
Appendix A – WDAT1034



QUEUE CLUSTER 6 PHASE I REPORT

January 17, 2014

This study has been completed in coordination with California Independent System Operator Corporation (CAISO) per CAISO Tariff Appendix DD Generator Interconnection and Deliverability Allocation Procedures (GIDAP)

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Attachments:

- 1. Interconnection Facilities, Network Upgrades and Distribution Upgrades**
- 2. Escalated Cost and Time to Construct for Interconnection Facilities, Reliability Network Upgrades, Delivery Network Upgrades, and Distribution Upgrades**
- 3. Allocation of Network Upgrades for Cost Estimates**
- 4. Distribution Provider Interconnection Handbook**
- 5. Short Circuit Calculation Study Results (see Appendix H of the area report)**
- 6. Customer Provided Project Dynamic Data**
- 7. SCE Northern Hemisphere Import Nomogram**

Figure A.1: Generating Facility One-Line Diagram

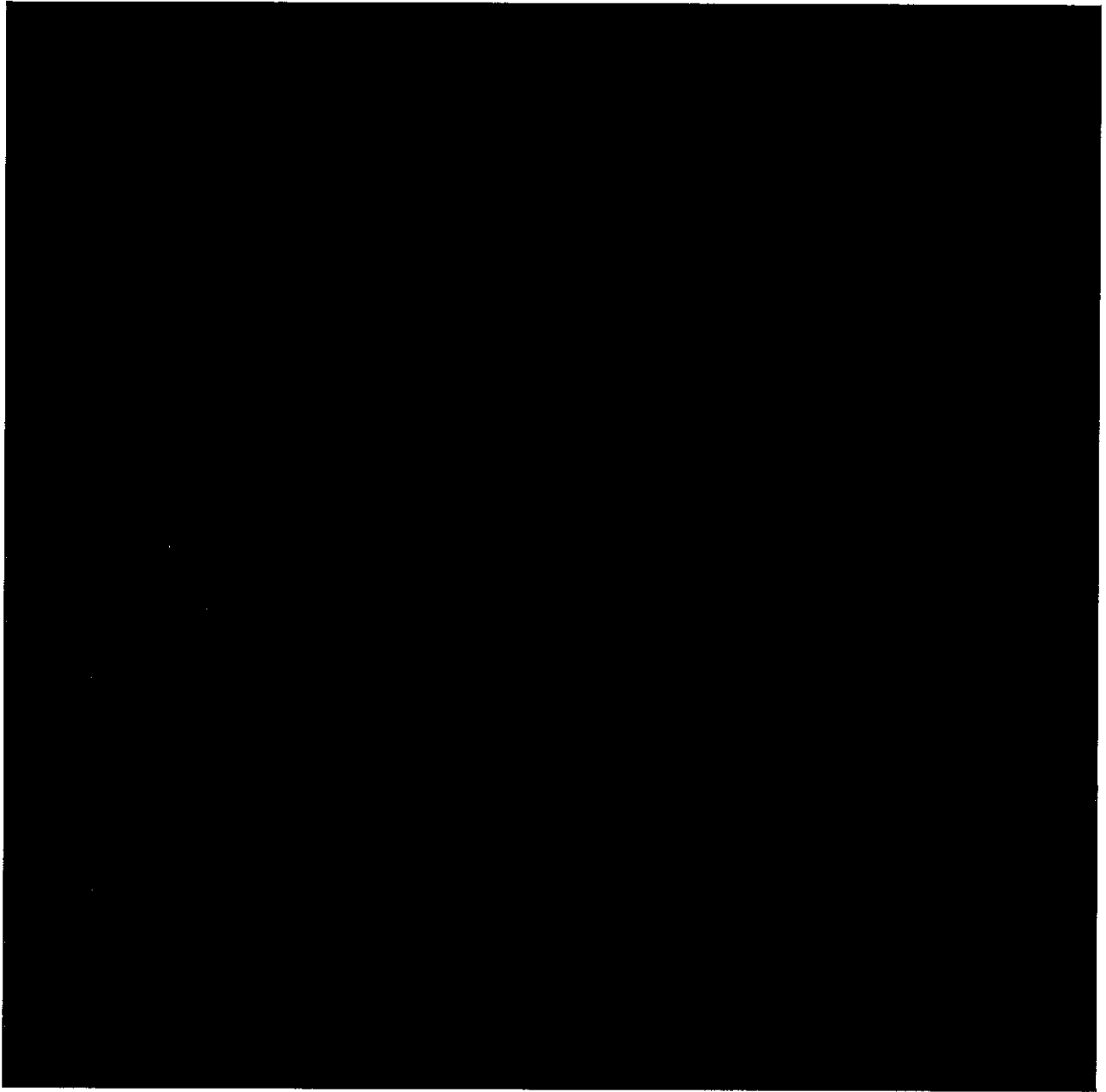
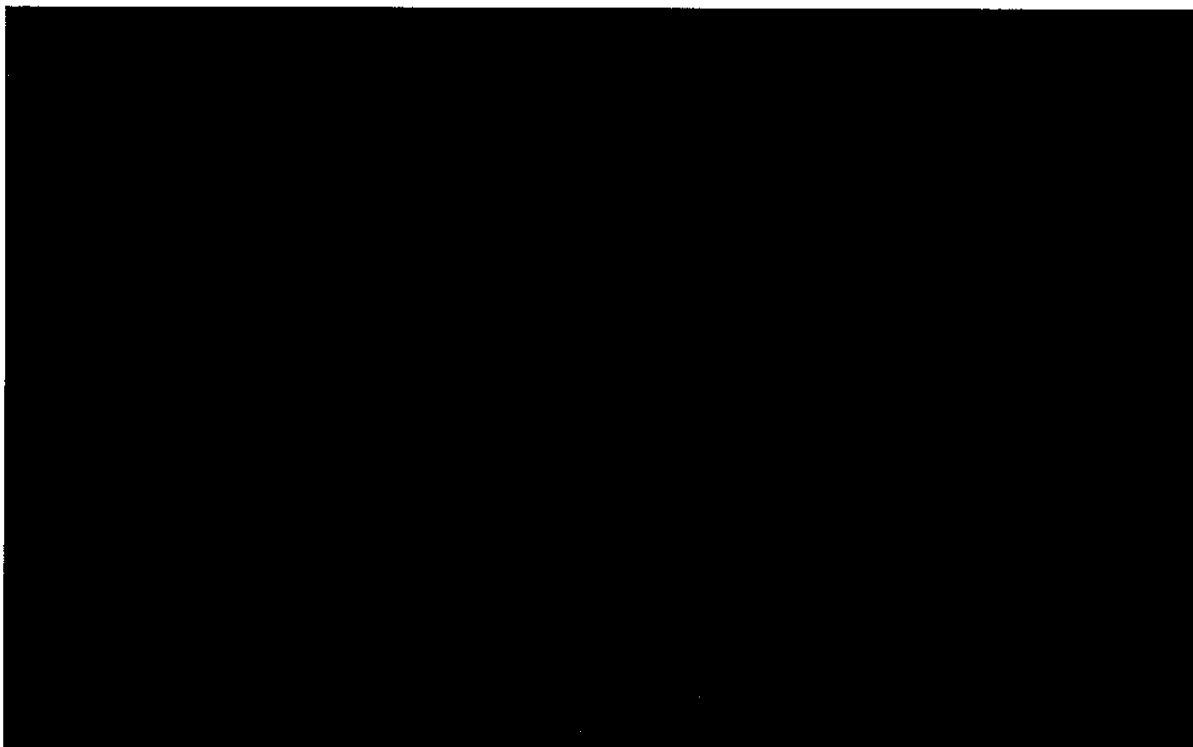


Table A.1 provides a summary of the Project information and Figure A.2 provides a map of the Project.

Table A.1: Project General Information

Project Location	[REDACTED] Pearblossom, CA Los Angeles County
Distribution Provider's Planning Area	Northern Area
Number and Type of Generators	[REDACTED] [REDACTED]
Interconnection Voltage	220 kV
Maximum Generator Output	[REDACTED]
Generator Auxiliary Load	0.5 MW
Maximum Net Output to Grid	[REDACTED]
Power Factor Range	> 0.99
Step-up Transformer(s)	[REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED]
POI	Distribution Provider's Vincent-Pearblossom 220 kV transmission line (CDWR owned section)
IC Requested COD	December 31, 2015

Figure A.2: Map of the Project



B. Study Assumptions

For detailed assumptions, please refer to QC6 Phase I area report. Below are the assumptions specific to the Project in respect to the SCE Transmission/Subtransmission System:

1. The following facilities will be installed by SCE and are included in this Phase I Study:

- The fiber optic lines required to support the line protection and SCADA for the Vincent-Pearblossom-WDT1034 220 kV line.
- The remote terminal units at the generating facility and Pearblossom Substation.
- The required retail load meters.

2. The following facilities are to be installed by the IC and are not included in this Phase I Study:

- The telecommunication conduit for control cables between WDT1034 and Pearblossom Substations and the last SCE structure with ADSS outside of WDT1034 to WDT1034 communication room. A communication path between WDT1034 and Pearblossom Substations will be required.
- The required CAISO Metering Equipment (Voltage and Current Transformers) and CAISO Meters.
- The metering cabinet to house the required SCE retail meters.

NOTE: The metering voltage and current transformers installed for the CAISO Metering will also be used for the SCE owned retail meters. The SCE Meters will be connected to the generator – owned voltage and current transformers to be installed for their CAISO metering

- The 220 kV line protection relays to be installed at the generating facility:
 - [REDACTED] or its equivalent successor.
 - [REDACTED] or its equivalent successor, with one dedicated digital communication channel to WDT1034 Substation.
- The 220 kV line protection relays to be installed at Pearblossom Substation:
 - [REDACTED] or its equivalent successor.
 - [REDACTED] or its equivalent successor, with one dedicated digital communication channel to Pearblossom Substation.

C. Reliability Standards, Study Criteria and Methodology

The generator interconnection studies will be conducted to ensure the CAISO controlled grid is in compliance with the North American Electric Reliability Corporation (NERC) reliability standards, WECC regional criteria, and the CAISO planning standards. Refer to Section C of the area report for details of the applicable reliability standards, study criteria and methodology.

D. Reliability Assessment Results

1. Steady State Power Flow Analysis Results

(a) Thermal Overloads

The group study indicated that the Project does not contribute to transmission facility overloads.

(b) Power Flow Non-Convergence

There were non-convergence issues under the double outage of the Lugo-Vincent No.1 and No.2 500 kV transmission lines identified by the addition of the Project due to the limited system capacity.

(c) Voltage Performance

With the generators providing the required power factor regulation capability (0.95 lead/lag at POI), no voltage performance issues were identified.

(d) Required Mitigations

A combination of congestion management, the Project providing 0.95 leading/lagging power factor regulation capability at the POI is required to mitigate the power flow impacts of the Project described above.

2. Short Circuit Analysis

Short circuit studies were performed to determine the fault duty impact of adding the QC6 Phase I 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 QC6 Phase I is determined. Each project in the cluster will be responsible for its share of the upgrade cost.

[REDACTED]

[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

This generation tie-line impedance was based on Distribution Provider calculation of generation tie-line electrical parameters utilizing tower and line conductor characteristics provided by the IC.

(b) Short Circuit Duty Study Results

All bus locations where the QC6 Phase I projects increase the short-circuit duty by 0.1 kA or more and where duty was found to be in excess of 60% of the minimum breaker nameplate rating are listed in the area report (Appendix H). These values have been used to determine if any equipment is overstressed as a result of the inclusion of QC6 Phase I 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 project.

As discussed in the area report, the QC6 Phase I breaker evaluation identified overstressed circuit breakers at the following buses. The pro-rata cost allocation for the Project, based on SCD contribution at each location, is also provided:

(i) Application Queue with RNUs and LDNUs Analysis Results

Fault duties were calculated with the inclusion of the QC6 projects and the identified RNUs and LDNUs to identify the incremental impacts associated with these Facilities. As discussed in Section D.5 of the area report, under this scenario the QC6 study breaker evaluation identified overstressed circuit breakers. The following is the pro-rata cost allocation for the Project, based on SCD contribution at each location.

SCD Mitigation - Table of Network Breaker Replacements (RNU and LDNUs)

Project	Vista 220 kV Substation		Barre 220 kV Substation		Rio Hondo 220 kV Substation	
	%	Allocated Cost (x1000) 2013 Dollars	%	Allocated Cost (x1000) 2013 Dollars	%	Allocated Cost (x1000) 2013 Dollars
WDAT1034	0.10	\$12	0.10	\$27	0.10	\$12

(ii) Application Queue Distribution Analysis Results

Fault duties were calculated for the QC6 projects on the distribution system. Under this scenario the QC6 study breaker evaluation identified overstressed circuit breakers at the following distribution substations. The following is the pro-rata cost allocation for the Project, based on SCD contribution at each location.

SCD Mitigation -Table of Distribution Breaker Replacements

Project	Vista 220 kV Substation		Barre 220 kV Substation		Hesperia 12 kV Substation		Auld 12 kV Substation	
	%	Allocated Cost (x1000) 2013 Dollars	%	Allocated Cost (x1000) 2013 Dollars	%	Allocated Cost (x1000) 2013 Dollars	%	Allocated Cost (x1000) 2013 Dollars
WDAT1034	0.10	\$1	0.10	\$5	0.00	\$0	0.00	\$0

(c) Preliminary Protection Requirements

Protection requirements are designed and intended to protect the Distribution Provider's system only. The preliminary protection requirements were based upon the interconnection plan as described in the introduction and shown in the one-line diagram depicted in Figure A.1 of this report.

The IC is responsible for the protection of its own system and equipment and must meet the requirements in the Distribution Provider Interconnection Handbook provided in Attachment 4.

3. 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 QC6 Phase I projects begin operation. The generator dynamic data used in the study for the Project is shown in Attachment 6.

(a) Transient Stability Study Scenarios

Disturbance simulations were performed for a study period of 10 seconds to determine whether the QC6 Phase I 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 Northern Bulk System were evaluated. For the list of specific line and generator outages evaluated, see the area report.

(b) Results

Limited stability analysis was performed for the Northern Bulk System to identify "relative" as opposed to "absolute" conclusions regarding the stability impacts of the Project. With all proposed system upgrades listed above and in Section F, the QC6 Phase I projects in SCE's Northern Bulk System would not cause the transmission system to go unstable under Category B and Category C outages. Stability plots are shown in Appendix F of the area report.

4. Reactive Power Deficiency Analysis

(a) Area Study Reactive Power Deficiency Results

The reactive power deficiency analysis included power flow sensitivity analysis in the Northern Bulk System on selected non-convergent cases from the power flow study. The analysis concluded that the QC6 Phase I projects, including the Project, collectively contribute to severe reactive power deficiencies in the transmission system under base case and contingency conditions, and voltage criteria violations under contingency conditions.

In particular, the reactive power deficiency analysis confirmed that the non-convergence cases in the power flow analysis were real transmission system deficiencies due to the addition of QC6 Phase I projects – such as insufficient reactive margin – and not numerical solution problems. The study concluded that a combination of existing reactive support devices and proposed mitigation will be required. For additional details, see the area report.

(b) Individual Project Power Factor Requirements

Based on the results of the Study, the Project will need to be designed to maintain a composite power delivery at continuous rated power at the POI at a power factor up to 0.95 leading and 0.95 lagging.

E. Deliverability Assessment Results

1. On Peak Deliverability Assessment

The Project does not contribute to the overloads identified in the peak deliverability assessment. For additional details, see the area report Section E.1.

2. Off- Peak Deliverability Assessment

The Project does not have significant contribution to the overloads identified in the off-peak deliverability assessment.

3. Required Mitigations

There is no mitigation identified for deliverability.

F. Interconnection Facilities, Network Upgrades, and Distribution Upgrades

Please see Attachment 1 for the Interconnection Facilities, Reliability Network Upgrades, Delivery Network Upgrades and Distribution Upgrades allocated to the Project.

G. Cost and Construction Duration Estimates

To determine the cost responsibility of each generation project in QC6, the CAISO developed cost allocation factors (Attachment 3) for Reliability Network Upgrades, Local Delivery Network Upgrades and Area Delivery Network Upgrades. Attachment 2 provides the 'constant' 2013 dollars and their escalation to the estimated COD year for Interconnection Facilities, Reliability Network Upgrades, Delivery Network Upgrades, and Distribution Upgrades which the Project was allocated cost. For the QC6 Study, the estimated COD is derived by assuming the duration of the work element will begin in June 2015, which is the CAISO Tariff scheduled completion date of the QC6 Phase I study plus 120 days for the Interconnection Agreement signing period and submittal of required funds by the IC.

H. SCE Technical Requirements

The IC is responsible for the protection of its own system and equipment and must meet the requirements in the Distribution Provider Interconnection Handbook provided in Attachment 4.

I. Environmental Evaluation, Permitting, and Licensing

Please see Appendix K of the QC6 Phase I area report.

J. Affected System Coordination

The CAISO Generator Interconnection and Deliverability Allocation Procedures (GIDAP) tariff Appendix DD section 3.7 requires that as part of the generator interconnection process, the ISO must regularly coordinate with adjacent electric systems in order to facilitate studies of potential reliability concerns caused by the interconnection of generation in the ISO generation interconnection queue to the ISO controlled grid. Similarly, generators interconnecting to the

facilities of transmission owners in adjacent electric systems may cause potential reliability concerns on the ISO controlled grid.

The ISO tariff defines an “Affected System” as an electric system other than the ISO controlled grid that may be affected by the proposed interconnection, and an “Affected System Operator” as the entity operating an Affected System. The ISO tariff provides a general framework for addressing the impact on Affected Systems of generation projects in the ISO interconnection queue. The tariff states that, in the initial project study stages, the ISO will:

- Notify potential Affected System Operators that could be impacted by a generator interconnection;
- Coordinate the conduct of studies to determine possible impacts; and
- Include potential Affected System Operators in all customer meetings.

However, the ISO does not comprehensively study the impacts of generator interconnections on Affected Systems, for several reasons. First, the ISO does not have detailed information about Affected Systems on a transmission-element level, nor does the ISO know the details of the various reliability and operating criteria applicable to the Affected Systems. Second, because the operation of transmission systems changes over time along with NERC reliability standards, the ISO cannot presume to know all of the impacts of these changes on Affected Systems. Consequently, the interconnection customer is responsible for:

- Cooperating with the ISO in all matters related to the Affected System studies;
- Signing a separate study agreement with the Affected System Operator so that potential impacts on the Affected System can be evaluated; and
- Paying for necessary studies and any upgrades necessary to mitigate the impacts of their interconnection on the Affected System.

Further, the Affected System Operator is required to cooperate with the ISO on all matters related to the conduct of studies and modifications to the Affected System.

The interconnection customer is obligated by the terms of the ISO’s relevant generator interconnection agreement (large or small) to enter into an agreement with the Affected System Operator, which must specify the terms governing payments for studies and mitigation, if required, to be made by the customer to the Affected System owner, and repayment by the Affected System Operator.

California Department of Water Resources (CDWR) and Los Angeles Department of Water and Power (LADWP)’s transmission networks adjoin the Northern Area. As such, the Project could potentially impact CDWR and /or LADWP systems. The ISO has notified CDWR and LADWP of the Project and provided study data and information for their review.

Prior to its generating unit in-service date, the Interconnection Customer must provide documentation to the ISO confirming that the Affected System Operators have been contacted, that any system reliability impacts have been addressed (or that there are no system impacts), or that the interconnection customer has taken all reasonable steps to address potential reliability system impacts with the Affected System Operator but has been unsuccessful.

K. Items not covered in this study

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 final engineering and design.

2. IC's Technical Data

The study accuracy and results for the QC6 Phase I Study are contingent upon the accuracy of the technical data provided by the IC. Any changes from the data provided could void the study results.

3. Study Impacts on Neighboring Utilities

Results or consequences of this QC6 Phase I 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).

4. Use of Distribution Provider Facilities

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

5. Distribution Provider Interconnection Handbook

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

6. Western Electricity Coordinating Council (WECC) Policies

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

7. System Protection Coordination

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

8. Standby Power and Temporary Construction Power

The QC6 Phase I Study does not address any requirements for standby power or temporary construction power that the Project may require prior to the In-Service Date of the Interconnection Facilities. Should the Project require standby power or temporary

construction power from Distribution Provider prior to the In-Service Date of the Interconnection Facilities, the IC is responsible to make appropriate arrangements with Distribution Provider to receive and pay for such retail.

9. Licensing Cost and Duration Estimate (Estimated Construction Schedule)

The estimated licensing cost and durations applied to the Project are based on the Project scope details presented in this study. These estimates are subject to change as Project environmental and real-estate elements are further defined. Upon execution of the Interconnection Agreement, additional evaluation including but not limited to preliminary engineering, environmental surveys, and property-right checks may enable licensing cost and/or duration updates to be provided.

10. Network/Non-Network Classification of Telecommunication Facilities

The cost for telecommunication facilities that were identified as part of the IC's Interconnection Facilities was based on an assumption that these facilities would be sited, licensed, and constructed by the IC. The IC will own, operate, maintain, and construct diverse telecommunication paths associated with the IC's generation tie line, excluding terminal equipment at both ends. In addition, the telecommunication requirements for SPS were assumed based on tripping of the generator breaker as opposed to tripping the circuit breakers at the Distribution Provider substation. Due to uncertainties related to telecommunication upgrades for the numerous projects in queue ahead of QC6 Phase I, telecommunication upgrades for higher queued projects were not considered in this study. Depending on the outcome of interconnection studies for higher queued projects, the telecommunication upgrades identified for QC6 Phase I may be reduced. Any changes in these assumptions may affect the cost and schedule for the identified telecommunication facilities.

11. Applicability

This document has been prepared to identify the impact(s) contributions of the Project on the SCE electrical system; as well as establish the technical requirements to interconnect the Project to the POI that was evaluated in the QC6 Phase I Study for the Project. Nothing in this report is intended to supersede or establish terms/ conditions specified in Interconnection Agreements agreed to by SCE, CAISO and the IC.

Attachment 1

Interconnection Facilities, Network Upgrades and Distribution Upgrades

Please refer to separate document.

Attachment 2

**Escalated Cost and Time to Construct for Interconnection Facilities, Reliability
Network Upgrades, Delivery Network Upgrades, and Distribution Upgrades**

Please refer to separate document.

Attachment 3
Allocation of Network Upgrades for Cost Estimates

Queue # WDT1034

	NU Cost (2013 \$1000)	Cost Share (%)	Allocated Cost (2013 \$1000)	Allocated Cost (Escalated \$)
RNU				
Vista 220kV substation CB upgrade	\$943	0.10%	\$1	\$1
Barre 220kV substation CB upgrade	\$16,309	0.10%	\$16	\$18
Rio Hondo 220kV substation CB upgrade	\$915	0.10%	\$1	\$1
Vista Substation grid ground study	\$11	100.00%	\$11	\$12
Barre Substation grid ground study	\$11	100.00%	\$11	\$12
Rio Hondo Substation grid ground study	\$11	100.00%	\$11	\$12
Grand Total	\$18,198		\$50	\$54

Attachment 4

Distribution Provider Interconnection Handbook

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

Attachment 5

Short Circuit Calculation Study Results

Please refer to the Appendix H of the area report.

Attachment 6

Customer Provided Project Dynamic Data

The following data was submitted by the IC for Dynamic simulation:

epcgen 99996 "PEARBL270" 0.270 "1" : #7 mva=10.0000 "smascpv.p" 3.0000 "rsrc"
0.0000 "xsrc" 0.0000 "Vratio" 1.2000 "Iratio" 1.1000 "Tdc" 0.0020 "Kpdc" 2.0000 "Kidc"
20.0000 "Kpq" 0.1000 "Kiq" 10.0000 "Ilim" 1.1100 "PFC" 1.0000 "PPS" -0.2500 "RPS" -
5.1700 "PFS" -0.4000 "FSP" 999.9000 "FRP" 60.0500 "Qreg" 0.0000 "MOD" 0.0000 "OV1L"
1.2000 "OV1T" 0.1600 "OV2L" 1.1000 "OV2T" 1.0000 "UV1L" 0.4500 "UV1T" 0.1600
"UV2L" 0.8500 "UV2T" 2.0000 "OFL" 62.0000 "OFT" 0.1600 "UFL" 57.0000 "UFT" 0.1600
"LVL" 0.0000 "VSP" 0.2000 "VRP" 0.2500

Attachment 7

SCE Northern Hemisphere Import Nomogram

Please refer to separate document.

Queue Cluster 6 Phase I Interconnection Study - Attachment 1 to Appendix A



Interconnection Facilities, Network Upgrades, and Distribution Upgrades

Interconnection Facilities, Network Upgrades, and Distribution Upgrades

To determine the cost responsibility of each generation project in QC6, the California Independent System Operator Corporation (CAISO) developed cost allocation factors (Attachment 3) for Reliability Network Upgrades and Local Delivery Network Upgrades. The CAISO developed the \$/MW cost rate for incremental Area Delivery Network Upgrades. The cost rate multiplied by the requested deliverable MW capacity provides the cost estimate for the Area Delivery Network Upgrades. The Interconnection Facilities are the sole cost responsibility of the Project. The Interconnection Facilities and Network Upgrades are listed below:

INTERCONNECTION FACILITIES

1. Substations

Vincent Substation

Install the following pair of protection relays:

- One (1) [REDACTED] or its equivalent successor.
- One (1) [REDACTED] or its equivalent successor, with one dedicated digital communication channel.

2. Metering Services Organization

- a. Install revenue meters required to meter the retail load at the generating facility.
- b. The customer will provide the required metering equipment (voltage and current transformers and metering cabinet).

3. Power System Controls

Install one (1) RTU at the generating facility and one (1) RTU at Pearblossom Substation 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 grid control center.

4. Real Properties

Obtain access easements for RTUs installed at the generation facility and Pearblossom Substation.

RELIABILITY NETWORK UPGRADES (RNU)

1. Short Circuit Duty (SCD) Mitigation - RNU¹

Refer to Section D and F of corresponding Area Report for additional details.

Interconnection Facilities, Network Upgrades, and Distribution Upgrades

LOCAL DELIVERY NETWORK UPGRADES (LDNU)

No Local Delivery Network Upgrades were identified as part of this QC6 Phase I study for Project.

AREA DELIVERY NETWORK UPGRADES (ADNU) AND ASSOCIATED DISTRIBUTION UPGRADES USED TO DERIVE DOLLAR-PER-MW VALUE

No Area Delivery Network Upgrades were identified as part of this QC6 Phase I study for Project.

DISTRIBUTION UPGRADES

1. Telecommunications

- a. Install approximately 10 miles of new fiber optic cable from WDT1034 to Little Rock Substation.
- b. Extend fiber optic cable between WDT1034 communications room and Pearblossom switchyard through customer installed conduit.
- c. Install all required lightwave, channel banks, and related terminal equipment at Vincent, WDT1034, and Pearblossom Substations.

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

Obtain licensing, permits, land rights and perform all required environmental activities for the installation of the fiber optic cable required to support the line protection and SCADA for the Vincent – Pearblossom – WDT1034 220 kV three point line.

3. Short Circuit Duty (SCD) Mitigationⁱ

Refer to Section D and F of corresponding Area Report for additional details.

ⁱ Network and Distribution system SCD mitigations (ie. circuit breaker upgrades) have costs allocated based on project short circuit duty contribution at each location.