

WDAT 661 ISP

***WDAT
INDEPENDENT SYSTEM IMPACT STUDY***

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**SOUTHERN CALIFORNIA
EDISON**
An EDISON INTERNATIONALSM Company

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SOUTHERN CALIFORNIA EDISON COMPANY

EXECUTIVE SUMMARY

[REDACTED] applied to Southern California Edison ("SCE") for interconnection and wholesale distribution service for its proposed Co-gen Project pursuant to SCE's Wholesale Distribution Access Tariff ("WDAT") Small Generator Interconnection Procedures. SCE performed an Independent System Impact Study as requested by [REDACTED] for a 16 kV interconnection and distribution service from the SCE 16 kV system. The interconnection is an applicant owned 16 kV switchgear, which will be located approximately 3.70 miles from Estero Substation, connected to a 16 kV circuit out of SCE's Estero 66/16 kV Substation. The request is for a WDAT fuel-oil ("FO") generation facility with a total capacity of 13.2 MW. The initial request is for service to commence by [REDACTED]

The new Co-generation, consisting of [REDACTED] 4.393 MW [Jenbacher] synchronous generators and [REDACTED] 5500 kVA 13.8/16 kV transformers, would receive interconnection service from SCE's 16 kV circuit out of Estero Substation via a new overhead line to the interconnection facility. The generated power would be delivered to the California Independent System Operator ("CAISO") grid at the 220 kV bus of SCE's Santa Clara Substation.

The purpose of this Independent System Impact Study is to determine the effect of the proposed generation addition on the SCE distribution system and the portion of SCE's electrical system that is part of the CAISO controlled grid, and to identify in general additional Interconnection Facilities, Distribution Upgrades, additions or modifications, or other facilities required to provide the requested service. The study was performed in two parts: Part A (performed by SCE's Distribution Field Engineering department) examines impacts related to that part of the SCE distribution system energized at less than 66 kV and also briefly summarizes the results of Part B, while Part B (performed by SCE's Generation Interconnection Planning department) examines impacts and facilities related to the portion of the SCE electrical system energized at 66 kV and above (the bulk power system), and impacts and facilities associated with the CAISO controlled portion of the SCE grid. This is the Part A study report; a detailed report of the Part B study results is included as Attachment B.

The Part A study was performed for expected year 2011 through 2020 projected peak load conditions as well as 2011 through 2020 minimum load conditions.

The Part A Independent System Impact Study consisted of a power flow analysis, three-phase short circuit duty analysis based on most current thevenin equivalents and circuit voltage profile analysis. The analyses were performed to determine whether the energy associated with the [REDACTED] can be transmitted through SCE's distribution system to the ISO grid at the 220 kV bus of Santa Clara Substation without creating the need for modifications to SCE's distribution system and/or to the ISO grid. The study showed that, with the [REDACTED] on-line:

¹ Date as requested in the application. Actual operating date depends on design, procurement, and construction requirements. Interconnection Studies will ultimately determine in-service date.

- For both peak load and light load conditions, the addition of the 13.2 MW [REDACTED] resulted in no violations of SCE's thermal loading criteria under base case and N-1 conditions for the SCE distribution System.
- The addition of the 13.2 MW [REDACTED] resulted in minimal voltage rise not exceeding allowable Rule 2 limits.
- The addition of the 13.2 MW [REDACTED] resulted in the increase of three-phase short-circuit duties [REDACTED] distribution substations. The circuit breaker interrupting capabilities were reviewed at these substation and it was determined that [REDACTED] circuit breakers will be required to be upgraded based on most current thevenin equivalents. The final results and financial responsibilities will be determined on the Cluster study process in accordance to the WDAT ISP study procedures.
- On 9/29/2011, the applicant requested that SCE study, design, procure and construct the distribution and interconnection facilities required to interconnect 2MW of the 13.2 MW on the existing Ramac 16KV circuit o/o Estero 66/15KV substation (Phase 1). Phase 1 showed that interconnection facilities where required to interconnect 2 of the 13.2 MW on to the existing Ramac 16KV circuit. The cost tables in this report identified the interconnection facilities which will be installed as part of phase 1 and which the applicant has already provided the funding.
- Based on the size and point of interconnection of the project it is assumed that the SCD impacts will be limited to the SCE distribution system. The SCD impacts of the project on the CAISO controlled transmission system are assumed to be negligible.
- With all active queued ahead generation projects and all corresponding facility upgrades modeled regardless of operating date, the queue order power flow study did not identify any new thermal overloads triggered by the Project under base case or outage conditions in the Northern Bulk Transmission system. An operational study was not required.

- Non-binding order of magnitude cost estimates for the required interconnection facilities and system upgrades are as follows:

Distribution Upgrades

No Distribution Upgrades required

Interconnection Facilities

Electrical System

- Approximately 19,500 ft. of 653 ACSR OH new line \$3.584 M²
- New 16 kV Circuit Breaker at Estero Substation \$0.824 M²
- Transducer \$0.048 M²
- Three Way Gas Switch* \$0.315 M²
- Approximately 250 feet of 1000 JCN Cable*
- Approximately 4000 feet of #4 ACSR overhead conductor*
- Approximately 2800 feet of 1/0 ACSR 4th wire line extension*
- RCS Controller*
- Metering CTs*
- Metering VTs*
- Metering*
- Ground Bank*

Telemetry \$0.212 M²

- Power System Control (PSC)
- Telecom Facilities

Total non-binding order of magnitude cost estimate \$4.983 M²

*Items shown with an asterisk are part of the initial 2.0 MW installation (see Letter Agreement dated September 29, 2011). The payment schedule which will be outlined in the GIA will take into account these deposits.

² Cost Estimate includes 35% ITCC. Cost estimate are in 2011 Constant Dollars.

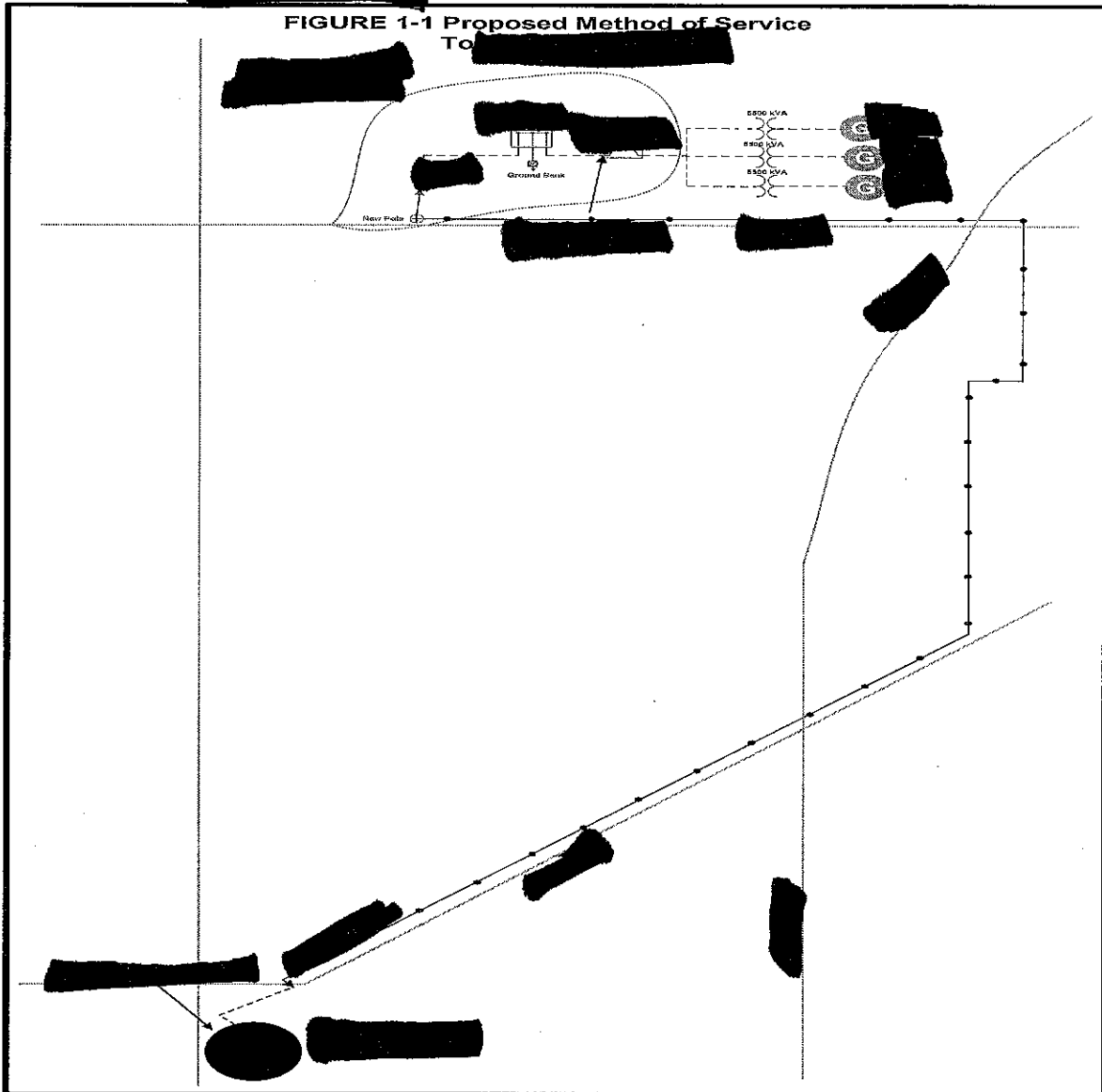
³ Upon execution of the 2.0 MW Letter Agreement, [REDACTED] paid Southern California Edison \$284,000 to start the engineering design, procurement and construction of the Distribution Provider's Interconnection Facilities.

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I. INTRODUCTION TO PART A

[REDACTED] applied to Southern California Edison ("SCE") for interconnection and wholesale distribution service for its proposed Co-gen Project pursuant to SCE's Wholesale Distribution Access Tariff ("WDAT") Small Generator Interconnection Procedures. SCE performed an Independent System Impact Study as requested by [REDACTED] for a 16 kV interconnection and distribution service from the SCE 16 kV system. The interconnection is an applicant owned 16 kV switchgear, which will be located approximately 3.70 miles from Estero Substation, connected to a 16 kV circuit out of SCE's Estero 66/16 kV Substation. The request is for a WDAT fuel-oil ("FO") generation facility with a total capacity of 13.2 MW. The initial request is for service to commence by [REDACTED]



¹ Date as requested in the application. Actual operating date depends on design, procurement, and construction requirements. Interconnection Studies will ultimately determine in-service date.

The new Co-generation, consisting of [REDACTED] 4.393 M [REDACTED] synchronous generators and [REDACTED] 5500 kVA 13.8/16 kV transformers, would receive interconnection service from SCE's 16 kV circuit out of [REDACTED] via a new overhead line to the interconnection facility. The generated power would be delivered to the California Independent System Operator ("CAISO") grid at the 220 kV bus of SCE's Santa Clara Substation.

The purpose of this Independent System Impact Study is to determine the impact of the proposed generation addition on the SCE distribution system and to identify in general additional Interconnection Facilities, Distribution Upgrades, additions or modifications, or other facilities required to provide the requested service. This study was performed for expected year 2011 through 2020 peak load conditions as well as low demand conditions.

II. PART A: SYSTEM IMPACT STUDY CONDITIONS & METHODOLOGY

Planning Criteria

The thermal rating of any conductor, connector, or apparatus should not exceed 100% of its normal rated capacity with all facilities in service (base case).

The thermal rating of any conductor, connector, or apparatus should not exceed 100% of its emergency rating under N-1 conditions.

Operational flexibility and reliability of the distribution system shall be maintained at all times.

Circuit voltage profiles should be maintained to comply within CPUC's Rule 2 requirements.

System Conditions

The power factor for the new generation facility was assumed to be within WDAT requirements of 0.95 lagging or leading.

Expected loading on the distribution system as projected by the SCE 2011 - 2020 plan was used.

Distributed Generation resources connected to the distribution system are analyzed offline and online during peak load conditions as well as during minimum daytime load conditions as to determine worst case scenario.

The Short circuit contribution from the inverter systems was determined using inverter manufacturer datasheets.

Thevenin equivalents for this study are based on most current thevenin equivalents. Final Short circuit study and cost responsibilities for breaker upgrades will be conducted in the cluster process in accordance with WDAT ISP.

III. PART A: SYSTEM IMPACT STUDY RESULTS

Short Circuit Analysis

Using the short circuit models from the synchronous generators being utilized in this co-generation system, it was calculated that the short circuit contribution at the substation 16 kV bus is approximately 2,750 kA; thus a breaker analysis was required due to the addition of the 13.2 MW [REDACTED]. The circuit breaker analysis concluded that [REDACTED] circuit breakers replacements are required as part of this project.

System Protection Considerations

In addition to the typical distribution line protection requirements, a ground bank will be required to sense phase-ground faults in the SCE distribution system and open the generator breaker. The applicant will be required to install a relay with adequate elements to incorporate the ground bank into the applicant's relay protection scheme.

Thermal Loading

The line section of the 16 kV circuit between the customer's facility and the 16 kV Point of Interconnection is expected to experience a reverse power flow of approximately 13.2 MW during minimum loading. Of that 13.2 MW, approximately 12.8 MW will flow back into the 16 kV bus at [REDACTED] 66/16 kV Substation during minimum loading. The installation of three transducers will be required to monitor this reverse power flow (MW & MVAR).

Distribution Voltage Control

The section of the 16 kV near the project area is expected to experience voltage rise of 2.1%, which would not exceed the allowable CPUC Rule 2 requirements as a result to the addition of the 13.2 MW [REDACTED] under the generating facilities conditions of maximum generation and unity power factor

Harmonic Impact

The harmonic impact of the subject inverter based generation was not part of this System Impact Study. Despite the relatively low THD (<3%) of the equipment, impacts on voltage distortion levels may be significant due to the high penetration level of the generation facility with respect to the local distribution grid strength. As with all equipment connected to the SCE distribution system, the generation project will be subject to the provisions of Rule 2.E, allowing SCE to require customer mitigation of interference with SCE service, including harmonic impacts, if harmonic interference is caused by the customer. Since the THD values which were provided are for individual inverters and not for the total generation requested, it will be required to determine the total harmonic contribution for the entire generation facility prior to approving the generation to interconnect to the SCE distribution system. Given the amount of generation and the strength of the distribution system, SCE will not require a harmonic study but strongly encourages that the applicant completes a harmonic study prior to interconnection. During the commissioning test of the generation system, SCE will be part of the commissioning test, install power quality equipment to verify that the total harmonic contribution from the generation system to the SCE meets the required standards. If during the commissioning test, it is found that the project does not meet the harmonic standards, the project will not be allowed to interconnect to the SCE system until the harmonic deviations are rectified. Therefore, it is encouraged that the applicant completes a harmonic study during the Facility Study to insure that the harmonic requirements are met. If the applicant chooses to complete a harmonic study, SCE

will then provide the required SCE distribution system data that are to be used as part of the harmonic study.

IV. PART A: GENERAL DESCRIPTION OF IDENTIFIED UPGRADES

Distribution Upgrades

No Distribution Upgrades are required to interconnect this co-generation facility.

Interconnection Facilities

Interconnection Facilities will be required to interconnect this co-generation project. These facilities include a new 16 kV circuit consisting of approximately 19,500 feet of overhead 653 ACSR multi-grounded conductor, a new 16 kV breaker, a ground bank, three transducers a new three way gas switch, RCS controller, metering CTs and VTs, metering, secondary underground conductor, etc.

Customer Equipment

The interface protection will be provided by the applicant and will include a 12 kV circuit breaker which was installed at the applicant-owned 16 kV switchgear. The applicant's protection has been coordinated with SCE's Estero Substation circuit breaker controls to provide adequate protection for the distribution system. The relay settings have been reviewed and approved by SCE and a certified timed trip testing report was provided to SCE prior to energizing the switchgear.

The switchgear must meet SCE's published Electrical Service Requirements (ESR). Drawings required by the ESR, where submitted, shall be reviewed, modified, and approved by SCE prior to release for fabrication/purchase of the equipment.

Applicant generation interconnection equipment must comply with SCE's Interconnection Handbook in regards to generation protection and lockable-visible disconnecting means at the point of interconnection.

Interconnection Facilities Study

An Independent Facilities Study will be required to determine cost and time to complete the required interconnection facilities for the [REDACTED]

V. NON-BINDING ORDER OF MAGNITUDE COST ESTIMATE

- Non-binding order of magnitude cost estimates for the required interconnection facilities and system upgrades are as follows:

Distribution Upgrades

No Distribution Upgrades required

Interconnection Facilities

Electrical System

- Approximately 19,500 ft. of 653 ACSR OH new line \$3.584 M²
- New 16 kV Circuit Breaker at Estero Substation \$0.824 M²
- Transducer \$0.048 M²
- Three Way Gas Switch* \$0.315 M²
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- RCS Controller*
- Metering CTs*
- Metering VTs*
- Metering*
- Ground Bank*

Telemetry \$0.212 M²

- Power System Control (PSC)
- Telecom Facilities

Total non-binding order of magnitude cost estimate \$4.983 M²

*Items shown with an asterisk are part of the initial 2.0 MW installation (see the Letter Agreement dated September 29, 2011). Deduct initial deposit of \$284,000 (received with the Letter Agreement) from total cost³.

² Cost Estimate includes 35% ITCC. Cost estimate are in 2011 Constant Dollars

³ Upon execution of the 2.0 MW Letter Agreement, [REDACTED] paid Southern California Edison \$284,000 to start the engineering design, procurement and construction of the Distribution Provider's Interconnection Facilities.

VI. PART A: SUMMARY

The Part A Independent System Impact Study showed:

1. No Distribution upgrades will be required to interconnection the generation system.
2. Real time telemetry will be required. RTU will be used to provide the telemetry requirements.
3. Interconnection service and distribution service pursuant to the WDAT would be expected to commence within 24 months of executing a Generator Interconnection Agreement (“GIA”) and associated Distribution Service Agreement.

4. Non-binding order of magnitude cost estimates for the required interconnection facilities and system upgrades are as follows:

Distribution Upgrades

No Distribution Upgrades required

Interconnection Facilities

Electrical System

- Approximately 19,500 ft. of 653 ACSR OH new line \$3.584 M²
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Telemetry \$0.212 M²

- Power System Control (PSC)
- Telecom Facilities

Total non-binding order of magnitude cost estimate \$4.983 M²

*Items shown with an asterisk are part of the initial 2.0 MW installation (phase 1) (see Letter Agreement dated September 29, 2011). Deduct initial deposit of \$284,000 (received with the Letter Agreement) from total cost³.

² Cost Estimate includes 35% ITCC. Cost estimate are in 2011 Constant Dollars.

³ Upon execution of the 2.0MW Letter Agreement (Phase 1), [REDACTED] paid Southern California Edison \$284,000 to start the engineering design, procurement and construction of the Distribution Provider's Interconnection Facilities.

5. This Independent System Impact Study is based on various technical data previously provided by the applicant. If any of that information changes significantly, as determined by SCE, the results of this study may no longer be appropriate and may necessitate a new study.
6. The Independent System Impact Study is based on applicant's queue position. Additional studies may be needed if any changes occur in the projects ahead in the queue.
7. Applicant is responsible for the cost of civil work which is required for the distribution and interconnection electrical facilities.
8. Current distribution standards are being updated to address generation interconnection systems. The proposed method of service in this report may change according on final design to comply with the updated distribution design standards.
9. An Independent Facilities Study detailing required scope and cost of the identified upgrades is required to proceed with the project.
10. Upgrades identified are general and preliminary descriptions only. The costs indicated are non-binding order of magnitude only. The schedule is projected and preliminary.

**PAGES OMITTED FOR
CEII REGULATIONS**

ATTACHMENT B – BULK POWER SYSTEM IMPACT STUDY REPORT

CAISO Controlled Bulk System

Short Circuit Duty

Since the project is connecting on the SCE distribution system and the project consist of inverter facilities which have limited short-circuit duty contribution, the SCD analysis determined no impact on SCE's high-voltage bulk power system after inclusion of the project.

Power Flow Study

The power flow study analysis focus on identifying system thermal overload problems within SCE bulk system. The power flow study results did not identify any impact on SCE bulk system serving the subtransmission system where the project is interconnected. In addition, the study identified that the inclusion of the project didn't require any modification to existing Special Protection System (SPS).