
Appendix A – WDT345

[REDACTED]

[REDACTED]

Final Report

May 14, 2010

This study has been completed in coordination with Southern California Edison Large Generator Interconnection Procedures (CLGIP) for Interconnection Requests in a Queue Cluster Window

Table of Contents

1. Executive Summary	2
2. Project and Interconnection Information	3
3. Study Assumptions.....	5
4. Power Flow Analysis	6
4.1 Overloaded Transmission Facilities.....	6
4.2 Recommended Mitigations.....	6
5. Short Circuit Analysis	6
5.1 Short Circuit Study Input Data	6
5.2 Results.....	7
5.3 Preliminary Protection Requirements.....	7
6. Reactive Power Deficiency Analysis.....	8
7. Transient Stability Evaluation	8
7.1 Transient Stability Study Scenarios.....	8
7.2 Results.....	8
8. Deliverability Assessment	8
8.1 On Peak Deliverability Assessment	9
8.2 Off- Peak Deliverability Assessment	9
9. Environmental Evaluation/Permitting.....	9
10. Upgrades, Cost Estimates and Construction schedule estimates	9
11. Items not covered in this study.....	13

Attachments:

1. Generator Machine Dynamic Data
2. Dynamic Stability Plots-(see Appendix F of the group report)
3. SCE Interconnection Handbook
4. Short Circuit Calculation Study Results (see Appendix H of the group report)
5. Deliverability Assessment Results
6. Allocation of Network Upgrades for Cost Estimates

1. Executive Summary

On July 31, 2009, the Southern California Edison Company ("SCE") received an interconnection request from [REDACTED] for the interconnection of its [REDACTED] Project, pursuant to the Cluster Large Generator Interconnection Procedures ("CLGIP") under the SCE Wholesale Distribution Access Tariff ("WDAT"). The [REDACTED] is a renewable synthesis gas and synthetic naphtha fueled combined cycle plant with an output of 49.9 MW to the requested Point of Interconnection (POI) on Southern California Edison Company's (SCE) Calectric – Highgrove No. 2 115 kV line. The Interconnection Customer's requested Commercial Operation Date of the [REDACTED] is [REDACTED].

In accordance with the Federal Energy Regulatory Commission (FERC) Cluster Large Generator Interconnection Procedures ("CLGIP"), SCE Transmission and Interconnection Planning has performed a Phase I Interconnection Study to determine the impacts of the group as well as impacts of the [REDACTED] on the ISO controlled grid and SCE Distribution System.

The group report has been prepared separately identifying the combined impacts of all projects in the Queue Cluster 1 Phase I Study (QC1) group on the CAISO Controlled Grid. This report focuses only on the impacts of the [REDACTED].

The report provides the following:

1. Transmission and Distribution system impacts caused by the [REDACTED]
2. System reinforcements necessary to mitigate the adverse impacts caused by the [REDACTED] under various system conditions,
3. A list of required facilities and a non-binding, good faith estimate of the [REDACTED] responsibility and time to construct these facilities.

The Phase I study has determined that the [REDACTED] does not contribute to the overloading of transmission facilities for which mitigation plans have been proposed.

In addition, the [REDACTED] may also be fully or partially responsible for overstressing circuit breakers at the Pisgah 220 kV¹, Whirlwind 220 kV, Vista 115 kV, and Highgrove 115 kV buses.

The [REDACTED] did not violate any parts of voltage criteria and hence caused no adverse voltage impacts on the grid. Also, the [REDACTED] did not significantly impact the transmission system's transient stability performance following selected contingencies. However, more detailed voltage impact and transient stability performance analysis will be performed as part of the Phase II study.

¹ Identification of facility voltages (220 kV) in this Phase I Study are shown consistent with SCE System Operating Bulletin 123. However, all studies were predicated on the base voltages reflected in the Western Electricity Coordinating Council (WECC) base cases. For the SCE bulk power system, the WECC base cases reflect 230 kV and 500 kV base voltages; consequently, all per-unit calculations presented were based on 230 kV and 500 kV voltages.

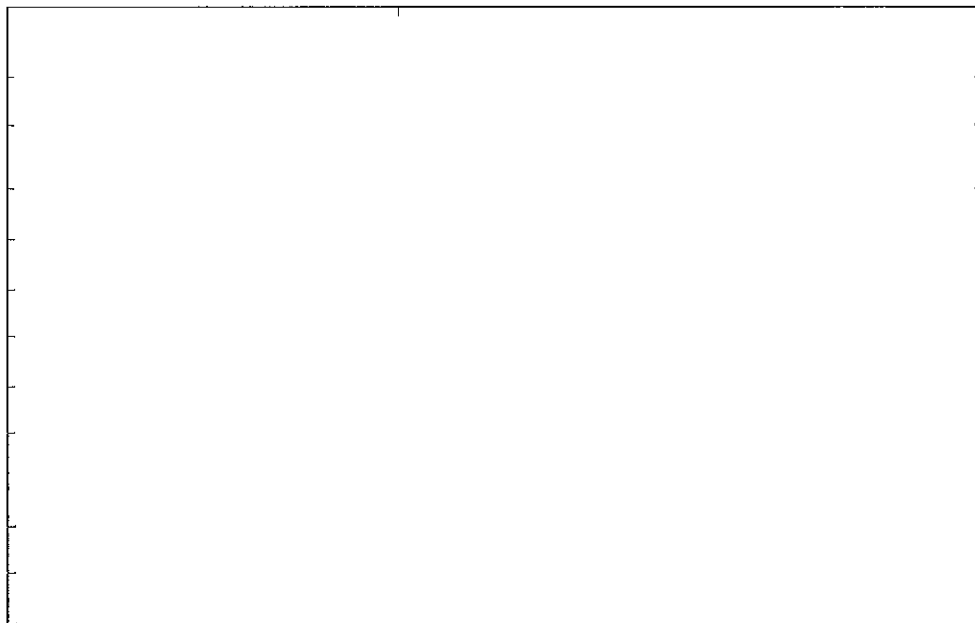
The non-binding cost estimate of Interconnection Facilities² to interconnect the [REDACTED] is \$ 15,436,000 including ITCC³. The maximum cost responsibility for the Network Upgrades⁴ to interconnect the [REDACTED] is \$ 0, and the cost of the Distribution Upgrades⁵ is \$ 7,767,000.

The non-binding construction schedule to engineer and construct the facilities is approximately 36 months from the signing of the Cluster Large Generator Interconnection Agreement (CLGIA).

2. Project and Interconnection Information

Table 2-1 provides general information about the [REDACTED]

Table 2-1: [REDACTED]



² The transmission facilities necessary to physically and electrically interconnect the Project to SCE's Distribution System.

³ Income Tax Component of Contribution

⁴ The transmission facilities, other than Interconnection Facilities, beyond the point of interconnection necessary to mitigate any impacts to the CAISO Controlled Grid.

⁵ These upgrades are not identified in ISO tariff, and need to be negotiated between the IC and the PTO

PAGES OMITTED FOR
CEII REGULATIONS

3. Study Assumptions

For detailed assumptions, please refer to the main report. The following assumptions are only specific to the [REDACTED]

A. The following Facilities were estimated and are included in the Phase I Study:

- [REDACTED] required telecommunication paths from the generating facility to the SCE tapped switchyard will be installed by SCE.
- It is assumed that the last structure of the [REDACTED] gen tie line outside the SCE tapped switchyard property line would be at a distance from the substation switchyard that would require SCE to install [REDACTED] structure and a total of [REDACTED] spans of conductor to reach the proposed 115 kV bus. The additional structure and conductors between the last [REDACTED] and the substation switchyard will be installed by SCE.
- The required revenue metering cabinet and retail load meters to be installed at the generating facility will be installed by SCE.
- The required remote terminal unit (RTU) to be installed at the generating facility will be installed by SCE.

B. The following facilities needed to support the 115 kV Gen Tie and Interconnection are to be installed by the Interconnection Customer and are not estimated or included in this Phase I Study:

- The [REDACTED] gen tie line from the generating facility to the last structure outside the SCE tapped switchyard property line will be installed by [REDACTED]. The 115 kV Gen Tie Line Right of Way should extend up to the edge of the SCE switchyard property line.
- The [REDACTED] gen tie line must be equipped with optical ground wire (OPGW) to provide [REDACTED] telecommunication paths required for the line protection scheme. The cost of the OPGW will be included in the cost of the Gen Tie line.
- All required revenue metering equipment to meter the generating facility retail load will be specified by SCE and installed by the customer at the generator end of the [REDACTED] gen tie line.
- The following 115 kV gen tie line protection equipment to be installed at the generating facility will be specified by SCE and provided by the customer and is not included in the Phase I Study. The interconnection customer and SCE will coordinate protection facilities after the completion of the Phase II Interconnection Study.
 - [REDACTED] current differential relay with dual dedicated digital communication channels to the SCE 115 kV switchyard.
 - [REDACTED] current differential relay with dual dedicated digital communication channels to the SCE 115 kV switchyard.

4. Power Flow Analysis

The group study indicated that the [REDACTED] is contributing to overloading of the following transmission facilities. The details of the analysis and overload levels are provided in the group study.

4.1 Overloaded Transmission Facilities

No overloaded Transmission Facilities identified.

4.2 Power Flow Non-Convergence

There were no non-convergence issues identified with this project.

4.3 Recommended Mitigations

No mitigations necessary.

5. Short Circuit Analysis

Short circuit studies were performed to determine the fault duty impact of adding the QC 1 projects to the transmission system and to ensure system coordination. The fault duties were calculated with and without the projects to identify any equipment overstress conditions. Once overstressed circuit breakers are identified, the fault current contribution from each individual project in QC 1 is determined. Each Project in QC1 will be responsible for its share of the upgrade cost based on the rules set forth in CAISO Tariff Appendix Y.

5.1 Short Circuit Study Input Data

The following input data provided by the Applicant of the [REDACTED] was used in this study:

CTG Short Circuit Data (Kato) @ 17.5 MVA Base:

- Positive Sequence subtransient reactance ($X''1$) = 0.132 p.u.
- Negative Sequence subtransient reactance ($X''2$) = 0.181 p.u.
- Zero Sequence subtransient reactance ($X''0$) = 0.063 p.u.

STG Short Circuit Data (Brush) @ 34.8 MVA Base:

- Positive Sequence subtransient reactance ($X''1$) = 0.22 p.u.
- Negative Sequence subtransient reactance ($X''2$) = 0.22 p.u.

- Zero Sequence subtransient reactance (X''_0) = 0.13 p.u.

Station Step-up Transformers (total of one)

- [REDACTED] three-phase 13.8/115 kV rated for 70 MVA with an impedance of 8% at 70 MVA base.

5.2 Results

All bus locations where the QC1 Projects increase the short-circuit duty by 0.1 kA or more and where duty is in excess of 60% of the minimum breaker nameplate rating are listed in the Group Report Appendix H. These values have been used to determine if any equipment is overstressed as a result of the QC1 interconnections and corresponding network upgrades, if any.

The responsibility to finance short circuit related Reliability Network Upgrades identified through a Group Study shall be assigned to all Interconnection Requests in that Group Study pro rata on the basis of short circuit duty contribution of each Large Generating Facility.

As discussed in the Group Report, the QC1 breaker evaluation identified overstressed circuit breakers at the following buses. The pro-rata cost allocation for this project, based on SCD contribution at each location, is also provided:

In order to mitigate single line to ground (SLG) short circuit duty (SCD) issues, QC 1 generation projects may be required to install transformers that limit each project's contribution to SLG SCD on the SCE system. This may be accomplished by installing transformers with delta-connected high side windings or with "impedance-grounded" wye-connected high side windings. These requirements will be further evaluated as part of the Phase II Study.

5.3 Preliminary Protection Requirements

Protection requirements are designed and intended to protect SCE's system only. The preliminary protection requirements were based upon the interconnection plan as shown in Figure 2-2.

The applicant is responsible for the protection of its own system and equipment and must meet the requirements in the SCE Interconnection Handbook provided in Attachment 3.

6. Reactive Power Deficiency Analysis

Limited reactive power deficiency analysis was performed. The power flow studies for Category "B" and Category "C" contingencies indicated that the [REDACTED] did not cause voltage drops of 5% or more from the pre-project levels, or cause the SCE system to fail to meet applicable voltage criteria. The [REDACTED] therefore, did not cause any adverse voltage impacts on the CAISO Controlled Grid. More detailed reactive power deficiency analysis will need to be performed as part of the Phase II Study.

7. Transient Stability Evaluation

Limited transient stability studies were conducted using full loop base cases to ensure that the transmission system remains in operating equilibrium, as well as operating in a coordinated fashion, through abnormal operating conditions after the QC 1 projects begin operation. The generator dynamic data used in the study for the [REDACTED] is shown in [Attachment 1](#).

7.1 Transient Stability Study Scenarios

Disturbance simulations were performed for a study period of 10 seconds to determine whether the QC 1 projects will create any system instability during a variety of line and generator outages. The most critical single contingency and double contingency outage conditions in the Devers area of the overall greater [REDACTED] were evaluated. For the list of specific line and generator outages evaluated, see the group report.

7.2 Results

Limited stability analysis was performed for the [REDACTED] to identify "relative" as opposed to "absolute" conclusions regarding the stability impacts of this QC 1 Phase 1 queued generation project.

In the limited stability analysis performed in the 500 kV, 220 kV and 115 kV systems with the upgrades in place to mitigate base case and outage related overload problems, no significant transmission system stability problems relative to existing stability criteria were identified. The study concluded that the [REDACTED] would not cause the transmission system to go unstable under Category "B" and Category "C" outages. More detailed stability analysis will need to be performed as part of the Phase II Study.

Stability plots are shown in Appendix F of the group report.

8. Deliverability Assessment

8.1 On Peak Deliverability Assessment

CAISO performed an On-Peak Deliverability Assessment. The power flow study results for Category "A", "B", and "C" are detailed in Attachment 5.

8.2 Off- Peak Deliverability Assessment

A modified version of the power flow 2014 Summer Off-Peak base case was created to perform the off-peak deliverability assessment of the QC 1 projects. The assumptions to create this case are listed in the group study. The impacts of the [REDACTED] are shown in Attachment 5.

9. Environmental Evaluation/Permitting

The Licensing, Permitting, and Environmental activities associated with the siting and construction of electric facilities 50kV and greater are discussed in Section 12 of the Group Report.

10. Upgrades, Cost Estimates and Construction schedule estimates

To determine the cost responsibility of each generation project in QC 1, the CAISO developed cost allocation factors based on the individual contribution of each project (Attachment 6). The cost allocation for the Interconnection Facilities and Network Upgrades for which the [REDACTED] is solely responsible is as follows:

PTO's INTERCONNECTION FACILITIES

1. Sub - Transmission:

RREC 115 kV Line Extension

Install [REDACTED] new TSP, 225' 336 ACSR conductor, insulators, line hardware and shield wire to make the connection between the new switchyard and the generator's last transmission structure. In addition, [REDACTED] automated switches on LWS poles will be installed upstream to support this interconnection.

2. Substation:

Tapped Switchyard

Install a tapped switchyard with a single circuit breaker to interconnect [REDACTED]

The interconnection facilities will be installed as follows:

- [REDACTED] dead-end structures
- [REDACTED] 1200A, 15 kV circuit breaker
- [REDACTED] sets of 1200 A disconnects

- [REDACTED] VTs
- [REDACTED] e current differential
- [REDACTED] line current differential relay

3. Telecom:
Install facilities needed to support the protection requirements for the gen-tie line.

4. Metering Services Organization:
Install a revenue metering cabinet and revenue meters required to meter the retail load at the generating facility.

The customer will provide the required metering equipment (voltage and current transformers).

5. Power System Control:
Install [REDACTED] the generating facility and one RTU at the SCE tapped switchyard to monitor typical generation elements such as MW, MVAR, terminal voltage and circuit breaker status at each generating unit and the plant auxiliary load and transmit this information to the SCE regional grid control center.

6. Real Properties, Transmission Project Licensing, and Environmental Health and Safety
Obtain easements and/or acquire land, obtain licensing and permits, and perform all required environmental activities for the installation of the SCE portion of the gen tie line.

PLAN OF SERVICE RELIABILITY NETWORK UPGRADES

No Plan of Service Reliability Network upgrades identified.

RELIABILITY NETWORK UPGRADE

No Transmission Network Upgrades identified

DELIVERY NETWORK UPGRADES

No Delivery Network upgrades identified.

DISTRIBUTION UPGRADES

1. Distribution Circuit Breaker Upgrades
Upgrade the following distribution circuit breakers (pro-rata share of upgrade based on project contribution to SCD at each location)

- [REDACTED]
- [REDACTED]

2. Real Properties, Transmission Project Licensing, and Environmental Health and Safety Organization

Obtain easements and/or acquire land, obtain licensing and permits, and perform all required environmental activities for the installation of new single-circuit 115 kV T/L, advancement of the proposed SCE switchyard, and new telecommunication facilities.

Table 10.1: Upgrades, Estimated Costs, and Estimated Time to Construct Summary

Type of Upgrade	Upgrade (May include the following)	Description	Cost Allocation Factor	Estimated Cost x 1000	Estimated Time to Construct (Note 3)
PTO's Interconnection Facilities (Note 1)	Subtransmission, Substation, Metering Services Organization, Power System Control, Real Properties, Transmission Project Licensing, Environmental Health and Safety	Non-network facilities needed to enable interconnection	100%	\$ 15,436	24 Months
Plan of Service Reliability Network Upgrades	None	Direct Assigned Network upgrades needed to enable interconnection.	100%	\$ 0	N/A
Reliability Network Upgrades	None	Allocated Network upgrades needed to maintain system Reliability	Multiple (See Sections 4 and 5)	\$ 0	N/A
Delivery Network Upgrades	None	Network upgrades needed to support Full Delivery, if requested	Multiple(See Section 8)	\$ 0	N/A
Distribution Upgrades (Note 2)	Distribution Circuit Breakers, Subtransmission Line, Substation, Telecommunications, Power System Control, Real Properties, Transmission Projects Licensing, and Environmental Health and Safety	Non-CAISO SCE Distribution Facilities	Multiple (See Section 5)	\$ 7,767	24 Months
Total				\$ 23,203	24 Months

Note 1: The Interconnection Customer is obligated to fund these upgrades and will not be reimbursed.

Note 2: These upgrades are not identified in ISO tariff, and need to be negotiated between the IC and the PTO

Note 3: The estimated time to construct (ETC) is for a typical project; schedules duration may change due to number of projects approved and release dates. Slacked projects impact resources, system outage availability, and environmental windows of construction. Assumption is SCE will need to obtain CPUC licensing and regulatory approvals prior to design, procurement and construction of the proposed facilities required to serve the interconnection customer and prerequisite facilities are in service.

11. Items not covered in this study

11.1 Conceptual Plan of Service

The results provided in this study are based on conceptual engineering and a preliminary plan of service and are not sufficient for permitting of facilities. The Plan of Service is subject to change as part of the Phase II Interconnection Study.

11.2 Customer's Technical Data

Additional technical data related to the Interconnection Customer's project may be required as part of the Phase II Study. The study accuracy and results for the Phase I Study are contingent upon the accuracy of the technical data provided by the Interconnection Customer. Any changes from the data provided could void the Study results.

11.3 Study Impacts on Neighboring Utilities

Results or consequences of this Phase I Study and/or to-be-performed Phase II Interconnection Study may require additional studies, facility additions, and/or operating procedures to address impacts to neighboring utilities and/or regional forums. For example, impacts may include but are not limited to WECC Path Ratings, short circuit duties outside of the CAISO Controlled Grid, and sub-synchronous resonance (SSR).

11.4 Use of SCE Facilities

The Interconnection Customer is responsible for acquiring all property rights necessary for the Interconnection Customer's Interconnection Facilities, including those required to cross SCE facilities and property. This Interconnection Study does not include the method or estimated cost to the Interconnection Customer of SCE mitigation measures that may be required to accommodate any proposed crossing of SCE facilities with Interconnection Customer's Interconnection Facilities. The use of SCE property rights shall only be permitted upon written agreement between SCE and the Interconnection Customer. Any proposed use of SCE property rights may require a separate study and/or evaluation, at the Interconnection Customer's expense, to determine whether such use may be accommodated.

11.5 SCE Interconnection Handbook

The Interconnection Customer shall be required to adhere to all applicable requirements in the SCE Interconnection Handbook. These include, but are not limited to, all applicable protection, voltage regulation, VAR correction, harmonics, switching and tagging, and metering requirements.

11.6 Western Electricity Coordinating Council (WECC) Policies

The Interconnection Customer shall be required to adhere to all applicable WECC policies including, but not limited to, the WECC Generating Unit Model Validation Policy.

11.7 System Protection Coordination

Adequate Protection coordination will be required between SCE-owned protection and Interconnection Customer-owned protection. If adequate protection coordination cannot be achieved, then modifications to the Interconnection Customer-owned facilities (i.e., Generation-tie or Substation modifications) may be required to allow for ample protection coordination

11.8 Standby Power and Temporary Construction Power

The Phase I Study does not address any requirements for standby power or temporary construction power that the project may require.

11.9 Construction Schedule

The estimated time to construct (ETC) is for a typical project; schedules and duration may change due to number of projects approved and release dates. Stacked projects impact resources, system outage availability, and environmental windows of construction. The assumption is that SCE will need to obtain CPUC licensing and regulatory approvals prior to design, procurement and construction of the proposed facilities required to serve the interconnection customer and prerequisite facilities are in service.

11.10 Network/Non-Network Classification of Telecommunication Facilities

The Phase I Study assumes that all telecommunication facilities required to implement an SPS for generators interconnecting to the CAISO controlled system will be classified as Reliability Network Upgrades. Actual classification of each telecommunication component may change depending on final SPS design, consistent with FERC definitions of network facilities and non-network facilities. This will be further evaluated as part of the Phase II Study.

Attachment 1

**Generator Machine Dynamic Data
(To be provided in the final report)**

Attachment 2

Dynamic Stability Plots

Please refer to Appendix F of the Group Report.

Attachment 3

SCE Interconnection Handbook

Preliminary Protection Requirements for Interconnection Facilities are outlined in the SCE Interconnection Handbook.

Attachment 4

Short Circuit Calculation Study Results

Please refer to Appendix H of the Group Report.

Attachment 5

Deliverability Assessment Results

There is no deliverability upgrade required for the Project.

Attachment 6

Allocation of Network Upgrades for Cost Estimates

The cost for the Eastern Bulk Cluster 1 network upgrades is 100% allocated to the Project since it is the only project in this cluster.