Pico Power Project

Appendix 10-D
Electrical Engineering Design Criteria

October 2002

APPENDIX 10D

ELECTRICAL ENGINEERING DESIGN CRITERIA

10 D1 INTRODUCTION

This appendix summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of electrical engineering systems for the facility. More specific project information will be developed prior to construction of PPP to support detailed design, engineering, material procurement, and construction specifications as required by the California Energy Commission.

10 D2 CODES AND STANDARDS

Design of the electrical systems and components will be in accordance with the laws and regulations of the federal government, State of California, and industry standards. The current issue or revision of the documents at the time of the filing of this AFC will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement shall apply.

The following codes and standards are applicable to the electrical aspects of the power facility.

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

10 D3 SWITCHYARD, TRANSFORMERS AND FACILITY AUXILIARY SYSTEM

10 D3.1 Switchyard

The switchyard will be air-insulated. The switchyard will consist of SF6 circuit breakers for the transformers and lines to the grid, with disconnect switches on each side of the breakers. Each line will be equipped with the appropriate instrument transformers for protection and metering.

The 115 kV switchyard will be located on the west end of the site. The 115 kV switchyards interconnect arrangement provides for looping the plant's switchyard onto the existing Kifer to Scott 115 kV tie line with three 115 kV breakers and associated disconnect switches. To provide for maintenance of the 115 kV breakers, one normally open 115 kV bypass air switch will be provided.

The SF6 breakers will be dead tank design with two bushing current transformers on each bushing. . Vertical switches will be located on each side of the breakers to isolate the breaker, and one horizontal bypass switch will be installed to bypass the breaker arrangement for breaker maintenance. Instrument

transformers (current and capacitive voltage transformers) will be included for protection. Separate instrument transformers will be used for metering.

Aluminum alloy tubular bus will be used. Cable connections between the tube bus and equipment will be ACSR cable. Tube and cables will meet all electrical and mechanical design requirements.

The switchyard design will meet the requirements of the National Electrical Safety Code—ANSI C2.

A grounding grid will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Substation Grounding. All equipment, and structures, will be connected to the grounding grid of buried conductors and ground rods, as required. The switchyard ground grid will be tied to the plant ground grid. The fence will be grounded separately.

Shield wires and/or lightning masts will provide lightning protection. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All faults shall be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to insure the safety of Equipment, Personnel, and the Public. Protective relaying will meet IEEE requirements and will be coordinated with the utility's requirements.

The 115 kV tie lines to Kifer Receiving Station and Scott Receiving Station will each be provided with a redundant high impedance differential relay system. Also, each outgoing 115 kV line will be provided with redundant high-speed relay systems with . primary and backup microprocessor-based distance relays.

Each circuit breaker will be provided with independent breaker failure relay protection schemes. Breaker failure protection will be accomplished by fault detector relays and timing relays for each breaker. Each high voltage breaker will have 2 redundant trip coils.

Interface with the utility supervisory control and data acquisition (SCADA) system including the facilities DCS system will be provided as required. Interface will be at the interface terminal box and RTU. Communication between the facility switchyard and the two substations at the other end of the overhead transmission lines will be included. Remote Terminal Units (RTUs) will allow interface and remote control of the switchyard.

Revenue metering will be provided on the 13.8 kV outgoing lines. Meters and the metering panel will be provided.

10 D3.2 Transformers

The plant will include two three winding 13.8 kV to 115 kV main generator step-up transformers, connected delta-wye, OA/FA/FA. The neutral point of the HV winding will be solidly grounded. Each main generator step-up transformer will have metal oxide surge arresters adjacent to the HV terminals and will have manual de-energized ("no-load") tap changers located in the HV windings. The step-up transformers will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.116.

Each one to the two combustion turbine generators will be connected to one of the secondary windings of one of the transformers. The other secondary winding of both transformers will be connected to the steam turbine generator through isolatable sections of generator bus.

10 D3.3 Facility Auxiliary System

The facility will have two sources of power for the auxiliary system. Facility power will be supplied through one 13.8 kV to 4.16 kV unit auxiliary transformers, connected upstream of one of the CTG Breakers, or one 12 kV to 4.16 kV station service transformer fed from an off-site 12 kV power source. Both transformers will be two winding, connected delta-wye.

The plant's facility power will normally be back fed from the 115 kV system via one of the main generator step-up transformers and the auxiliary transformer. However, the plant design will also provide for starting up the plant from the off-site 12 kV source should the 115 kV system become unavailable. Once the plant is on line, the plant's auxiliary system will be transferred to the unit auxiliary transformer (normal source) via fast transfer, supervised by a power-transfer relay.