Appendix A – WDT1490

[redacted]

Queue Cluster 10 Phase II Report

November 21, 2018

This study has been completed in coordination with the California Independent System Operator Corporation (ISO) per Southern California Edison Company's Wholesale Distribution Access Tariff (WDAT), Attachment I Generator Interconnection Procedures (GIP)

Interconnection Study Document History

No.	Date	Document Title	Description of Document
1	11/21/18	Queue Cluster 10 Phase II Appendix A Report	Final Phase II interconnection study report

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ATTACHMENTS

A. INTRODUCTION

[redacted] the Interconnection Customer (IC), has submitted a completed Interconnection Request (IR) to Southern California Edison (SCE), the Distribution Provider, for its proposed [redacted] (Generating Facility).

In accordance with FERC approved SCE's WDAT Attachment I Generator Interconnection Procedures (GIP), the Generating Facility was grouped with Queue Cluster 10 (QC10) Phase II projects to determine the impacts of the group as well as impacts of the Generating Facility on SCE's Distribution System and the ISO Grid.

An Area Report and, where applicable, a Subtransmission Assessment Report have been prepared separately identifying the combined impacts of all projects on the ISO Grid and to distribution facilities served out of the Vestal 66 kV Subtransmission System, respectively. This Appendix A report focuses only on the impacts or impact contributions of the Generating Facility. This report is not intended to supersede any contractual terms or conditions specified in a forthcoming Generator Interconnection Agreement (GIA).

The report provides the following:

1. Distribution and transmission system impacts allocated to the Generating Facility.
2. System reinforcements or mitigation necessary to address the adverse impacts allocated to the Generating Facility under various system conditions.
3. A list of required facilities and a good faith estimate of the Generating Facility's cost responsibility and time to construct[1] these facilities. Such information is provided in Attachment 1 and Attachment 2 as separate documents in the Appendix A report package of the Generating Facility.
4. Identification of potential short circuit duty impacts to Affected Systems served from the Subtransmission or Distribution System.

The Generating Facility consists of all equipment and to be located in Delano, California, as disclosed by the IC in its IR and/or Appendix B, as may have been amended during the Interconnection Study process, as summarized below:

[1] It should be noted that construction is only part of the duration of months specified in the study, which includes detailed engineering, licensing, and other activities required to bring such facilities into service. These durations are from the execution of the GIA, receipt of: all required information, funding, and written authorization to proceed with design and engineering, procurement, and construction from the IC as will be specified in the GIA to commence the work.

Table A.1: Generation Facility General Information per the IR, including Appendix B

[redacted]

The IC has requested, and the GIA will provide for, a total net capacity of 55.83 **MW** as measured at the high-side of the main step-transformer(s) and 55.83 **MW** at the POI. If the Generating Facility is capable of exceeding these values, the IC shall be required to install, own and maintain a control limiting device or, alternatively, by means of configuring the Generating Facility's control system, as approved by SCE that will ensure the Generating Facility complies with these restrictions.

The Interconnection Facilities of the Generating Facility are illustrated in Figure A.1. While Figure A.2 illustrates the location of the Generating Facility. Additional information is provided in Table A.2

Figure A.1: Generating Facility One-Line Diagram

[redacted]

Figure A.2: Generating Facility Location Map

[redacted]

Table A.2: Additional Generating Facility General Information

Generating Facility Location	[redacted]
SCE's Planning Area	Northern Area
Interconnection Voltage	66 kV
POI	Vestal-Growers-Kern River 66 kV line
Number and Types of Generators	[redacted] each rated at 1.0 MW for a combined output of 58 MW at inverter terminal
Requested Maximum Generating Facility Delivery at POI[2]	55.83 MW
Generation Tie Line	0.00825 miles, 954 ACSR Line Rating: 359A / 478A Z_1(p.u.): 0.000019+j0.000135, B = 0.000002 Z_0(p.u.): 0.000075+j0.000505, B = 0.000002
Main Step-Up Transformer(s) Main Transformers T1	[redacted]
Collector Equivalent	Nominal Voltage: 34.5 kV Z_1(p.u.): 0.000578+j0.004100, B = 0.00006 Z_0(p.u.): 0.001734+j0.012300, B = 0.00006
Pad-Mount Transformer(s) Downstream of Main Transformer Bank T1	[redacted]
Generator Data Downstream of Main Transformer Bank T1	[redacted]

[2] The MW output at the POI varies under different operating conditions. The IC is reminded that this value is tied to the generation tie-line (gen-tie) losses. The estimated Maximum Net Output value at POI and gen-tie losses illustrated in Section E, are contingent upon the accuracy of the technical data provided by the IC, and are subject to change should the IC change its gen-tie parameters during the detailed engineering and design phase of the Generating Facility. Please note that the Generating Facility shall not exceed the total net output of 55.83 MW at the POI.

	[redacted]
Generator Auxiliary Load and/or Station Light and Power	1.365 MW
Voltage Regulation Devices Downstream of Main Transformer Bank T1	Six (6) sets of 2.0 MVAR capacitor bank
Dynamic Models Used Downstream of Main Transformer Bank T1	regc_a, reec_b, repc_a, lhvrt, and lhfrt
Deliverability Requested	Full Capacity
Option (A/B) Requested	Option A
Proposed Dates[3]	
In-Service Date (ISD)	10/31/2021
Initial Synchronization Date/Trial Operation	11/15/2021
Commercial Operation Date (COD)	12/1/2021

B. STUDY ASSUMPTIONS

For detailed assumptions regarding the group cluster analysis, please refer to the QC10 Phase II Area Report. Below are the assumptions specific to the Generating Facility:

1. The Generating Facility was modeled as described in Table A.1 and A.2 above.

2. The facilities that will be installed by SCE and the IC are detailed in Attachment 1.

3. Roles and Responsibilities for Environmental Activities, Permits, and Licensing. No Environmental activities were included in the analysis of this Generating Facility, as no environmental impacts were identified based on the facilities that will be installed by SCE disclosed in Attachment 1.
    - For further details on the environmental evaluation and permitting/licensing requirements for generation projects refer to Appendix K of the Area report.

4. Other Items to Consider:
    - Final metering requirements will be identified as part of the detailed engineering and design of the Generating Facility and could result in modifications to the Generating Facility.

C. TECHNICAL REQUIREMENTS[4]

1. **Preliminary Protection Requirements**
   Protection requirements are designed and intended to protect SCE's electric system only. The preliminary protection requirements were based upon the interconnection plan as shown in the one-line diagram depicted in line item #4 in Attachment 1.

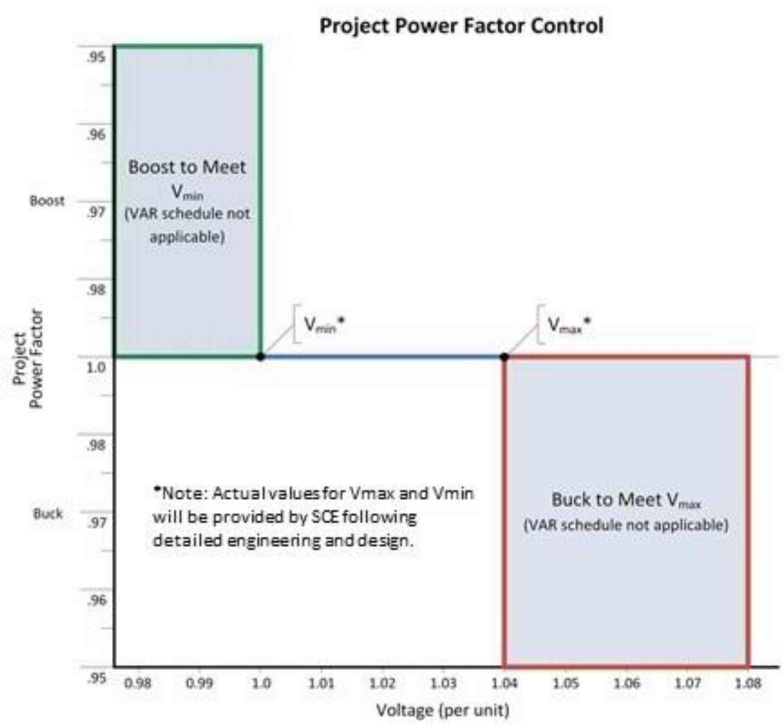
[3] Such dates are specified in the Generating Facility's Attachment B. Actual ISD, Initial Synchronization Date, and COD will depend on licensing, engineering, detailed design, and construction requirements to interconnect the Generating Facility after the GIA has been executed and/or filed at Federal Energy Regulatory Commission (FERC) for acceptance.

[4] The IC is advised that there may be technical requirements in addition to those that outlined above in Section C of this report that are included in SCE's Interconnection Handbook or that will be addressed in the Generating Facility's GIA.

The IC is responsible for the protection of its own system and equipment and must meet the requirements in the SCE's Interconnection Handbook.

2. **Power Factor Requirements**
The Generating Facility will be required to maintain a composite power delivery at continuous rated power output at the high-side of the IC's substation or other equivalent location at a power factor within the range of 0.95 leading to 0.95 lagging. This power factor range standard shall be dynamic

3. **Operating Voltage Requirements**
Under real-time operations, the Generating Facility will be required to operate under the control of automatic voltage regulator with settings as shown in the figure below. The actual values of the Vmin and Vmax will be provided once the Generating Facility executes a Generation Interconnection Agreement and detailed engineering and design is complete. The Vmin and Vmax values are to be used as the basis for setting up the automatic voltage control mode (with its automatic voltage regulator in service and controlling voltage) of the Generating Facility in order to maintain scheduled voltage at a reference point.



4. **Harmonic Requirements**
The harmonic impact of the subject inverter-based generation was not part of this study. Impacts on voltage distortion levels may be significant due to the penetration level of the Generating Facility with respect to the local distribution grid strength. As with all equipment connected to SCE's electric system, the Generating Facility will be subject to the provisions of CPUC Rule 2.E, allowing SCE to require the IC to mitigate interference with service to other SCE customers, including harmonic impacts, if the harmonic interference is caused by the IC.

5. **Low/High Voltage Ride-Through (LHVRT) and Low/High Frequency Ride-Through (LHFRT) Capability**
   Actual fault events have demonstrated that certain asynchronous generators (i.e., inverters) from specific manufacturers may be susceptible to false tripping or temporary shutdown during fault conditions. The most severe disturbance to date resulted in the temporary loss of 1,178 MW at photovoltaic plants when inverter control systems throughout Southern California responded to a 500 kV fault by temporarily stopping the production of electric power. Based on the results of an investigation performed into this issue, several causes and contributing factors have been identified which include:

   a. Apparent miscalculated frequency at many inverters when fault-induced phase shifts occurred in the reference voltage
   b. Inverter protection settings set to meet IEEE 1547 standards
   c. Momentary overvoltage
   d. Momentary under-voltage

   The NERC PRC-024-2 standard currently allows generators to instantaneously trip if the system conditions are outside of a defined set of bounds. Because different inverter manufacturers use different methods to calculate frequency (zero crossing, DFT, PLL, etc.), the methods used by some manufacturers have resulted in calculations of the instantaneous frequency during power system disturbances that do not accurately reflect actual frequency. Inaccurate frequency calculations may result in the reduction of electric power from inverter-based resources, which is an unacceptable response. In addition, voltage transients caused by capacitive switching (among other potential causes) can cause inverters to trip due to a momentary overvoltage condition which too is an unacceptable response unless the Generating Facility has reached the power factor lead (buck) limits and the voltage is still in excess of the maximum allowable voltage limit.

   When under-voltage occurs during the fault, some inverters may cease operation temporarily. Such performance impacts system reliability and may not be allowed in the future reliability standards/interconnection standards.

   The IC should work with the inverter manufacturer to ensure that the Generating Facility’s inverters meet the requirements of NERC Standard PRC-024 and conform to the NERC industry recommendations issued on May 01, 2018:

   https://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/NERC_Alert_Loss_of_Solar_Resources_during_Transmission_Disturbance-II_2018.pdf

   This NERC industry recommendations are required to be followed by all inverter based generation connected to the CAISO controlled grid.

6. **Primary Frequency Response Requirement**
   Per FERC Order 842, the IC is required to install a governor or equivalent controls with the capability of operating: (1) with a maximum 5 percent droop and ±0.036 Hz deadband; or (2) in accordance with the relevant droop, deadband, and timely and sustained response settings from the Approved Applicable Reliability Standards providing for equivalent or more stringent parameters. The IC shall ensure that the Electric Generating Unit’s real power response to

sustained frequency deviations outside of the deadband setting is automatically provided and shall begin immediately after frequency deviates outside of the deadband, and to the extent the Electric Generating Unit has operating capability in the direction needed to correct the frequency deviation.

Also per FERC Order 841, nuclear generating facilities and certain Combined Heat and Power (CHP) facilities are exempt from these primary frequency response requirements.

D. RELIABILITY STANDARDS, STUDY CRITERIA AND METHODOLOGY

1. SCE Analysis

The generator interconnection studies were conducted to ensure the ISO Grid is in compliance with the North American Electric Reliability Corporation (NERC) reliability standards, WECC regional criteria, and the ISO planning standards. Refer to Section C of the Area Report for details of the applicable reliability standards, study criteria, and methodology. In addition, the Subtransmission Assessment was performed in compliance with SCE's Subtransmission Planning Criteria.

2. Coordination with Affected Systems

Per GIP Section 3.7, the SCE will notify the Affected System Operators that are potentially affected by an IC's IR or group of interconnection requests subject to a Group Study. The SCE will coordinate the conduct of any studies required to determine the impact of the IR on Affected Systems with Affected System Operators and, if possible, include those results (if available) in its applicable Interconnection Study within the time frame specified in the GIP. SCE will include such Affected System Operators in all meetings held with IC as required by the GIP. IC will cooperate with SCE in all matters related to the conduct of studies and the determination of modifications to Affected Systems. A transmission provider which may be an Affected System shall cooperate with SCE with whom interconnection has been requested in all matters related to the conduct of studies and the determination of modifications to Affected Systems.

Refer to Section F for additional information.

E. POWER FLOW RELIABILITY ASSESSMENT RESULTS

Analysis of the Generating Facility

Steady State Power Flow Analysis Results - Bulk Electric System

1. Thermal Overloads

The Northern Bulk Area studies indicate that the Generating Facility contributes to overloads under contingency conditions when operated in discharge mode. However, mitigation and corresponding cost allocation was not assigned to this Generating Facility due to the relatively small contribution.

2. Required Mitigations

No mitigation was identified.

Steady State Power Flow Analysis Results - Subtransmission Electric System

1. **Thermal Overloads**
   The group and/or Subtransmission study indicated that the Generating Facility contributes to overloads on the following facilities listed below under normal, single contingency, and multiple contingency conditions. The details of the analysis and overload levels, as well as the details of the recommended mitigation to address these overloads, are provided in the corresponding Area and/or Subtransmission Assessment Report(s).

   I. Normal Conditions
      - Under Normal Conditions the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line is overloaded due to the addition of this Generating Facility

   II. Single Contingency
      - Under Single Contingency the Vestal-Glennville-Greenhorn-Kern River 3 66 kV Line is overloaded with the loss of the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line
      - Under Single Contingency the Kern River 3 leg of the Vestal-Growers- Kern River 3 66 kV Line is overloaded with the loss of the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line
      - Under Single Contingency the Vestal-Browning-Quinn-Ultragen 66 kV Line is overloaded with the Vestal Pos. 5 bus side breaker out for maintenance followed by a bus outage
      - Under Single Contingency the Browning leg of the Vestal-Browning-Delano 66 kV Line is overloaded with the Vestal Pos. 5 bus side breaker out for maintenance followed by a bus outage

   III. Multiple Contingency

      - No overloads were identified under Multiple Contingencies.

2. **Power Flow Non-Convergence**
   There were no non-convergence issues identified with the inclusion of the Generating Facility operating at the required power factor range; refer to Area Report and/or Subtransmission Assessment Report for additional details.

3. **Voltage Performance**
   There were no voltage performance issues identified with the inclusion of the Generating Facility; refer to Area Report and/or Subtransmission Assessment Report for additional details.

4. **Required Mitigations**
   Power flow mitigations on the Subtransmission system were identified to be required. The mitigation requirement is as follows:

   a. Base Case Mitigations
   The Generating Facility will need to reconductor the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line to 954 SAC.

b. Single Contingency

A Transfer Trip was placed into service as part of WDT433 project execution. The Transfer Trip trips the customer breaker for the following outages: Vestal Pos.5 bus side breaker out for maintenance followed by bus outages, and the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line. To mitigate these overloads the Generating Facility may utilize the existing Transfer Trip.

5. Line Loss Analysis for Generating Facility

Based on the technical data provided for the individual generator unit(s), the collector system equivalent, pad-mount and main transformer banks, the internal Generating Facility losses are shown in Table 1. In addition, losses incurred on the generation tie line are shown in Table 2 below. The Generating Facility losses identified represent those assuming the Generating Facility is limiting its output at the high side of the main transformer bank to achieve the desired MW delivery at the POI.

Table 1

[redacted]

Table 2

[redacted]

6. Power Factor Evaluation

FERC Order 827 provides the reactive power requirements for newly interconnecting non-synchronous generators which requires these resources to design the facility to be capable of providing reactive power to meet power factor 0.95 as measured on the high-side of the IC’s substation or other equivalent location. This capability should be dynamic.

Base case power flow was evaluated to determine reactive power losses internal to the Generating Facility in order to ascertain if the reactive capability of the Generating Facility is adequate to supply these losses and meet the power factor requirements. A summary of the power factor evaluation is provided in the table below.

[redacted]

[redacted]

Based on the technical details provided, the Generating Facility, as proposed, does not have the capability to meet 0.95 power factor requirement as measured at the high-side of the IC's substation or other equivalent location. Additional reactive power resources will need to be installed to address the Generating Facility reactive power deficiencies. These additional reactive power resources shall be dynamic and can be provided with adding additional inverters or installation with dynamic VAR devices. Such installation would allow for the full utilization of the reactive power supplied by the inverters to provide for the dynamic resources required to meet the 0.95 power factor requirement as measured at the high-side of the IC's substation or other equivalent location.

F. TRANSIENT STABILITY EVALUATION

1. Generating Facility Performance

Dynamic simulation study results illustrating the frequency and voltage performance of the Generating Facility based on the technical parameters supplied for the Generating Facility are provided below.

Voltage and Frequency Plots for Generating Facility at the high-side of the IC's substation or other equivalent location with fault at POI

[redacted]

Power Flow Plots for Generating Facility at inverter terminal with fault at POI

[redacted]

The results indicate acceptable performance and reflect the expected performance when Generating Facility ultimately interconnects.

2. System Performance

System transient stability performance was found to be acceptable. Refer to the Area Report for additional details pertaining to the Phase II transient stability evaluation criteria and assessment results, respectively.

G. SHORT-CIRCUIT DUTY RESULTS

Short-circuit studies were performed to determine the fault duty impact of adding the Phase II projects to SCE's electric 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 Phase II is determined. Each project in the cluster will be responsible for its share of the upgrade cost based on the rules set forth in Section 4 of the GIP.

1. SCE-owned Facilities

All bus locations where the Phase II 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) and applicable Subtransmission Assessment Report (Attachment 7). These values have been used to determine if any equipment is overstressed as a result of the inclusion of Phase II interconnections and corresponding Network Upgrades, if any.

1) If any equipment is found to be overstressed with the inclusion of the cluster and corresponding Local Area Deliverability Network Upgrades, further analysis is performed to identify the specific projects that drive the need for the upgrade. This further analysis identifies the individual project contribution at the impacted location which are then used to determine which project or group of projects drives the need for the mitigation.
2) If any equipment is found to be overstressed with the inclusion of the cluster and corresponding Local Area Deliverability Network Upgrades, subsequent mitigations or upgrades will be identified. Further analysis will be performed to identify the individual project contributions at the impacted location which are then used to determine which project or group of projects drives the need for the mitigation.

The QC10 Phase II breaker evaluation did not identify any additional overstressed circuit breakers triggered with the inclusion of the projects in QC10 Phase II.

The responsibility to finance short circuit related Distribution and Reliability Network Upgrades identified from increases in short circuit duty through a group study shall be assigned pro rata to all projects requiring the upgrade based on SCD contribution of each project.

Please refer to the QC10 Phase II Area Report and/or the applicable Subtransmission Assessment report for additional details.

2. Affected Systems

Not applicable to the Generating Facility, since it's located within SCE's Distribution System that does not serve any municipalities.

3. SCE's Ground Grid Duty Concerns

The short-circuit studies did not flag any substations that increased the substation ground grid duty by at least 0.25 kA and as a result do not require a ground grid analysis to be performed as part of execution once LGIAs/GIAs are in place and projects proceed towards commercial operation.

Refer to the Area Report and/or Subtransmission Assessment Report for further information.

4. **Short Circuit Duty Considerations**
SCD operational mitigation was identified taking into account new generation projects that have executed LGIAs /GIAs, approved SCE's Transmission Network Upgrades fully permitted and under construction, and new generation projects including the QC10 Phase II projects, which do not yet have an executed LGIA/GIA. The study results for these operational studies are provided in Section II of the Generation Sequencing Implementation Short Circuit Duty evaluation (Appendix G). Based on the study results, replacement of four (4) Vincent 500 kV circuit breakers (triggered by QC3&4) are required to be in place in order to enable interconnection of the Generating Facility. Replacement of the four (4) Vincent 500 kV circuit breakers has not been initiated, because this upgrade is required only when sufficient generation projects (with executed LGIAs/ GIA's in good standing) achieve ISD. The identification of the need for the Vincent 500 kV circuit breaker upgrades is based on the assumption that all queued generation projects actually materialize and are interconnected, but the true need occurs only when sufficient queued generation achieves ISD. This SCD mitigation will be continuously evaluated as part of ongoing LGIA/GIA negotiations with queued generation projects to properly define the actual trigger of SCD mitigation based on the actual execution of LGIAs/ GIA and development of generation facilities toward commercial operation.

H. DELIVERABILITY ASSESSMENT RESULTS

1. **On Peak Deliverability Assessment**
The Large Generating Facility contributes to the following overloads in this Cluster Study:

[redacted]

The Antelope – Vincent 500kV line overload is an area constraint that limits deliverability of generation in the SCE northern area. For details of Antelope – Vincent area constraint, refer to section E.1.3 of the area report.

2. **Off- Peak Deliverability Assessment**
Consistent with the CAISO Tariff, the results of the off-peak deliverability assessment is for information only. The Project contributes to Antelope – Vincent 500kV overloads in the off-peak study. The Project output may be curtailed to mitigate the overloads.

3. **Required Mitigations**
No Delivery Network Upgrades are required. The Project is required to participate in the proposed Tehachapi centralized. The Project is subject to TPD allocation on Antelope – Vincent area constraint.

I. INTERCONNECTION FACILITIES, NETWORK UPGRADES, AND DISTRIBUTION UPGRADES

Please see Attachment 1 for SCE's IF's, RNU's, Delivery Network Upgrades[5] (DNU's), and DU's allocated to the Generating Facility. Please note that SCE considered current system configuration, approved SCE sponsored projects, and all queued generation in determining scope for IFs and/or Plan of Service but will not "reserve" the identified scope of upgrades for the proposed POI unless a GIA is executed per the specified timelines shown in Table K.1.

J. COST AND CONSTRUCTION DURATION ESTIMATE

1. Cost Estimate
   The Generating Facility's estimated interconnection costs, adjusted for inflation and provided in 'constant' 2018 dollars escalated to the Generating Facility's feasible operating date (as identified below), are provided in Attachment 2 and the Generating Facility's allocated cost for shared network upgrades are provided in Attachment 3. The costs will be utilized in developing the GIA. However, should there be a delay in executing the GIA beyond 2019, a new cost estimate adjusted for inflation will be required and reflected into the GIA.

2. Construction Duration Estimate
   The construction duration for the identified facilities is as follows:

   a. SCE's Interconnection Facilities – 27 months

      These facilities involve non-network facilities located within SCE's Growers 66 kV Substation and at the IC's Generating Facility that are necessary to complete physical interconnection of the Generating Facility and ensure adequate line protection.

      Please refer to Attachment 1 for details related to these facilities.

   b. Reliability Network Upgrades

      No required Reliability Network Upgrades were identified in this Phase II Interconnection Study.

   c. Voltage Support Mitigation

      No required voltage support mitigations were identified in this Phase II Interconnection Study.

   d. Distribution Upgrades – 18 months

      Reconductor the Vestal leg of the Vestal-Growers-Kern River 3 66 kV Line to 954 SAC.

3. Other Potential Costs to the Generating Facility
   a. The Generating Facility will utilize existing SCE Interconnection Facilities (WDT433 tap substation referred to as Growers 66 kV Substation) and other plan of service upgrades whose costs (both capital costs and applicable ongoing O&M charges) have or are being paid

[5] At the IC's discretion, the IC or parties other than SCE pursuant to Section 10.2 under GIP may construct an Option (B) Generating Facility Area Delivery Network Upgrades (ADNUs) not allocated TP Deliverability. If SCE does not construct the ADNUs, the IC is not required to make the third Interconnection Financial Security posting to the Applicable Participating TO pursuant to Section 4.8.4.2.1 under GIP.

for by an earlier-queued project(s). The IC will be responsible for its allocated share of such costs unless the earlier-queued project(s) agrees to fund the IC's allocated share.

NOTE: The IC is advised that the duration provided assumes the IC will perform environmental work related to the installation of SCE's IF's and/or DU's as specified in this report, in parallel with SCE's preliminary design and engineering. The IC is expected to engage SCE's ES group to obtain concurrence prior to commencement of this work and during execution of the work. Since SCE will be using the IC's environmental documents and/or work products, delays on the IC's part to produce such documents and/or work product(s) may delay SCE's ability to obtain required permits and/or license(s). Should delays occur, the commencement of SCE's detailed engineering, procurement, and construction of may be deferred, which will increase the duration identified in this report and push out the feasible ISD provided in Table K.1 ISD and COD Assessment.

K. IN-SERVICE DATE AND COMMERCIAL OPERATION DATE ASSESSMENT

An ISD and COD assessment was performed for this Generating Facility to establish SCE's estimate of the earliest achievable ISD based on the QC10 Phase II Interconnection Study process timelines and the time required for SCE to complete the facilities needed to enable physical interconnection as an Interim Deliverability or Energy Only Deliverability interconnection (as applicable) for the Generating Facility. This date may be different from the IC's requested ISD and will be the basis for establishing the associated milestones in the draft GIA.

Details pertaining to Full Capacity Deliverability Status and Partial Capacity Deliverability Status are provided below.

1. **ISD Estimation Details**
   For the QC10 Phase II Interconnection Study, the estimated earliest achievable ISD is derived by the time requirements to complete the QC10 Interconnection Study Process, tender a draft GIA, negotiate and execute the GIA, and construct the necessary facilities as described below in Table K.1

Table K.1 ISD and COD Assessment

Reference starting point	Days/Months	Issuance of Phase II Interconnection Study Report	11/21/18
Add:	**30 CD**	Phase II Results Meetings	12/21/18
Add:	**15 BD (20 CD)**	**Starting Point:** TPD Results issued and IC response provided	4/2/19
Add:	**30 CD**	**Earliest Reasonable Tender of draft GIA**	5/2/19
Add:	**150 CD**	• GIA negotiation time as outlined in GIP 120 CD • GIA execution, filing, and related activities 30 CD	7/31/19

Add: Construction Duration	**27 months**	Construction duration outlined in the Phase II Study Report. Construction completion no earlier than date which reflects earliest ISD	10/31/21
	Reference:	IC-requested ISD via Attachment B	10/31/2021
	Reference:	IC-requested COD via Attachment B	12/1/2021
		Difference between IC ISD and COD	1 month
Equals:		Earliest achievable In-Service Date (ISD)	**10/31/21**
		Earliest achievable Commercial Operation Date (COD) (Using difference between ISD and COD requested by IC)	**12/1/21**

Notes on the Achievable ISD and COD calculation:

1) Assumes duration required to construct those facilities required for an Interim Deliverability Interconnection or Energy Only interconnection (as applicable) for the Generating Facility until the applicable DNUs are completed.
2) The construction durations shown represent the estimated amount of time needed to design, procure, and construct the facilities with the start date of the duration based on the effective date of the GIA; and necessarily include timely receipt of all required information and written authorizations to proceed (ATP), and timely receipt of construction payments and financial security postings and other milestones.
3) Assumes that GIA is tendered after the TP Deliverability allocation results are disclosed.

2. ISD Conclusion

Based on these timelines, the IC's requested ISD of 10/31/2021 and COD of 12/1/2021 appears to be achievable if the schedule outlined in Table K.1 is followed.

SCE can reasonably tender a draft GIA by May 2019. The draft GIA should be executed and/or filed at FERC no later than August 2019 and will target the IC's requested ISD and COD.

The CAISO will perform its Annual Reassessment (January - July 2019) and Transmission Plan Deliverability (TPD) Allocation[6] (due April 2019). Any changes in scope, cost, or schedule requirements that come out of CAISO's Annual Reassessment and 2019 TPD Allocation will be reflected in a 2019 Reassessment Report, which will be used to revise the draft LGIA (if under negotiation) or amend the LGIA (if already executed).

[6] The TPD Allocation Process is estimated to be completed in April 2019. The actual date may vary.

L. TIMING OF FULL CAPACITY DELIVERABILITY STATUS, INTERIM DELIVERABILITY STATUS, AREA CONSTRAINTS, AND OPERATIONAL INFORMATION

The Generating Facility would be granted its requested FCDS only if the Generating Facility receives TPD allocation in the forthcoming TPD Allocation Study Process. Furthermore, timing of obtaining the requested FCDS is dependent on the completion of DNUs identified below in this report, which may be updated in any subsequent annual reassessment. Until such time that these DNUs are completed and placed in-service, the Generating Facility may be granted Interim Deliverability Status based on annual system availability. The sections below provide a discussion of the timing of FCDS, Interim Deliverability Status, Area Constraints, and Operational Information.

1. System Upgrades Required for Full Capacity Deliverability Status (FCDS)

   In order to provide for FCDS, the following facilities are required in addition to the Reliability Network Upgrades described in Section 2 (b) of Attachment 1:

   a. Triggered Delivery Network Upgrades – None

   b. Delivery Network Upgrades Triggered by Earlier Queued Projects – None

   c. Approved Transmission Upgrades - Various

      - Eldorado-Lugo Series Capacitor Upgrade – The current estimated in-service date of this project is Dec 2022.
      - Lugo-Mohave Series Capacitor Upgrade – The current estimated in-service date of this project is Dec 2022.
      - Lugo – Victorville 500kV Upgrade - – The current estimated in-service date of this project is June 2021.

   d. Transmission Upgrades outside the CAISO Controlled Grid - None

2. Interim Operational Deliverability Assessment for Information Only

   The operational deliverability assessment was performed for study years 2019 ~ 2022 by modeling the Transmission and generation in service in the corresponding study year. For details of the Transmission and generation assumption, refer to Section E.3 of the Area Report. The Generating Facility contributes to the Lugo – Victorville 500kV line overload under various contingencies and will have Interim Deliverability Status until all the upgrades listed above are in service.

3. Area Constraints

   The Generating Facility contributes to the Antelope – Vincent area constraint. Since the Project selected Option A for deliverability, no ADNUs are required. The requested FCDS is subject to TPD allocation on the Antelope – Vincent area constraint.

M. ADDITIONAL STUDY ANNOTATIONS

1. **Conceptual Plan of Service**

   The results provided in this study are based on conceptual engineering and a preliminary Plan of Service (POS) and are not sufficient for permitting of facilities. The POS is subject to change as part of detailed engineering and design.

2. The study does not include analysis related to the power output rate of change that may occur due to the following or other conditions:

   - System morning start up for solar generating facilities: That is when each morning the Generating Facility commences to generate and export electrical energy to the electric system.
   - Cloud Cover: Solar generating facilities have significant generation output variation (Variability) which can have an impact on electric system voltage profiles.

3. **IC's Technical Data**
   The study accuracy and results for the QC10 Phase II Interconnection Study was contingent upon the accuracy of the IR technical data provided by each IC during the Interconnection Study Cycle. Any changes from the data provided as allowed under GIP would have been submitted in Attachment B within ten (10) Business Days following the Phase I Interconnection Study Results Meeting. Any changes in the Attachment B submission that extended beyond the modifications allowed in accordance with Section 4.5.7.2.2 of GIP will need to be evaluated following the Material Modification Assessment (MMA) process to determine if such change results in a material impact to queued-behind generation requests. These change(s) would only be allowed if it is determined that there were no material impacts to queued-behind generation requests.

4. **Study Impacts on Affected Systems**
   Results or consequences of this 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 ISO Controlled Grid, and sub-synchronous resonance (SSR). Refer to Affected Systems Coordination Section H of the Area Report and above in Section F for additional information.

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

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

7. **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.

8. **System Protection Coordination**
   Adequate Protection coordination will be required between SCE-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.

9. **Standby Power and Temporary Construction Power**
   The Phase II Interconnection Study does not address any requirements for standby power or temporary construction power that the Generating Facility may require prior to the ISD of the Interconnection Facilities (IF's). Should the Generating Facility require standby power or temporary construction power from SCE prior to the ISD of the IF's, the IC is responsible to make appropriate arrangements with SCE to receive and pay for such retail service.
10. **Licensing Cost and Estimated Time to Construct Estimate (Duration)**
   The estimated licensing cost and durations applied to this Generating Facility are based on the Generating Facility scope details presented in this Phase II Interconnection Study. These estimates are subject to change as the Generating Facility's environmental and real estate elements are further defined. Upon execution of the GIA, 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.
11. **Network/Non-Network Classification of Telecommunication Facilities**

    a. Non-Network (Interconnection Facilities) Telecommunications 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 main and diverse telecommunication paths associated with the IC's generation tie line, excluding terminal equipment at both ends. In addition, the telecommunication requirements for the RAS were assumed based on tripping of the generator's breaker in lieu of tripping the circuit breakers and opening the IC's gen-tie at SCE's substation.

    b. Network (Network Upgrades) Telecommunications Upgrades: Due to uncertainties related to telecommunication upgrades for the numerous projects in queues ahead of this Generating Facility, telecommunication upgrades for earlier queued projects without a signed GIA which upgrades have not been constructed were not considered in this study. Depending on the scope of these earlier queued projects, the cost of telecommunication upgrades identified for Phase II may be reduced. Any changes in these assumptions may affect the cost and schedule for the identified telecommunication upgrades.
12. **Ground Grid Analysis**
   A detailed ground grid analysis will be required as part of the detailed engineering for the Generating Facility at the SCE substations whose ground grids were flagged with duty concerns.
13. **SCE Technical Requirements**
   The IC is advised that there may be technical requirements in addition to those that outlined above in Section C of this report that will be addressed in the Generating Facility GIA.
14. **Applicability**
   This document has been prepared to identify the impact(s) of the Generating Facility on the SCE's electric system; as well as establish the technical requirements to interconnect the Generating Facility to the POI that was evaluated in the final Phase II Interconnection Study for the Generating Facility. Nothing in this report is intended to supersede or establish terms/conditions specified in GIAs agreed to by the SCE, ISO, and the IC.
15. **Process for Initial Synchronization Date/Trial Operation Date and COD of the Generating Facility**

The IC is reminded that the ISO has implemented a New Resource Implementation (NRI) process that ensures that a generation resource meets all requirements before Initial Synchronization Date/Trial Operation Date and COD. The NRI uses a bucket system for deliverables from the IC that are required to be approved by the ISO. The first step of this process is to submit an "ISO Initial Contact Information Request form" at least seven (7) months in advance of the planned Initial Synchronization Date. Subsequently an NRI project number will be assigned to the Generating Facility for all future communications with the ISO. SCE has no involvement in this NRI process except to inform the IC of this process requirement. Further information on the NRI process can be obtained from the ISO Website using the following links:
New Resource Implementation webpage:
http://www.caiso.com/participate/Pages/NewResourceImplementation/Default.aspx

NRI Checklist:
http://www.caiso.com/Documents/NewResourceImplementationChecklist.xls

NRI Guide:
http://www.caiso.com/Documents/NewResourceImplementationGuide.doc

16. **ISO Market Dispatch**
This study did not evaluate any potential limitations that may be driven by the ISO market under real-time operating conditions.

17. **Interconnection Request to Third-Party Owned Facilities**
Generating Facility's requesting to interconnect to a Third party owned facility will need to obtain written approval from the owner(s) of the facility prior to execution of the GIA.

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 and Maximum Network Upgrade Cost Responsibility

There is no network upgrade required for the project.

Attachment 4:
SCE's Interconnection Handbook

Preliminary Protection Requirements for Interconnection Facilities are outlined in SCE's Interconnection Handbook at the following link:

https://www.sce.com/wps/wcm/connect/348e4d71-5c2a-431f-bf78-16267486fdc9/Interconnection%2BHandbook_1483725988_1485215238.pdf?MOD=AJPERES

Attachment 5:
Short-Circuit Duty Calculation Study Results
Please refer to the Appendix H of the Area Report

Attachment 6:
IC Provided Generating Facility Dynamic Data

[redacted]

Attachment 7:
Subtransmission Assessment Report
Please refer to separate document