7.3 Stormwater Runoff

Storm water run off is collected at various locations throughout the facility in drainage sumps. Pumping systems within the sumps transfer water to the storm water retention basin located at the eastern side of the facility.

1.8 Noise Limits

Project far field noise levels will meet local ordinance requirements of 60 dBA at the property line of the facility. Equipment noise mitigation features will be accounted for in the plant design as required to meet LORS.

1.9 Subsurface Conditions

It is not expected that hazardous materials will be encountered during site excavation as the site has been primarily used for agriculture. Full subsurface conditions can be found in the Site Geotechnical Report.

1.10 Electrical / Communication Interconnection

1.10.1 Permanent Electric Power Export and Backfeed

The facility will be connected to the electric utility system through high voltage (HV), circuit breakers and disconnect switches located adjacent to the associated GSUT. During facility startup and shutdown, the power required for the facility electrical auxiliary systems will be backfed from the utility system through the GSUT.

1.10.2 Stand-by Electric Power

Stand-by electric power of 1000 kW capacity will be provided in the form of a diesel driven Emergency Generator. The generator will be connected via a dedicated circuit breaker to the plant 480V switchgear.

1.10.3 Communications

Telephone and communication links between the facility and utility, the fuel supplier, and other outside parties will be provided by Owner. Appropriate interface will be provided in the final Plant Design.

1.11 Codes, Standards, and Specifications

The building code for the project location is the 2007 version of the California Building Code (CBC).

The following codes, standards, and specifications of U.S. organizations will be consulted to establish a basis for quality and safety in facility design and operation. Systems and equipment will be designed in accordance with the latest edition and addenda in effect at the date of contract execution, unless noted otherwise.

AASHTO	American Association of State Highway and Transportation Official
AFBMA	Anti-Friction Bearing Manufacturers Association
ACI	American Concrete Institute
AMCA	Air Moving and Conditioning Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
API	American Petroleum Institute (Applicable sections will be referenced)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CBC	California Building Code
CMAA	Crane Manufacturers Association of America
CTI	Cooling Technology Institute
EJMA	Expansion Joint Manufacturing Association
FM	Factory Mutual (Applicable sections will be referenced)
HEI	Heat Exchange Institute
HIS	Hydraulic Institute Standards
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers

IES	Illuminating Engineering Society of North America
IFC	International Fire Code
ISA	Instrument Society of America
ISO	International Standards Organization
LPC	Lightning Protection Code
MBMA	Metal Building Manufacturers Association
MSS	Manufacturers Standardization Society of Valves and Fittings Industry
NACE	National Association of Corrosion Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PFI	Pipe Fabrication Institute
RMA	Rubber Manufacturers Association
SDI	Steel Deck Institute Standards
SJI	Steel Joist Institute Standards
SMACCNA	Steel Metal & Air Conditioning Contractor National Association
SSPC	Society for Protective Coatings
TEMA	Tubular Exchanger Manufacturers Association
TIMA	Thermal Insulation Manufacturers Association
UL	Underwriters Laboratories
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code

Design specifications and construction of the Project will also be in accordance with all applicable local, state, and federal laws, including but not limited to those set forth below.

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980
- Clean Air Act and Amendments
- Environmental Protection Agency Regulations
- Federal Aviation Administration Regulations
- Federal Energy Regulatory Commission Regulations
- Federal Power Act
- Noise Control Act of 1972
- Occupational Safety and Health Act
- Occupational Safety and Health Standards
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act
- Solid Waste Disposal Act
- Superfund Amendments and Reauthorization Act of 1988

- Toxic Substances Control Act
- Bay Area Air Quality Management District
- California State Water Resources Board

In the event conflicts arise between the codes, standards of practice, specifications or manufacturer recommendations described herein and codes, laws, rules, decrees, regulations, standards, etc., of the locality where the equipment is to be installed, the more stringent code will apply

1.12 Banned Materials

No materials or products containing the following materials are allowed in the project:

- Asbestos
- PCB's
- Hexavalent Chrome
- Mercury (Exception: A limited number of mercury tube level switches may be supplied)

END OF SECTION