
Appendix A – WDT1640



Queue Cluster 12 Phase II Report

November 20, 2020

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	11/20/20	Queue Cluster 12 Phase II Appendix A Report	Final Phase II interconnection study report

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A. INTRODUCTION

██████████ the Interconnection Customer (“IC”), has submitted a completed Interconnection Request (“IR”) to Southern California Edison (“SCE”), the Distribution Provider, for its proposed ██████████ (“Generating Facility”). The IC’s IR and/or Attachment B stipulated Full Capacity Deliverability Status (“FCDS”) and an Option A selection for the Generating Facility. In addition, the IC requested an In-Service Date (“ISD”) and Commercial Operating Date (“COD”) of 11/1/2023 and 1/31/2024, respectively. However, the actual in-service dates for the Generating Facility will depend on the duration required for: licensing, engineering, detailed design, and construction associated with the facilities required to interconnect the Generating Facility. The duration for these activities would commence after the Generation Interconnection Agreement (“GIA”) for the Generating Facility has been executed or filed at the Federal Energy Regulatory Commission (“FERC”) for acceptance and funded.

In accordance with FERC’s approved SCE’s Wholesale Distribution Access Tariff (“WDAT”) Attachment I Generator Interconnection Procedures (“GIP”), the Generating Facility was grouped with Queue Cluster 12 (“QC12”) 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 to discuss the combined impacts of all projects on the ISO Grid and to the distribution facilities served out of the ██████████, respectively. This Appendix A report focuses only on the impacts or impact contributions of the Generating Facility to SCE’s Electric System and is not intended to supersede any contractual terms or conditions specified in a forthcoming GIA.

B. REPORT OBJECTIVE

SCE performed a QC12 Phase II Study that included the Generating Facility, and this report addresses the results of the analysis.

The report provides the following:

1. Transmission and Distribution system impacts attributed to the Generating Facility.
2. System reinforcements or mitigation necessary to address the adverse impacts attributed 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 SCE’s construction schedule¹, assuming SCE is constructing the required facilities. Such information is provided in Attachment 1 and Attachment 2 as separate documents in the Appendix A report package for the Generating Facility.
4. Identification of potential short circuit duty impacts to Affected Systems served from the Transmission, Subtransmission or Distribution System.

Furthermore, since the Generating Facility encompasses a battery energy storage system (“BESS”), an “As-Available Charging” analysis to determine the charging impacts on SCE’s Electric System was

¹It should be noted that construction is only part of the duration of months specified in the study, which includes final 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.

conducted as well. The analyses focused on the Charging Capacity² aspects of the Generating Facility and considered varying levels of system demand with minimal generation dispatch within the local distribution system.

Accordingly, this report also discloses the following:

- a. The adequacy of SCE’s Electric System to support the Generating Facility under As-Available Charging Distribution Service (“ACDS”).
- b. Provides a high-level explanation of potential exposure to the Generating Facility of charging restrictions on the electric system.]
- c. As-Available Monthly Contract Demand Charge per kW (monthly rate) used to calculate the IC’s Generating Facility demand charge rate. Please refer to Attachment 2 of this report for the monthly rate assigned to the IC’s Generating Facility.

In addition, the IR also specifies that the IC elected SCE to perform a Firm Charging Distribution Service Analysis (“Firm Charging Study”) for the BESS of the Generating Facility. Several assumptions were used in developing the scope of facilities that will be installed by SCE and the IC including but not limited to:

- a. Plan of Service facilities are based on SCE standards.
- b. Preliminary metering assumptions that are subject to change once final metering requirements are determined as part of execution of the Generating Facility.
- c. Preliminary protection requirements identified in this study are designed to protect SCE’s electric system only. These preliminary protection requirements were based upon the interconnection plan as shown in the one-line diagram depicted in Attachment 1. The IC is responsible for the protection of its own system and equipment and must meet the requirements in SCE’s Interconnection Handbook provided in Attachment 4. Furthermore, protection coordination studies will be performed in support of project execution once a GIA is executed.

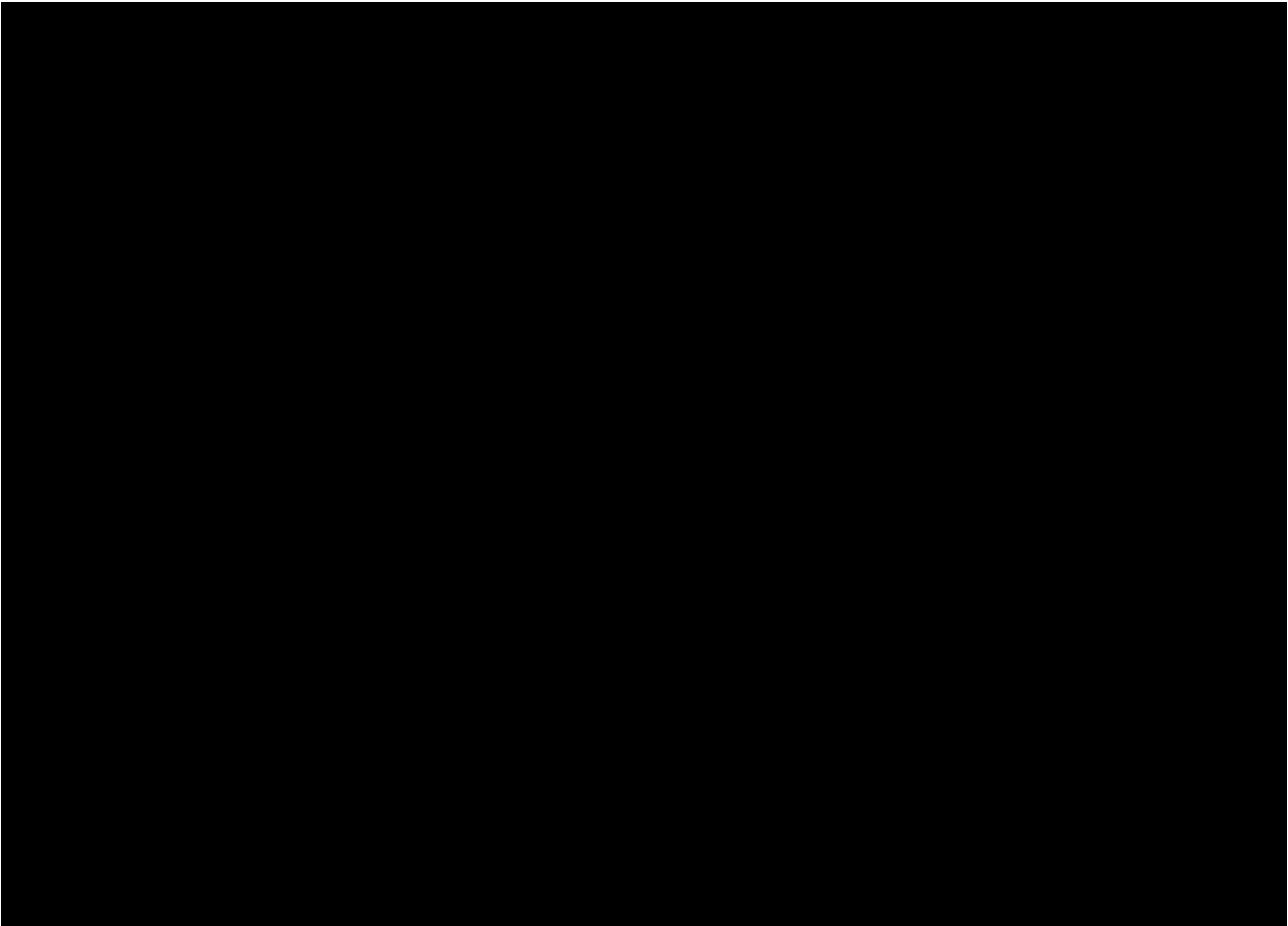
Accordingly, scope details, estimated cost, and schedule associated with any upgrades required to provide Firm Charging Distribution Service to the Generating Facility will be disclosed in the forthcoming Firm Charging Distribution Service Analysis Report which is Attachment 9 to this Appendix A report. Attachment 9 is scheduled to be issued to the IC by 01/04/2021.

C. DESCRIPTION OF GENERATING FACILITY

Generating Facility: all equipment and facilities comprising the IC’s [REDACTED] Generating Facility located in [REDACTED] as disclosed by the IC in its IR and/or Attachment B, as may have been amended during the Interconnection Study process, as summarized below:

Table A.1: Generation Facility General Information per the IR and/or including Attachment B

² Charging Capacity: The load associated with the storage component of the Eligible Customer’s Resource charged from the Distribution System that is used for later redelivery of the associated energy, net of Resource losses, to the Distribution System. Charging Capacity does not include load that is subject to the Distribution Provider’s retail tariff.



Note: Detailed loss analysis used in defining net capability at high side of main transformer bank and net capacity at the POI

Generation Export Limit for the Generating Facility

The IC has requested a total net capacity of [REDACTED] as measured at the high-side of the main step-transformer(s) and [REDACTED] at the POI. The Parties acknowledge that should the Generating Facility exceeds these values or is capable of exceeding these values the IC agrees to: install, own, operate and maintain a control limiting device or, alternatively, limit output by means of configuring the Generating Facility’s control system. This is to ensure the Generating Facility does not exceed the total net capacity at the high-side of the main step-up transformer(s) and POI.

As-Available Charging Capacity Limit for the Generating Facility

“The IC has requested for a total Charging Capacity under As-Available Charging distribution service of [REDACTED] as measured at the high-side of the main step-up transformer(s) and [REDACTED] at the POI. The Parties acknowledge that should the Generating Facility exceed these values or is capable of exceeding these values the IC agrees to: install, own, operate and maintain a control limiting device or, alternatively, limit output by means of configuring the Generating Facility’s control system. This is to ensure the Generating Facility does not exceed these total Charging Capacity values at the high-side of the main step-up transformer(s) and POI.

The scope of facilities that will be installed by SCE and the IC for physical interconnection of the Generating Facility, to provide for the requested 20 net MW output at the POI taking into account the requested Deliverability, and in support of ACDS resulting from this study are detailed in Attachment 1

to this Appendix A report. The proposed plan for interconnecting the Generating Facility is illustrated in Figure A.1. and Figure A.2 illustrates the proposed location of the Generating Facility. Additional information is provided in Table A.2

Figure A.1: Generating Facility One-Line Diagram

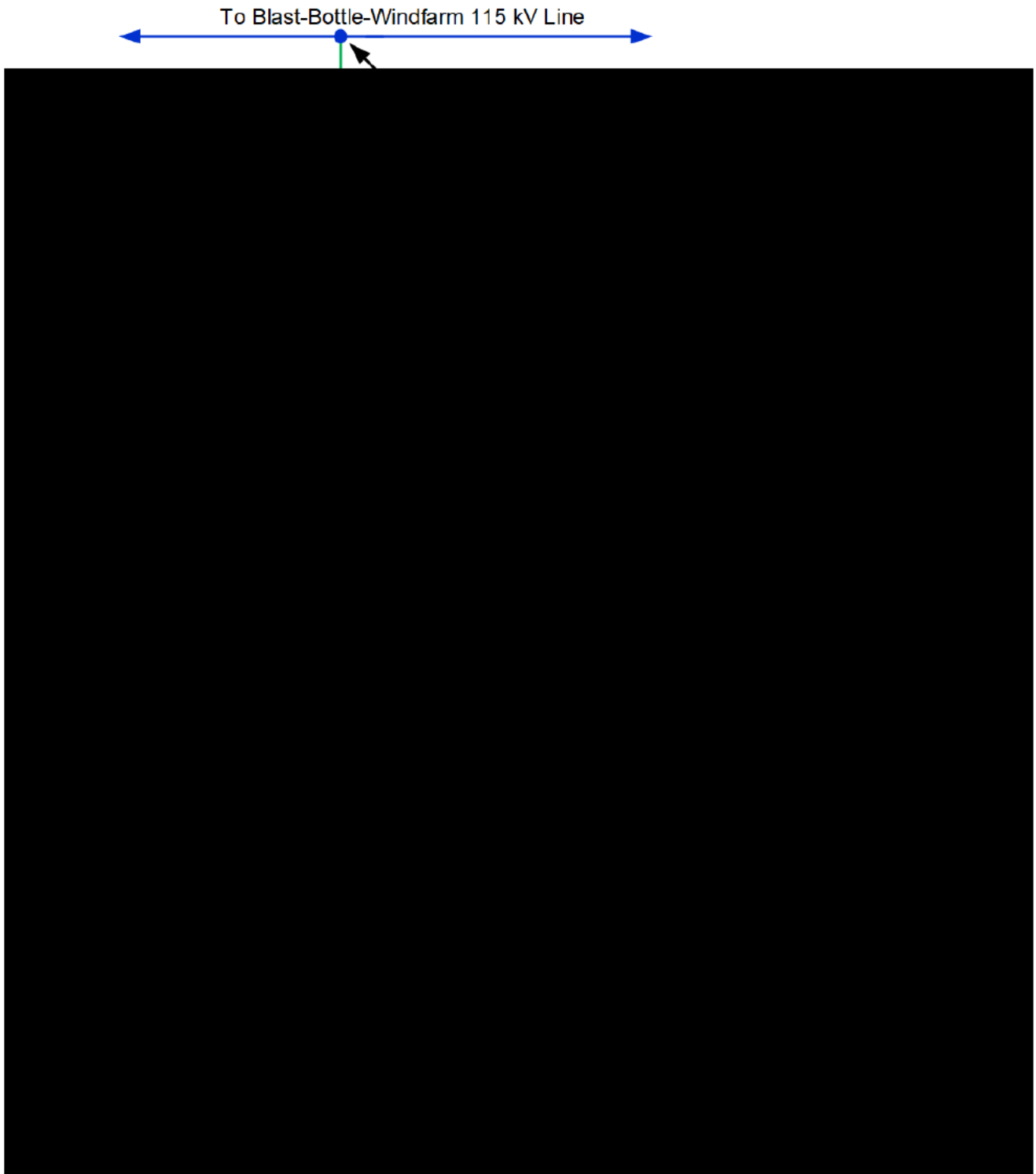


Figure A.2: Generating Facility Location Map

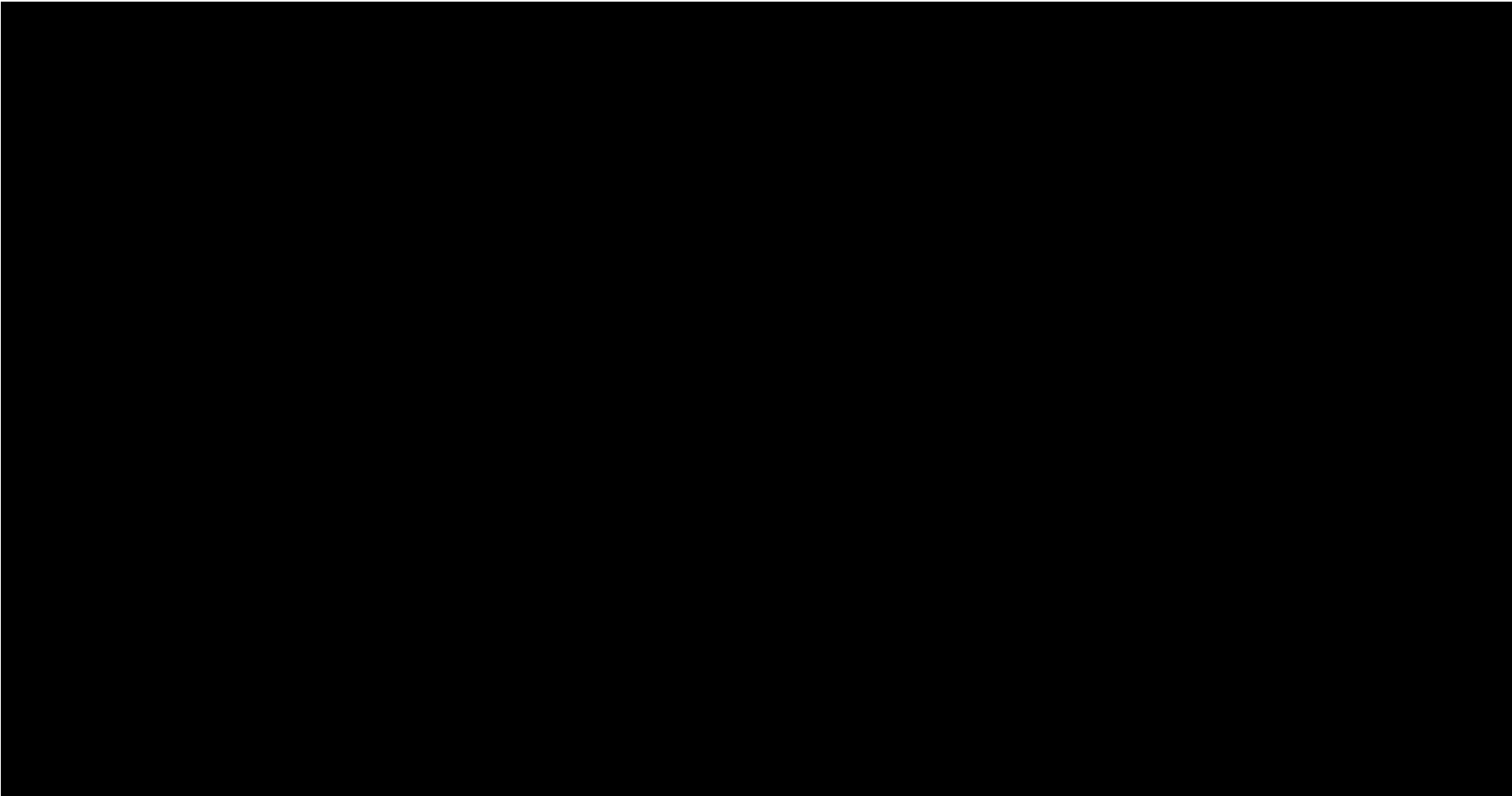
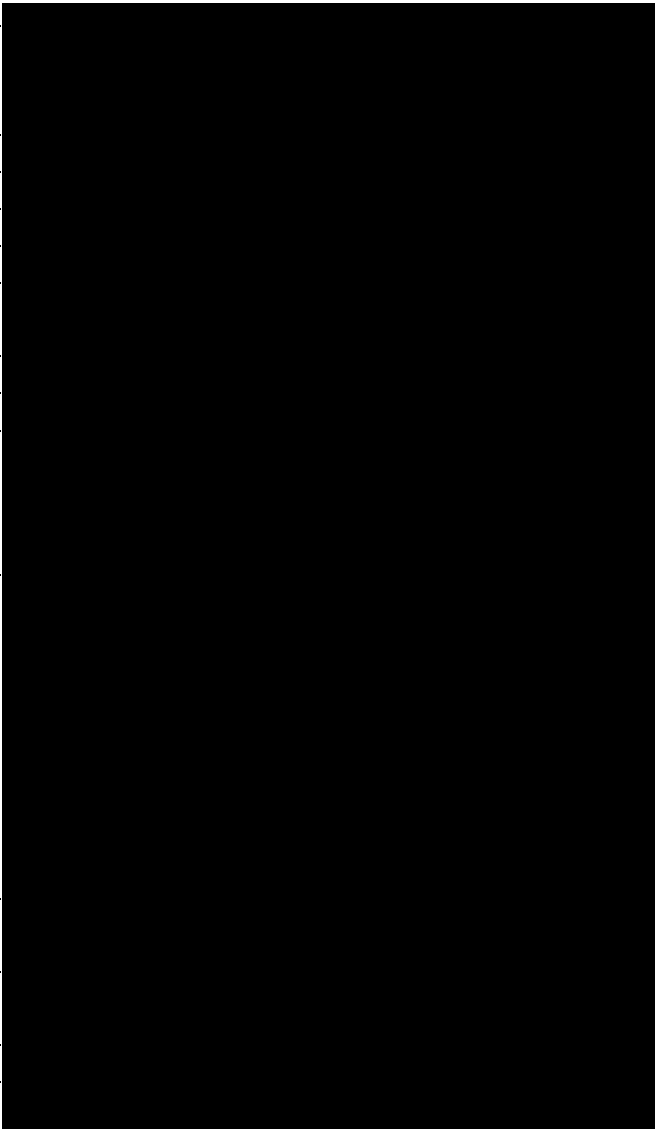


Table A.2: Additional Generating Facility General Information per IR and/or Attachment B

Generating Facility Location	
SCE's Planning Area	
Interconnection Voltage	
POI	
Number and Types of Generators	
Requested Maximum Generating Facility Delivery at Point of Interconnection ³	
Generation Tie Line	
Main Step-Up Transformer(s)	
Collector Equivalent	
Padmount Transformer(s)	
Generator Data Downstream of Main Transformer Bank T1	
Generator Auxiliary Load and/or Station Light and Power	
Voltage Regulation Devices	



D. STUDY ASSUMPTIONS

For detailed assumptions regarding the transmission and subtransmission system, please refer to the Area Report and Subtransmission Assessment Report, respectively. 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. Wildfire mitigation measures have been incorporated into all of SCE's construction standards and operational practices. SCE has notified ICs with a proposed project(s) and associated Interconnection Facilities to be in, or interconnecting to, an identified high fire risk area

³ 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 above 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 final engineering and design phase of the Generating Facility. Please note that the Generating Facility shall not exceed the total net output of 20 MW at the POI.

("HFRA") or high fire risk area circuit ("HFRA circuit"). As a result of implementing these mitigation measures, please be advised that the facilities and their associated costs identified in this Appendix A report (Attachment 1 and Attachment 2) are above and beyond the mitigation identified in previous cluster studies. SCE is implementing these measures to address the heightened wildfire risk in HFRA and HFRA circuits. In the future, SCE may develop and implement additional mitigation measures in these HFRA that are not identified in this study as a means of continuously ensuring the safety and reliability of SCEs Electric System and the public it serves. If this occurs prior to in servicing the Generating Facility, additional scope will be included via an addendum to this study report or via Technical Study report outlining the facilities.

3. The facilities that will be installed by SCE and the IC are detailed in Attachment 1.
4. Environmental Activities, Permits, and Licensing.

The assumptions for the Environmental Activities, Permits, and Licensing are as follows:

- i. SCE's Interconnection Facilities ("IF") and Distribution Upgrades ("DU") needed to interconnect the Generating Facility and provide for the level of service requested for Charging Capacity:
 - a. SCE's IFs and DUs needed to interconnect the Generating Facility: No Environmental activities were assumed as no environmental impacts were identified based on the IFs and DUs that will be installed by SCE disclosed in Attachment 1.
 - b. SCE's Shared DUs assigned to the Generating Facility and needed to interconnect the Generating Facility:
 - SCE will perform all required environmental studies, prepare environmental permit applications, obtain required environmental permits, and perform monitoring of all SCE construction activities related to the installation of SCE's Shared DUs.
 - Under certain circumstances, SCE's Shared DUs may need to be described and analyzed as part of the IC's CEQA and/or NEPA documents for the Generating Facility. Further coordination to discuss these circumstances may occur during GIA negotiations and/or after GIA execution. Any changes to the environmental and licensing assumptions may result in the need to update cost and duration estimates, and potentially amend the GIA.
- ii. SCE's Reliability Network Upgrades ("RNUs") and Delivery Network Upgrades ("DNUs") assigned to the Generating Facility: No Environmental activities were assumed as no environmental impacts were identified based on the RNUs and DNUs that will be installed by SCE disclosed in Attachment 1.
- iii. For further details on the environmental evaluation and permitting/licensing requirements for generation interconnection projects, refer to Appendix K of the Area report.

5. Energy Storage Considerations

- SCE currently offers ACDS pursuant to SCE’s WDAT Energy Storage filing under Docket No. ER19-25054 accepted by FERC and effective October 30, 2019⁵. Interconnection customers will be assessed an As-Available Monthly Contract Demand Charge per kW (monthly rate) in addition to the mitigation costs identified in this Study. The monthly rate is based on the POI and the type of facilities used by the IC’s Generating Facility to charge its BESS from SCE’s Distribution System. Please refer to Attachment 2 of this Study for the monthly rate assigned to the IC’s Generating Facility.
- SCE’s Distribution Standards and Practices are in the process of being updated to address BESS facilities. The proposed Plan of Service in this report may require changes to comply with SCE’s Distribution Standards and Practices.
- This study assumes that the Generating Facility will include all equipment, software, appropriate controls, and other related equipment necessary to maintain Charging Capacity restrictions per SCE’s requirements.
- In order to ensure limits are communicated in a timely and reliable manner, the IC is responsible for providing reliable communication between the Generating Facility and SCE to transmit the required telemetry data as outlined in SCE’s Interconnection Handbook. Should the communication channel fail, the Generating Facility’s operating limits will automatically revert to zero (no charging allowed).
- If the Generating Facility does not follow the given charging limitations, the Generating Facility will be disconnected.
- The preliminary charging analysis discussed in this report assumed that Charging Capacity is curtailable before wholesale and retail load, and this assumption was used to determine the charging restrictions mentioned in this report for the Generating Facility. The BESS component of the Generating Facility will need to be metered separately. The IC is required to install multiple sets of metering (i.e. separate sets of potential transformers & current transformers and supporting metering equipment) for the Generating Facility.
- SCE plans to deploy the Constraint Management System (“CMS”) to implement real time charging restrictions for BESS projects electing to receive ACDS on an interim basis while the Distributed Energy Resource Management System (“DERMS”) is completed. However, there are certain situations where a BESS project will not be able to participate in either CMS or DERMS. These situations include but are not limited to:
 1. the project does not intend to use a dedicated RTU
 2. the ACDS study results identified thermal overloads on subtransmission lines
 3. inability to monitor overloaded facilities properly to enable ACDS

Any project that falls into one of the situations listed above, will not be able to participate in either CMS or DERMS and the only means available to the BESS project to receive ACDS is through a safety charging schedule provided to the IC that will be updated on an as-needed basis as new BESS projects interconnect, or at a very minimum once a year to adjust the charging schedule in accordance to the annual load forecast.

BESS projects deemed CMS compatible, will be added to the CMS on an interim basis until such time the project is migrated over to the DERMS once its operational.

⁴ Link: <https://www.ferc.gov/CalendarFiles/20200124142753-ER19-2505-001.pdf>

⁵ FERC accepted SCE’s proposed WDAT revisions effective October 30, 2019 subject to refund, and established hearing and settlement judge procedures

6. Other Items to Consider:

- [REDACTED]
- [REDACTED]

E. TECHNICAL REQUIREMENTS⁶

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.

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

Generating Facility will be required to maintain a composite power delivery at continuous rated power output at the high-side of the generator substation or other equivalent location. At that point, the generator must provide dynamic reactive power within the power factor range of 0.95 leading to 0.95 lagging. The Generating Facility may meet the dynamic reactive power requirement by utilizing a combination of the inherent dynamic reactive power capability of the inverter, dynamic reactive power devices, and static reactive power devices to make up for losses.

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 (“GIA”) and final 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.

⁶ The IC is advised that it shall comply with mandatory regulatory standards of but not limited to FERC/NERC/WECC/CPUC and there may be technical requirements in addition to those that outlined above in Section C of this report that are included in the SCE’s Interconnection Handbook or that will be addressed in the Generating Facility’s GIA.



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. **Sub-Synchronous Control Interaction**

A detailed screening for Sub-Synchronous Control Interaction ("SSCI") was performed as part of the Phase II study utilizing the technical data in PSLF format (epc and dyd files) provided by the IC. The detailed screening will identify if a detailed Power System Computer Aided Design ("PSCAD") model of the Generating Facility and associated control systems, along with the manufacturer representative's contact information, may be required for further SSCI analysis. If a complete SSCI study is required using the Generating Facility PSCAD model, this will be done as part of execution for the Generating Facility and will need to be completed prior to Initial Synchronization Date of the Generating Facility. The SSCI study will identify potential controls interaction that will need to be mitigated by the IC. Any identified mitigation shall be at the expense of the IC.

Conventional synchronous generating facilities are susceptible to Sub-synchronous Interactions including Sub-synchronous Resonance ("SSR") and Sub-synchronous Torsional Interactions ("SSTI") The IC will be 100% responsible for conducting any studies related to SSR or SSTI including screening and/or final engineering studies. The IC will be responsible for performing a SSR or SSTI study as part of project execution and will need to be completed prior to Initial

Synchronization Date of the Generating Facility. The SSR or SSTI study will identify any mitigation(s) that will be required. Any identified mitigation shall be at the expense of the IC.

Synchronous generators close to series compensated transmission line and all inverter-based generators are required by the ISO Transmission Planning Process Business Practice Manual⁷ to submit an electromagnetic transient model. The PSCAD model, if required, must be submitted within one hundred twenty (120) calendar days after to achieving its COD, or from the date of request made by the ISO, whichever is later.

Please refer to Section G for the results of the SSCI screen.

6. Low/High Voltage Ride-Through (“LHVRT”) and Low/High Frequency Ride-Through (“LHFRT”) Capability

Consistent with PRC-024, the Generating Facility may not trip or cease to inject current within the “no-trip” zone of the frequency and voltage ride through curves of PRC-024. Momentary cessation—ceasing to inject current during a fault—is prohibited unless transient high voltage conditions rise to 1.20 per unit or more. For transient low voltage conditions, the Generating Facility will inject reactive current directionally proportional to the decrease in voltage. The inverter must produce full rating reactive current when the AC voltage at the inverter terminals drops to a level of 0.50 per unit and must continue to operate and attempt to maintain voltage for transient voltage conditions between 1.10 and 1.20 per unit. In addition, the Generating Facility may not trip or cease to inject current for momentary loss of synchrony within the no-trip zone of PRC-024.

7. 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.

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

An operating range shall be identified in the GIA that specifies a minimum state of charge and a maximum state of charge between which the electric storage resource will be required to provide primary frequency response. The GIA shall also specify whether the operating range is static or dynamic; in addition, the operating range is subject to reevaluation and modification by SCE in consultation with the IC and ISO.

F. RELIABILITY STANDARDS, STUDY CRITERIA AND METHODOLOGY

- **Study Criteria**

⁷ <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Transmission%20Planning%20Process>

The generator interconnection studies were conducted to ensure the ISO Grid follows 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 and Guidelines.

- **SCE Short Circuit Duty Study Methodology**

All bus locations where the Phase II projects increased the Short Circuit Duty (“SCD”) 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 SCE equipment is overstressed and associated mitigation. Similarly, this information is also utilized to identify any SCE-owned substations that may require a ground grid study.

The responsibility to finance the SCD mitigation(s) identified in the Phase II Study due to increases in SCD, shall be assigned pro rata to all projects requiring the SCD mitigation based on their respective SCD contribution.

- **Coordination with Affected Systems**

Per GIP section 3.7, 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. 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.

G. STUDY RESULTS

1. ISO controlled facilities (Bulk Level Facilities)

a. Generation Export Analysis

i. Steady State Power Flow Reliability Analysis

[REDACTED]

use congestion management to mitigate for overloads on ISO facilities/equipment.

ii. Transient Analysis

Refer to the Area Report for additional details pertaining to the transient stability evaluation criteria and assessment results on the Bulk System, respectively.

b. Deliverability Assessment

Section I – Deliverability Assessment Results of this report provides information on any Delivery Network Upgrades (Local or Area) assigned to the Generating Facility, if any.

c. SCD Analysis

i. SCE-owned Facilities

[Redacted]

ii. SCE’s Ground Grid Duty Concerns

[Redacted] Refer to the Area Report for further information

iii. SCD Considerations

[Redacted]

d. As-Available Charging Analysis

i. Thermal Overloads

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted] Bluff No.2 500 kV T/L under the loss of the Devers-Red Bluff No.1 500 kV T/L

ii. Required Mitigations

[Redacted]

2. Non-ISO controlled Subtransmission System (66 kV or 115 kV)

a. Generation Export Analysis

i. Steady State Power Flow Analysis

1. Thermal Overloads

The subtransmission assessment indicates that the Generating Facility contributes to overloads on the following facilities listed below under normal and single 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 Subtransmission Assessment Report. Provided below is a summary of the overloaded facilities under normal, single contingency, and/or multiple contingency conditions with associated mitigation, if applicable.

I. Normal Conditions

- [Redacted]
- [Redacted]

II. Single Contingency

- [Redacted]
- ■ [Redacted]
- [Redacted]

2. Power Flow Non-Convergence

[Redacted]

3. Voltage Performance

[Redacted]

4. Required Mitigations

[Redacted]

Base Case Mitigations:

- a. [Redacted]
- b. [Redacted]

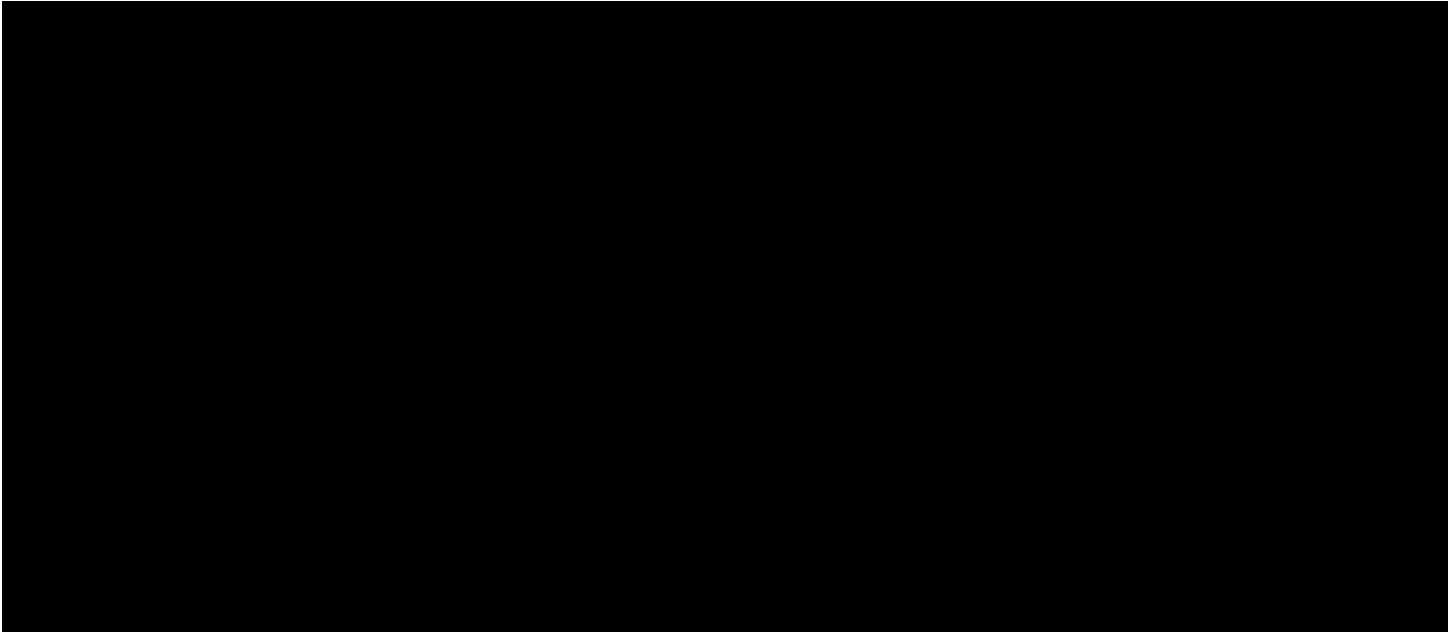
Single Contingency Mitigations:

- a. [Redacted]

The details of the analysis and overload levels are provided in the corresponding Subtransmission Assessment Report. Please refer to Attachment 1 and Attachment 2 for additional scope and costs information

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.



a. 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.

Evaluation Assumptions	
Generating Facility MW Output at Terminal(MW)	
Ambient Temperature for Generator Capability (°C)	
Effective Power Factor at Generator Terminal	
Generating Facility MW at High Side of the Transformer (MW)	
Reactive Power Requirements	

Pad-mount transformer losses (Mvar)
Collector equivalent losses (Mvar)
Main transformer losses (Mvar)
PF Requirements at High Side of Transformer (Mvar)
Total VAR Requirements (Mvar)
Reactive Power Supply
SMA 2750-EV PV Inverters at Pgen (Mvar)
Shunt Capacitors (Mvar)
Collector Line Charging (Mvar)
Other Dynamic VAR Devices (Mvar)
Total VAR Supply (Mvar)
Total Dynamic VAR Supply (Mvar)
Total Reactive Power (Shortage) / Surplus Total Requirements less Total Supply
Dynamic Reactive Power (Shortage) / Surplus PF Requirements at High Side of Transformer less Total Dynamic VAR Supply



Based on the technical details provided, the Generating Facility, as proposed, has the capability to meet 0.95 power factor requirement as measured at the high-side of the IC's substation or other equivalent location.

b. Subsynchronous Interaction Evaluations

As part of the QC12 Phase II study a detailed screening for SSCI was performed utilizing the technical data in PSLF format (epc and dyd files) provided⁸ by the IC for the Generating Facility to determine if a detailed SSCI study is needed. The SSCI screen determined that the Generating Facility does not require a detailed SSCI analysis. However, as previously mentioned in Section E.5 of this report, all inverter-based generators are required by the CAISO Transmission Planning Process Business Practice Manual⁹ to submit the final Power System Computer Aided Design ("PSCAD") of the Generating Facility.

Please refer to Appendix L of the Area report for details on the study and Attachment 1 for additional requirements after the Generating Facility achieves commercial operation.

c. Transient Analysis

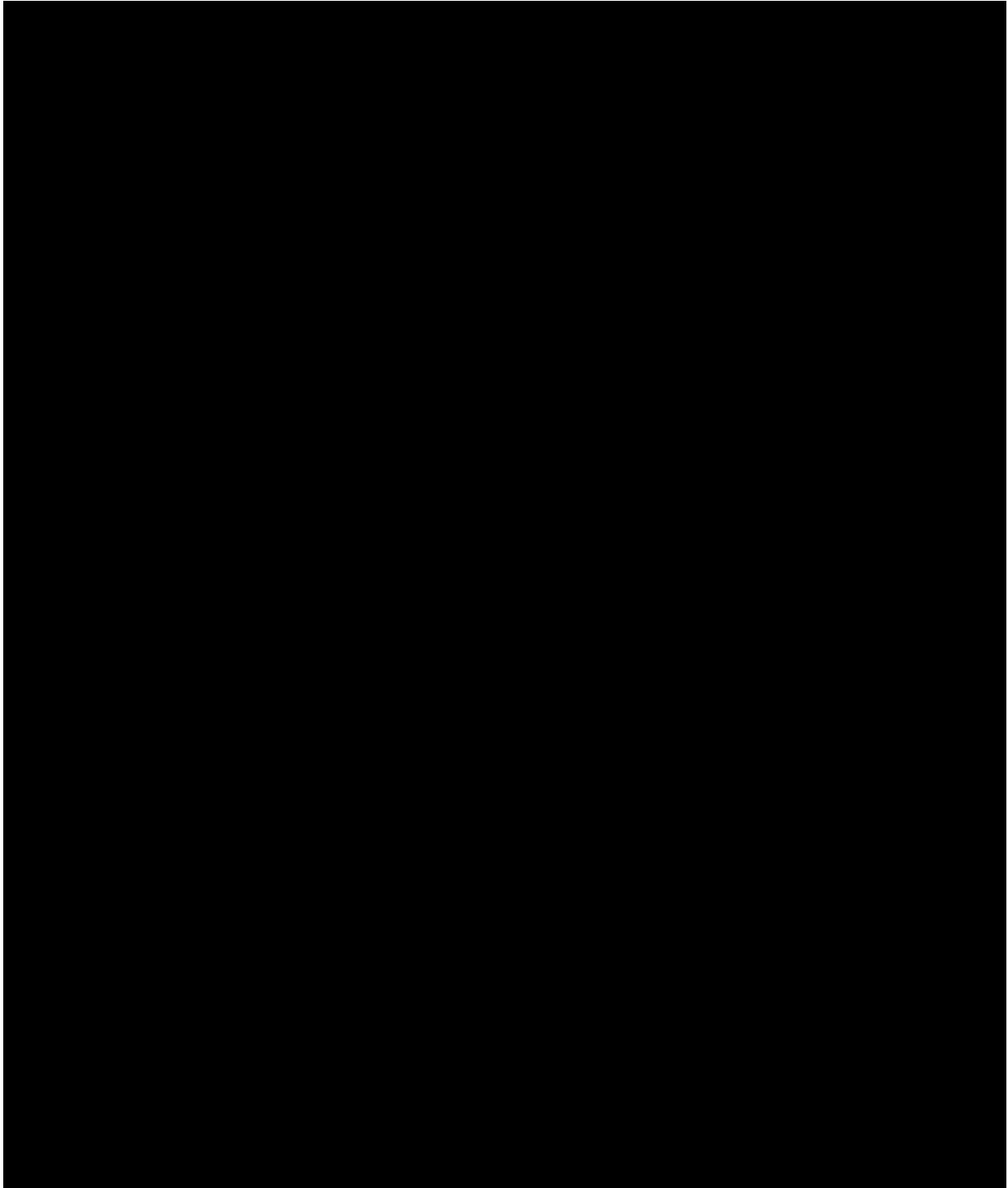
i. Generating Facility Performance



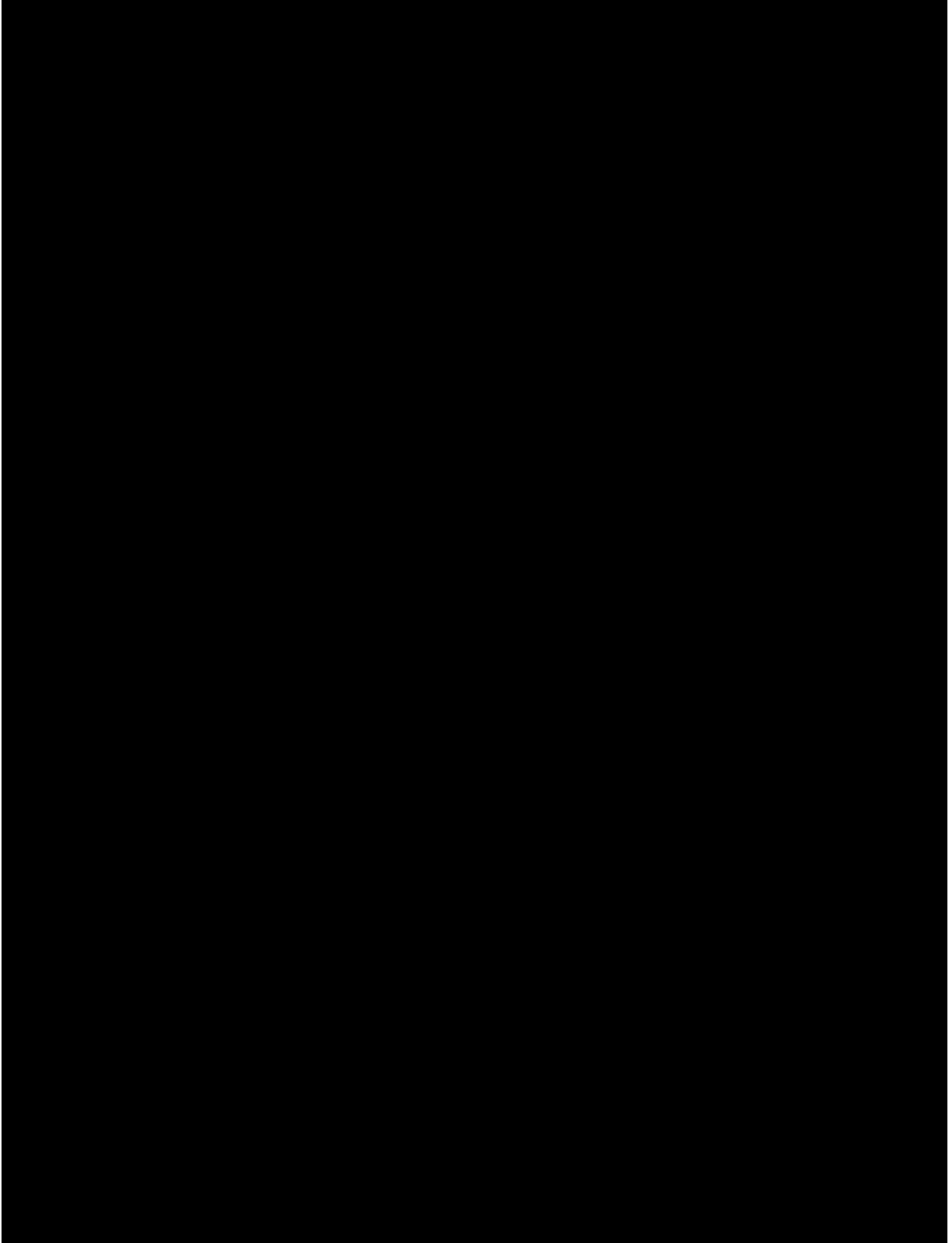
⁸ Any changes from the data provided will need to be re-evaluated by SCE in accordance with the Material Modification Process per GIDAP Section 6.7.2.

⁹ <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Transmission%20Planning%20Process>

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



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



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

ii. System Performance

[Redacted]

d. SCD Analysis

i. SCE-owned Facilities

[Redacted]

ii. SCE's Ground Grid Duty Concerns

[Redacted]

iii. Short Circuit Duty Considerations

[Redacted]

e. As-Available Charging Analysis

Steady State Power Flow Analysis

1. Thermal Overloads

[Redacted]

2. Power Flow Non-Convergence

[Redacted]

3. Voltage Performance

[Redacted]

4. Power Factor Requirement under As-Available Charging operation of the Generating Facility

[Redacted]

5. As-Available Charging Restrictions of the Generating Facility

[REDACTED]

6. Implementation of ACDS Charging Restrictions for the Generating Facility

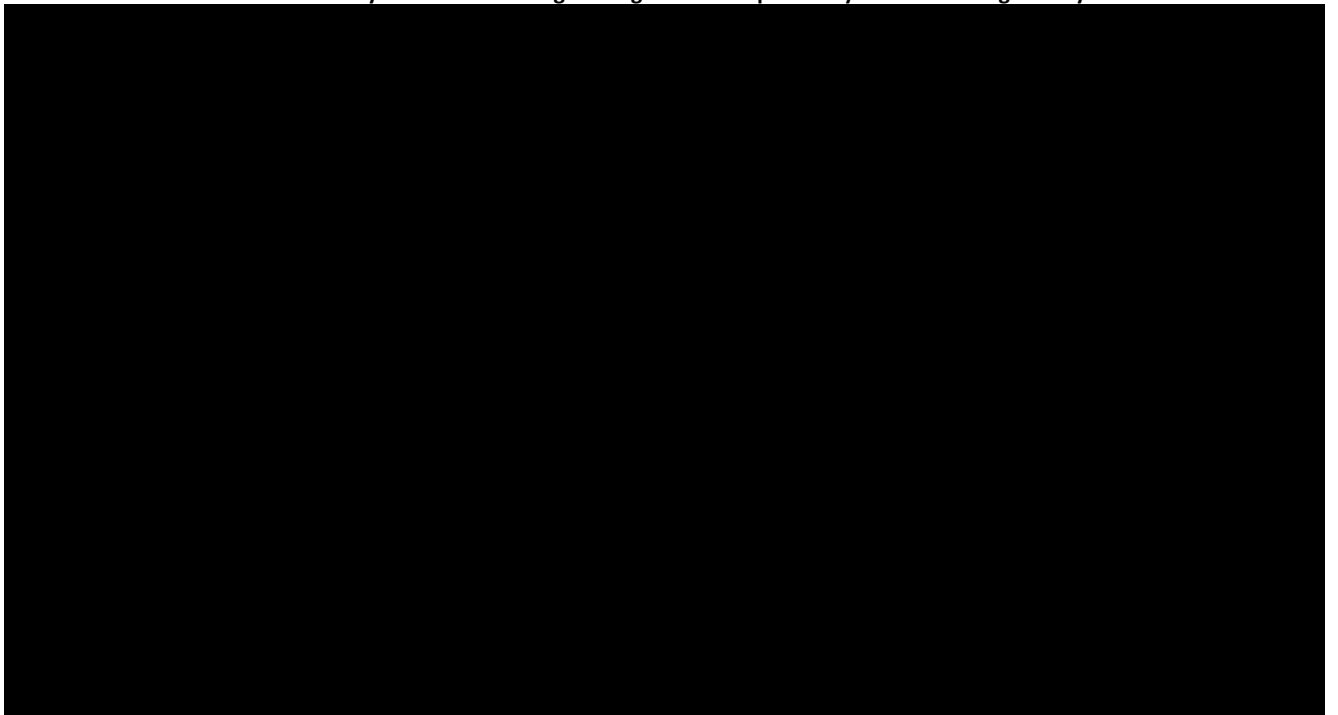
Per the Phase II Study results, there is no need for the Generating Facility to be added to CMS or follow a safety charging schedule upon COD. However, as additional projects materialize in the area, that may be required in the future. When the potential need to implement charging restrictions for the Generating Facility by SCE is identified, the IC will be notified, and a technical assessment will need to be conducted at the IC's expense. The technical assessment will be performed by SCE to determine if the charging restrictions will be applied by adding the Generating Facility to CMS/DERMS or by a safety charging schedule. The technical study will be at the IC's expense and provide associated scope and costs.

[REDACTED]

H. AFFECTED SYSTEMS SCD RESULTS

The specific SCD contribution from the Generating Facility to Neighboring Utilities is outlined in Table H.1 below. Impacts on the Affected Systems with the addition of all QC12 Phase II projects, are provided in the Area Report (Section H.2), and in Attachment 7.

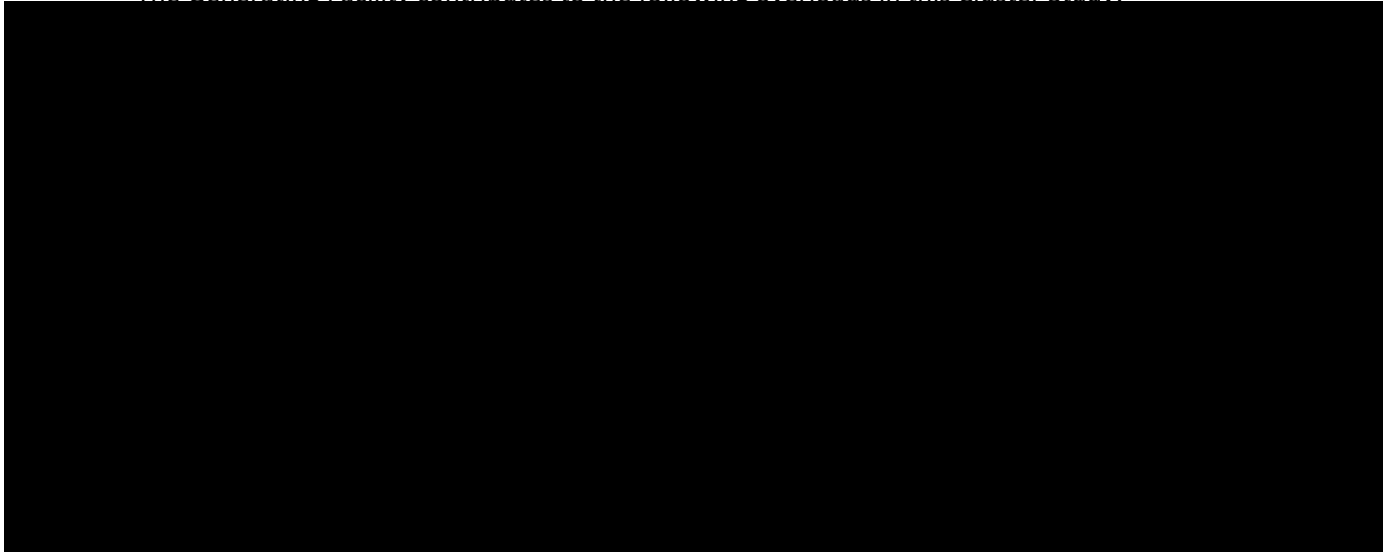
Table H.1: Short-Circuit Duty Evaluation of Neighboring Utilities Impacted by the Generating Facility



I. DELIVERABILITY ASSESSMENT RESULTS

1. On Peak Deliverability Assessment

The Generating Facility contributes to the following overloads in this Cluster Study:



2. Off- Peak Deliverability Assessment

For details, see Section E.2 of the Area Report.

3. Required Mitigations

No delivery Network Upgrades are required.

J. INTERCONNECTION FACILITIES, NETWORK UPGRADES, AND DISTRIBUTION UPGRADES

Please see Attachment 1 for SCE's IF's, RNU's, DNU's¹⁰, and DU's allocated to the Generating Facility for physical interconnection, to provide for the requested MW export at the POI taking into account the requested Deliverability, and in support of ACDS. 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 Tale L.1.

K. COST AND CONSTRUCTION DURATION ESTIMATE

I. Cost Estimate

The Generating Facility's estimated interconnection costs, adjusted for inflation and provided in 'constant' 2020 dollars escalated to the Generating Facility's feasible COD (as identified below in Table L.1), are provided in Attachment 2 and the Generating Facility's allocated cost for shared network upgrades are provided in Attachment 3 to this Appendix A report. Furthermore, Attachment 2 includes the IC's Generating Facilities Charging Capacity rate as it relates to ACDS.

¹⁰ 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 SCE pursuant to Section 4.8.4.2.1 under GIP.

The interconnection costs will be documented in the forthcoming GIA for the Generating Facility. However, should there be a delay in executing the GIA beyond 2021, a new cost estimate adjusted for inflation will be required and reflected into the GIA.

II. Preliminary Durations for SCE Engineering, Design, and Construction to enable interconnection of the Generating Facility

The duration shown in Table K.1 represents the estimated time needed for SCE to design, procure, and construct the applicable 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. The durations for the facilities identified for the Generating Facility is as follows:

Table K.1 Estimated Execution Duration

Facilities	Description	Duration	Notes
Interconnection Facilities (IF)	Facilities described in Section 1.b of Attachment 1		2
Reliability Network Upgrades (RNU)	No required RNU were identified in the Phase II Interconnection Study	NA	NA
Area Delivery Network Upgrades (ADNU)	Because the Generating Facility elected to proceed under Option A, no Area Delivery Network Upgrades were identified for the Generating Facility in the Phase II Interconnection Study	NA	NA
Local Delivery Network Upgrades (LDNU)	No required LDNUs were identified in the Phase II Interconnection Study	NA	NA
Distribution Upgrades (DU)	DUs described in Section 3 of Attachment 1		1,2

SCE Notes for SCE Facilities Timelines Identified in Table K.1:

1. Construction Duration Estimates for Identified Upgrades

Any construction durations identified in this section may vary. During the cluster study process, SCE includes all queued and active generation projects without regard to corresponding desired in-service dates or actual status to identify system upgrades, including SCD related upgrades, and a duration for SCE to build them. Such duration affects the ISD for this specific Generating Facility. As status for queued projects change (withdrawals, downsizing, suspensions, or deferred in-service dates), SCE may be able to accelerate in-service dates for projects affected by status changes. Furthermore, SCE will only begin design/construction of an identified system upgrade when enough projects 1) execute and fund a GIA and/or a Letter of Agreement with SCE and 2) those projects trigger the need for an upgrade.

2. **Coordination of Environmental Work**

Where this study assumes that the IC will perform environmental work related to the installation of SCE's IFs and DUs as specified in this report, the IC is advised that any durations provided above assume so and that the IC will perform this environmental work related to the installation of SCE's IFs and/or DUs specified in this report and will perform them in parallel with SCE's preliminary design and engineering. The IC is expected to engage SCE to obtain concurrence prior to commencement of any environmental work and during execution of that work. Since SCE will be using the IC's environmental documents and/or work products, IC delays producing them may delay SCE's ability to obtain required permits and/or license(s). Such delays would likely cause additional delays in the commencement of SCE's final engineering, procurement, and construction. These delays could increase any durations identified in this report and push out the feasible ISD provided in Table L.1 ISD and COD Assessment.

L. IN-SERVICE DATE AND COMMERCIAL OPERATION DATE ASSESSMENT

An ISD and COD assessment was performed for the Generating Facility to establish SCE's estimate of the earliest achievable ISD based on the cluster 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.

1. ISD Estimation Details

For the QC12 Phase II Interconnection Study, the estimated earliest achievable ISD is derived by the time requirements to complete the following:

1. QC12 Interconnection Study Process
2. Tender a draft GIA
3. Negotiate and execute the GIA
4. Longest duration associated with the facilities required to interconnect the Generating Facility (i.e., IF, RNU, and DU), per the durations specified in table K.1. above.

Table L.1 ISD and COD Assessment

Action or Assumption	Calendar Days or Months for Calculation	Item Description
		Issuance of Phase II Interconnection Study Report
Add:	30 CD	Phase II Results Meetings
Starting Point:		For WDTs the assumption is that the TPD Results issued and IC response provided before starting the draft GIA (the IC does have the option to start the GIA negotiation earlier)
Add:	30 CD	Earliest reasonable Tender draft GIA
Add:	90 CD	GIA negotiation time, execution, and related activities
Add: Construction Duration (Months)	27	Construction duration outlined in the Phase II Study Report. Construction completion no earlier than date which reflects earliest ISD
Reference:		IC-requested ISD via Attachment B
Reference:		IC-requested COD via Attachment B
		Duration difference between ISD and COD (months)
Equals:		Earliest achievable In-Service Date (ISD) per estimated construction duration
		Earliest achievable Commercial Operation Date (COD) (Using difference between ISD and COD requested by IC)

Notes on the Achievable ISD and COD calculation:

- 1) This calculation assumes that the duration 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) The IC-requested dates are specified in the Generating Facility’s IR and/or 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 or filed at the FERC for acceptance. Table L.1 provides SCE’s preliminary estimated achievable ISD and COD for the Generating Facility.

- 4) Assumes that GIA is tendered after the Transmission Plan Deliverability (“TPD”) allocation results are disclosed.

2. ISD Conclusion

[REDACTED]

SCE can reasonably tender a [REDACTED]. The draft GIA should be executed and/or filed at FERC no later than [REDACTED] and will include the earliest ISD and COD as identified in target the IC’s requested ISD and COD.

The ISO will perform its [REDACTED] and TPD allocation¹¹ (due April 2021). Any changes in scope, cost, or schedule requirements that come out of ISO’s Annual Reassessment and [REDACTED] if applicable, which will be used to revise the draft GIA (if under negotiation) or amend the GIA (if already executed).

M. 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 DNU’s identified below in this report, which may be updated in any subsequent annual reassessment. Until such time that these DNU’s 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)

[REDACTED]

a. Triggered Delivery Network Upgrades – [REDACTED]

b. Delivery Network Upgrades Triggered by Earlier Queued Projects – Various

- [REDACTED]

c. Approved Transmission Upgrades - Various

- [REDACTED]

d. Transmission Upgrades outside the ISO Controlled Grid - None

2. Interim Operational Deliverability Assessment for Information Only

¹¹ The TPD Allocation Process is estimated to be completed in April 2021. The actual date may vary.

[REDACTED] details of the Transmission and generation assumption, refer to Section E.3 of the Area Report.

3. Area Constraints

[REDACTED]

N. ADDITIONAL STUDY ANNOTATIONS

1. Conceptual Plan of Service

The results provided in this study are based on conceptual engineering and are preliminary. The information is not sufficient for permitting purposes and is subject to change as part of final 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 QC12 Phase II Interconnection Study were 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 should be submitted in Attachment B within ten (10) Business Days following the Phase I Interconnection Study Results Meeting. Any changes from the data provided would need to be evaluated under a Material Modification Assessment (MMA) to determine if such change(s) results in a material impact to queued-behind generation.

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

a. Crossing of SCE-owned Lines and Property

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 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 SCE 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. If the IC's Facilities result in the need to modify SCE's existing facilities, SCE recommends that the IC identify and include a description of such modifications in the IC's environmental study reports submitted to the lead agency permitting the Generating Facility. An interconnection customer may initiate this process by contacting SCE's Land Management Department at this link:

<https://www.sce.com/partners/real-estate-and-locations/secondary-land-use>.

b. Utilizing SCE Property or ROW

In instances where a site deposit is provided in lieu of site control documents for the location of a Generating Facility, and the site plan for the Generating Facility included in the IR package depicts the Generating Facility location on SCE owned property or utilizing SCE ROW; the IC will be required to provide an alternative site or submit a secondary land use request to SCE's Land Management Department for review and approval. A secondary land use request to support third party generation development is unlikely to get approved by SCE, but nevertheless the IC can submit a secondary land use request to SCE's Land Management Department for a review and approval at this link:

<https://www.sce.com/partners/real-estate-and-locations/secondary-land-use>.

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 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. SCE recommends that the IC identify and include a description of such facilities in the IC's environmental study reports submitted to the lead agency permitting the Generating Facility.

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 (IF) 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 final 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.

18. Future Charging Restrictions

Charging restrictions not identified in this study may occur in the future if the underlying operating assumptions prove to be different from the conditions evaluated in this study.

19. Transmission Voltage Reference

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

- 20.** The IC is advised that SCE reserves its right to issue an addendum or revision to this report, if applicable to comply with future tariff amendments filed and accepted by FERC associated with the treatment of energy storage devices interconnected or proposing to interconnect to the Distribution System.

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**
Not Applicable

Attachment 4:

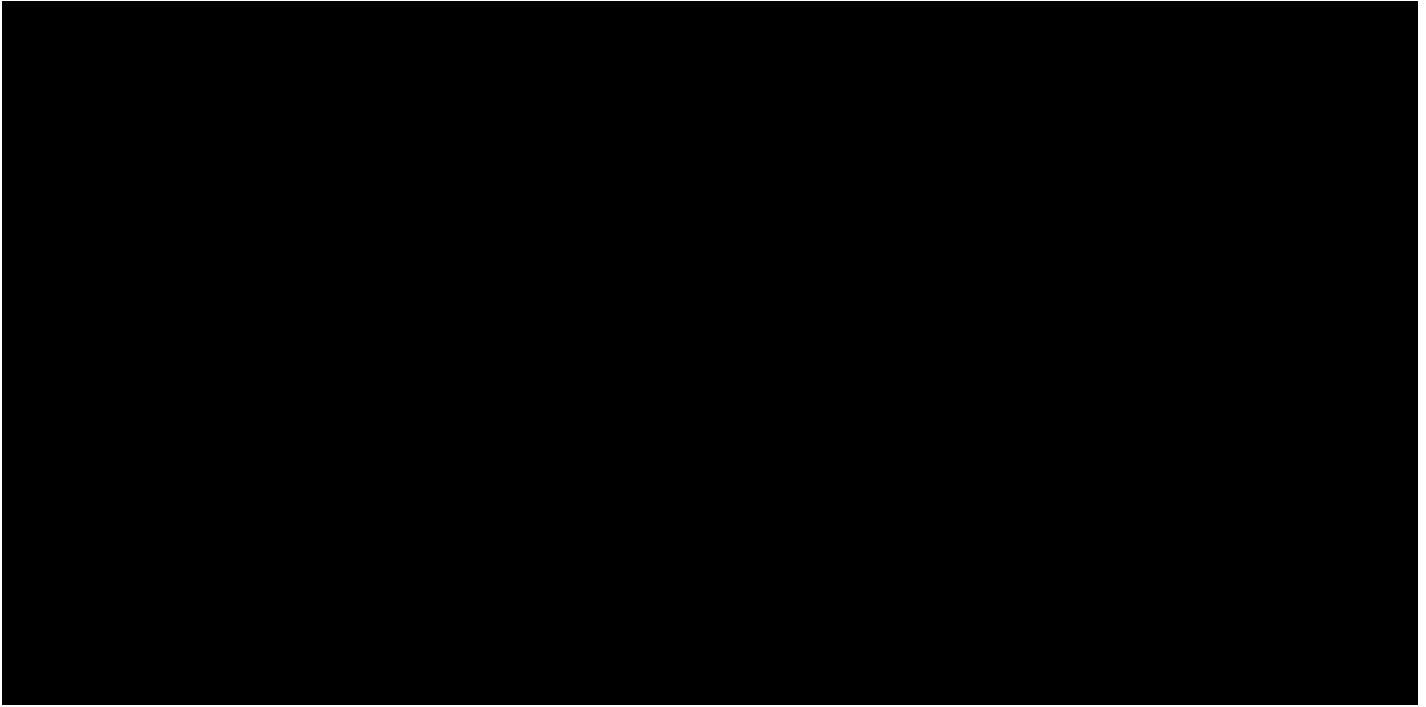
SCE's Interconnection Handbook

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

https://library.sce.com/content/dam/sce-doelib/documents/business/generating-your-own-power/grid-interconnections/SCE_InterconnectionHandbook.pdf

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**



Attachment 7:
Subtransmission Assessment Report
Please refer to separate document

**Attachment 8:
Not Used**

Attachment 9:
Firm Charging Distribution Service Report
Please refer to separate document