[redacted]

WDT1289EXP

[redacted] and Generation

Interconnection System Impact Study

April 22, 2016

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1. Purpose

The [redacted] submitted an interconnection request for a [redacted] The point of interconnection for the [redacted] is the [redacted] The project, along with the queued ahead project WDT1289 studied as part of the Queue Cluster 8 Studies, is an expansion of the existing [redacted] WDT190.

The purpose of this study is to determine the adequacy of SCE's electrical distribution system to accommodate the [redacted] and to identify system limitations that would require Distribution Upgrades on the subtransmission system to mitigate any identified impacts. The study included all existing and queued ahead generation projects in the [redacted] regardless of the in-service dates of such prior queued generation projects. The study considered minimum daytime levels of load demand with maximum generation dispatch as well as maximum levels of load demand coupled with maximum charging of energy storage facilities and minimal generation within the local subtransmission system.

2. [redacted] Project Interconnection Information

The most current interconnection information provided for the [redacted] is listed below. Table A.1 lists the essential data obtained from the interconnection request.

Table A.1: Project General Information

Project Location	[redacted]
Participating TO's Planning Area	SCE Northern Area
Number and Types of Generators	[redacted]
Interconnection Voltage	[redacted]
Maximum Generator Output	[redacted]
Generator Auxiliary Load	0 MW
Maximum Net Output at Generation Facility	[redacted]
Estimated Generation Tie-Line Losses	Not Applicable
Estimated Maximum Net Output at POI	[redacted]
Power Factor Range	Lead 0.95 / Lag 0.95 at POI per interconnection application

Step-up Transformer(s)	[redacted]
Point of Interconnection	[redacted]
IC Requested COD	August 1, 2016

3. System Assumptions

3.1 Planning Criteria

The generator interconnection studies were conducted utilizing SCE's Reliability Planning Criteria. More specifically, the main criteria applicable are as follows:

Power Flow Analysis

The following contingencies are considered for subtransmission lines and 220/66 kV transformer banks ("A-banks"):

- Single Contingencies (N-1) – Loss of one line or one A-bank
- Double Contingencies (N-2) – Loss of two lines

The following reliability criteria are used:

Subtransmission Lines	Base-Case	Limiting Component Normal Rating
	N-1 and N-2	Limiting Component Emergency Rating
220/66 kV Transformer Banks (A-banks)	Base-Case	Normal Loading Rating *
	N-1 and N-2	As defined by SCE Operating Bulletin

* Please note that Normal Rating has been reduced to reflect 95% of name-plate rating for charging cases.

3.1.1. Normal Overloads

Normal overloads are those that exceed 100 percent of normal facility rating with all facilities in-service (base case). Mitigation will be required to address any identified normal overload triggered by the inclusion of QC8 Phase I projects.

3.1.2. Contingency Overloads

Contingency overloads are those that exceed 100 percent of emergency ratings under outage conditions. Mitigation will be required to address any identified contingency overload triggered by the inclusion of QC8Phase I projects.

3.1.3. Voltage Criteria

Voltage performance under single and double outage conditions will be limited to 5 percent and 10 percent deviation respectively.

3.1.4. Power Factor Criteria

All projects will need to comply with SCE's Interconnection Handbook requirements.

3.2 Load Assumptions

The load assumptions used for local subtransmission system initially considered a 2020 load forecast. The 2020 load forecast was derived using SCE's Distribution Engineering A-bank Planning load forecast as well as the individual load serving substation (B-bank) load forecast for 2014-2023.

The A-bank Normal and Criteria load forecast was distributed to each individual B-bank substation (lower voltage substations served from the 220/66kV substation) on a pro-rata basis. The resulting individual B-bank substation values are shown below in Table 3.1 and were used as the basis for evaluating subtransmission system performance.

Table 3.1
Local Subtransmission System Load Assumptions

[redacted] Load Serving Substations	2020	
	Normal	Criteria
[redacted]	19.6	20.4
[redacted]	21.1	22.0
[redacted]	79.0	82.2
[redacted]	3.6	3.7
[redacted]	24.6	25.6
[redacted]	3.4	3.6
[redacted]	3.5	3.7
[redacted]	20.9	21.7
[redacted]	4.4	4.6
[redacted]	14.9	15.5
[redacted]	30.5	31.7
[redacted]	27.6	28.7
[redacted]	24.6	25.6
[redacted]	18.4	19.2
[redacted]	18.6	19.3
[redacted]	5.2	5.4
[redacted]	13.0	13.5
[redacted]	6.5	6.8
Total Station Load	339.5	353.1

The assessment used to evaluate maximum generation output considered the minimum daytime load for the study while the assessment used to evaluate "charging" aspects of the project utilized the peak load demand forecast.

3.3 Generation Assumptions

There were seven (7) existing generation projects in the [redacted] Subtransmission System. Table 3.3 lists these existing generator projects with essential data.

Table 3.3: SCE Existing Projects at [redacted]

[redacted]

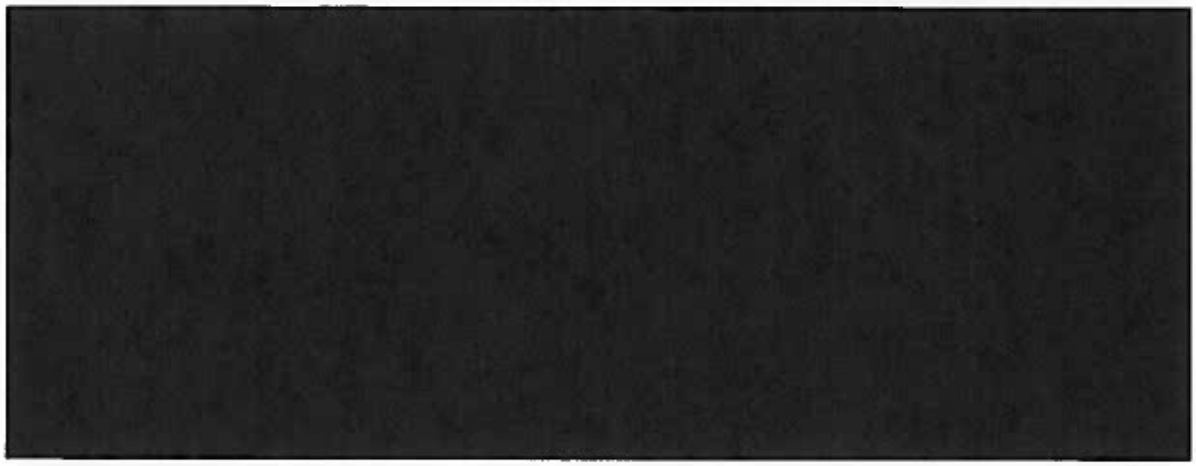
There were also a total of eleven (11) queued ahead generation projects, totaling [redacted] seeking interconnection to the [redacted] Subtransmission System. Table 3.4 lists these queued ahead generator projects with essential data obtained from the SCE WDAT Generation Queue.

Table 3.4: SCE Queued Ahead Projects at Vestal 66 kV System

[redacted]

[redacted]

SCE [redacted] SUBTRANSMISSION AREA



3.4 Subtransmission System Assumptions

The [redacted] Independent Study modeled the existing [redacted] without any additional upgrades. The study considered existing system operating bulletins/procedures that transfer system load from Vestal to adjacent systems under certain outage conditions.

3.5 Study Methodology

3.5.1. Power Flow Study

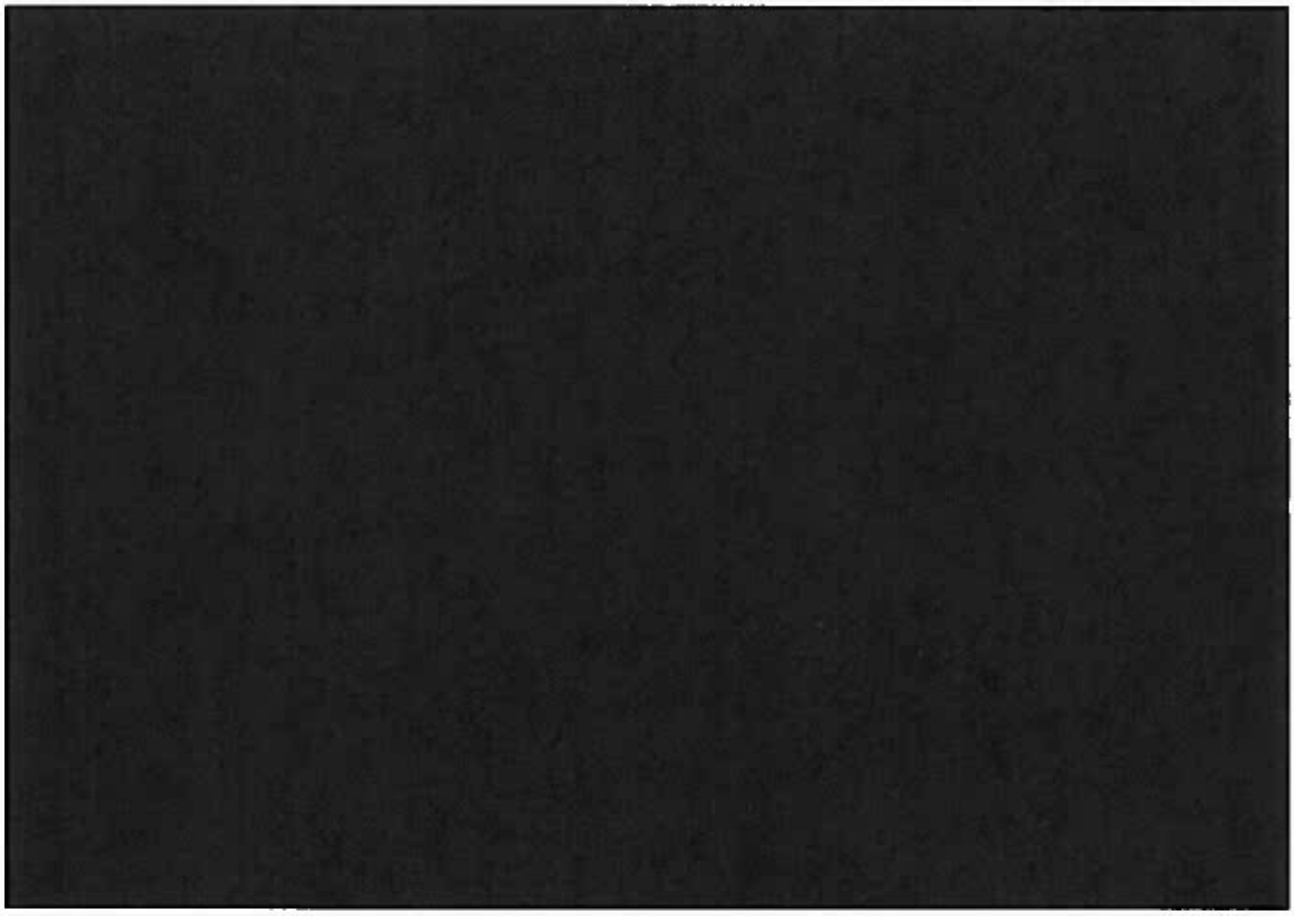
The base cases were developed to represent stressed scenarios of loading and generation conditions for the study group area. This assessment is comprised of power flow study scenarios that represent load conditions reflected in Table 3.1.

As part of the QC8 Phase I studies, the Interconnection Customer submitted an energy storage project, WDT1289, with a total charging/discharging capability of [redacted] However, the Interconnection Customer elected to reduce the project to [redacted] for the QC8 Phase I Interconnection Study. In concurrence, the IC submitted the [redacted] Interconnection Request for [redacted] thereby maintaining the total MWs connecting to the [redacted] to [redacted] already evaluated as part of the QC8 Phase I Interconnection Studies.

Because the Interconnection Customer did not increase the MWs that were studied as part of QC8 Phase I, the study results obtained for QC8 Phase I will be leveraged to summarize results corresponding to the [redacted] as they properly reflect the expected post-project power flow conditions.

The critical outage conditions evaluated that were evaluated as part of Q8 Phase I study are provided below in Table 3.5.1.

Table 3.5.1
List of Contingencies Evaluated



Note: Though other relevant contingencies were also evaluated, only those listed above were the most critical and seen to create overloads that could be attributed to the addition of the QC8 Phase I projects.

3.5.2. Post Transient Voltage Study

The power flow study voltage results were used in the QC8 Phase I Interconnection Studies as a screen to identify those contingencies that may have required additional post-transient voltage studies. Contingencies identified in the power flow to have a voltage drop in excess of 5% were selected for post-transient voltage analysis. The Post-transient voltage studies compare voltage deviations to the reliability requirements for contingency outages on the subtransmission system. Mitigation measures will be recommended for any criteria violation that may have been identified to be triggered with the inclusion of QC8 projects.

4. Power Flow Results

Because the [redacted] did not increase the MWs that were studied as part of QC8 Phase I Interconnection Studies, the study results obtained for QC8 Phase I properly reflect the expected post-project power flow conditions. A summary of these results is provided below.

4.1 Maximum Generation Coupled with Minimum Load Conditions

4.1.1 Base Case Conditions

The QC8 Phase I study results identified that with the inclusion of the QC8 Phase I projects an overload on the [redacted] was triggered.

4.2 Maximum Generation Coupled with Maximum Load Conditions

4.2.1 Base Case Conditions

In addition to the base case overloads discussed above in Section 4.1, the QC8 Phase I project(s) in the [redacted] were identified to exacerbate an existing base case overload on the [redacted] under the Maximum Generation with Maximum Load assumption. As a result, QC8 Phase I project(s) in this area will need to wait for mitigation to be put in place prior to allowing for interconnection. SCE is currently developing a project that would address this pre-QC8 Phase I overload. Consequently, no mitigation for this overload is assigned to QC8 Phase I Projects or the [redacted]

4.2.2 Outage Conditions

The addition of QC8 Phase 1 Projects were identified to trigger single contingency subtransmission overloads on the Vestal leg of the [redacted] under the condition where the bus side circuit breaker at [redacted] is out for maintenance and a bus outage occurs.

4.3 Maximum Energy Storage Coupled with Minimum Local Subtransmission Generation Conditions

The storage facility charging study was performed using the load assumptions discussed above in Table 3.2. The QC8 Phase I projects did not trigger any base case or contingency subtransmission overloads during any of the time blocks.

4.4 Power Flow Study Observations, Notes, and Restriction to Energy Storage

(a) Northern Bulk Area Export Limits

The Projects contribute to thermal overload issues on the Northern Bulk system that are already being addressed, will be addressed by pending upgrades, or addressed via CAISO congestion protocols. As a result, the Projects were not allocated Network Upgrade costs related to thermal overload issues. However, the Projects may be exposed to congestion management while pending upgrades are being implemented on the bulk system (please refer to the Area Bulk Report for additional details).

(b) N-1-1 Outages

There is an operational risk associated with non-common corridor N-2 outages. Loss of two lines under a non-common mode failure is considered an N-1-1 contingency event which allows for manual system adjustments between contingencies if an overload is anticipated for the next contingency that follows the first contingency. It is important to note that under such potential conditions, curtailment of generation output will be implemented under real-time operation of the system, if required, in advance of the second outage to ensure potential overload is properly mitigated. Because all interconnection agreement contain provision to enable such generation curtailment, no additional physical upgrades were identified to be required under any such N-1-1 outage conditions.

(c) Energy Storage Restrictions

The study results did not identify a base case or outage related thermal overload problem on the [redacted] that necessitate the need to restrict charging of the QC8 project in the [redacted] at this time. However, charging restrictions may occur in the future under the following conditions, but not limited to:

- Incremental load growth beyond forecasts
- Decrease in amount of internal generation in the area assumed to be available
- Additional energy storage interconnection requests beyond QC8
- Limitations on CAISO network corresponding to operating conditions that involve loss of multiple elements (please refer to section C in the Northern Bulk Area Report)
- Maintenance and/or unplanned outage conditions

4.5 Subtransmission Assessment Mitigations

Because the [redacted] did not increase the MWs that were studied as part of QC8 Phase I the following mitigation is valid for the Project.

(a) Maximum Generation Coupled with Minimum Load Conditions

Mitigation for A-Bank Overload

Base Case - To address the base case overload identified on the single [redacted] the second A-Bank in place that is currently operated normally open will need to be operated normally in-service. This will require protection modifications at the [redacted]

Loss of A-Bank - After the base case mitigation is in place, the only remaining contingency requiring mitigation is loss of an A-Bank. The mitigation will be to implement a Loss of A-Bank Scheme which would disconnect generation tie lines connected directly to [redacted]

(b) Maximum Generation Coupled with Minimum Load Conditions

To address the incremental loading on the [redacted] under the condition where the bus side circuit breaker at [redacted]

kV Position 5 is out for maintenance and a bus outage occurs, generation restrictions (curtailment) will be implemented.

(c) Maximum Energy Storage Coupled with Minimum Local Subtransmission Generation Conditions

The inclusion of QC8 Phase 1 projects did not trigger base case or contingency overloads. Therefore, no mitigation was proposed.

5. Post Transient Voltage Stability Assessment Results

Review of the QC8 Phase I power flow study results identified that no voltage deviations exceeded the criteria discussed above. As a result, no further post-transient analysis on the subtransmission system was performed.

6. Short Circuit Duty Assessment Results

Short Circuit Duty assessment have been performed as part of End of Queue Generation study. No impacts were identified to the[redacted]system that would necessitate mitigation.

7. Conclusion

Because the[redacted]did not increase the MWs that were studied as part of QC8 Phase I Interconnection Studies the study results obtained for QC8 Phase I properly reflect the expected post-project power flow conditions of adding the Project to the[redacted] Substransmission System. No additional mitigation was identified to be triggered by the addition of the[redacted] The intent is for WDT1289 and[redacted](WDT1289EXP) to both be expansions to the existing WDT190 project, where all three projects will be incorporated into one GIA. Under this assumption, no additional facilities were identified to be needed for the[redacted]beyond those required for WDT190 and WDT1289. In the event that the QC8 WDT1289 Interconnection Request is withdrawn, WDT1289EXP will require the new Interconnection Facilities and Distribution Upgrades to be identified in the WDT1289 Phase II Interconnection Study necessary to interconnect such expansion project.