[redacted]

System Impact Study

[redacted]

October 21, 2015

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1. Purpose

[redacted] submitted an interconnection request for a [redacted] Energy Storage Project utilizing [redacted] connecting to the existing [redacted] The point of interconnection for the [redacted] is the [redacted] position used to terminate the existing [redacted] at the [redacted]

The purpose of this study is to determine the adequacy of SCE's electrical distribution system to accommodate the [redacted] under both the "charging" and "discharging" aspects of the project 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] subtransmission system, 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.

Results of the study will be used as the basis to determine appropriate cost allocation for any identified Distribution Upgrades.

2. [redacted] Project Interconnection Information

The most current interconnection information provided for the [redacted] was received on April 17, 2015 as part of an Independent Study Process. 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	66 kV
Maximum Generator Output	[redacted] (at the terminal voltage)
Generator Auxiliary Load	[redacted]
Maximum Net Output at Generation Facility	[redacted] (at the high-side of the customer main transformer bank)
Estimated Generation Tie-Line Losses	[redacted] (based on generation tie-line technical parameters provided)
Estimated Maximum Net Output at POI	[redacted] (Maximum Net Output – Estimated losses on generation tie line)
Power Factor Range	[redacted] at POI per interconnection application and as required by Interconnection Handbook

Step-up Transformer(s)	[redacted]
Pad Mount Transformer(s)	[redacted]
Point of Interconnection	Distribution Provider's [redacted] position terminating the [redacted] [redacted] generation tie-line
IC Requested COD	12/31/2020

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 [redacted]

- Single Contingencies – Loss of one line or one A-bank
- Double Contingencies – 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
[redacted] (A-banks)	Base Case	Normal Loading Rating
	Long Term Emergency Loading Limit (LTELL) & Short Term Emergency Loading Limit (STELL)	As defined by SCE Operating Bulletin

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 the [redacted]

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 the [redacted]

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 considered the load forecast used for QC7 Phase1. The QC7 Phase 1 load assumptions were derived from historical load. [redacted] 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 prior to inclusion of the Project. The load values will increase by [redacted] with the inclusion of the Project when the project is modeled in "charging" mode.

Table 3.1
Local Subtransmission System Load Assumptions

[redacted]

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

Generation dispatch of local subtransmission system generation (existing and queued) was done in a manner that would provide for a stressed export of generation in the system. In order to assess the subtransmission system and stress it to its maximum capacity, all local generation resources within the [redacted] Subtransmission System were dispatched as listed in the table below. Note that the [redacted] production from [redacted] installed during the QF era have been modeled to reflect a collective [redacted] The total MW output with the inclusion of [redacted]

Table 3.2
Existing and Queued Ahead Local Generation

[redacted]

[redacted]

3.4 Subtransmission System Assumptions

The [redacted] modeled the existing [redacted] without any additional upgrades. It is important to note that subtransmission upgrades previously identified to be needed to support queued ahead generation projects have failed to materialize as every project identified to trigger new upgrades, specifically installation of a [redacted] have ultimately withdrawn.

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. A pre-case with the inclusion of all queued ahead projects, including the IC's [redacted] were fully dispatched in the foundation base case. The post-case added the [redacted] to identify the incremental impacts corresponding to an incremental [redacted]

Because the Interconnection Customer has identified that it is their intent to replace the undeveloped [redacted] potion of their current [redacted] with energy storage under a material modification application (MMA) and have submitted this request in the event the MMA is not approved, a sensitivity study has been performed which limits [redacted] to the current [redacted] of PV already placed into service. Under this sensitivity, the pre-case will reflect [redacted]ess and the post-case would add the undeveloped portion at the end of the queue.

Mitigation measures will be recommended for any power flow criteria violation identified to be triggered with the inclusion of the Project. The outage conditions evaluated, shown below in Table 3.5.1, are limited due to the fact that the project is directly connecting to the [redacted]
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Table 3.5.1
List of Contingencies Evaluated

[redacted]

3.5.2. Post Transient Voltage Study

The power flow study voltage results were used as a screen to identify those contingencies that may require additional post-transient voltage studies. Single and double 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 single and double contingency outages on the subtransmission system. Mitigation measures will be recommended for any criteria violation identified to be triggered with the inclusion of the Project.

4. Power Flow Results

4.1. Inclusion of [redacted] – Base Case Evaluation

Based on the assumptions listed above, the addition of the [redacted] triggered base case and single contingency subtransmission overloads under maximum generation with minimum load study conditions. The addition of the [redacted] triggered base case overloads on the [redacted] With the addition of the project, loading on these transformer banks was increased from [redacted] up to [redacted] requiring Distribution Upgrades in the form of adding [redacted]

The storage facility charging study was performed using the load assumptions discussed above in Table 3.1. No Base Case or contingency overloads were identified during this scenario.

4.2. Inclusion of [redacted] – Sensitivity Case

The reduction of [redacted], results in pre-project loading on the [redacted] Such reduction allows adequate capacity for the [redacted] as the addition of the project, coupled with the reduction of [redacted] results in post-project loading of [redacted] These results are only valid if [redacted] is ultimately reduced to reflect [redacted]

Under outage conditions, [redacted] will need to be added to the existing [redacted] is a logic scheme implemented for loss of one of the [redacted] which results in loading the remaining [redacted] in excess of the Long Term Emergency Loading Limit (LTELL). Under this condition, [redacted] would open thus disconnecting the [redacted] and in doing so, also disconnecting [redacted] and [redacted] No additional upgrades are required as this [redacted] is already in place.

5. Post Transient Voltage Stability Assessment

5.1. Maximum Generation Coupled with Minimum Load Condition

End of Queue post-transient voltage stability analysis was performed based on the results of the power flow study. The post-transient analysis evaluated the system with the inclusion of all distribution upgrades and assumed all new generation projects met the power factor requirements articulated in the Interconnection Handbook (asynchronous generating facilities are required to provide [redacted] correction at the POI). Under such conditions, the post-transient study showed acceptable system performance.

5.2. Maximum Energy Storage Coupled with Minimum Local Subtransmission Generation Conditions

There were no impacts identified to the [redacted] subtransmission system that would necessitate mitigation.

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] Subtransmission system that would necessitate mitigation.

7. Conclusion

Based on the results of this study, Distribution Upgrades in the form of a [redacted] are required to interconnect the [redacted] The need for the [redacted] will disappear if [redacted] ultimately reduces project size down to [redacted]

[redacted]

[redacted]

[redacted]