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Appendix 3A
Queue Cluster 7 Phase I
Interconnection Study

December 17, 2014

Mr. Mitchell Weinberg
Mission Rock Energy Center, LLC
4160 Dublin Blvd., Suite 100
Dublin, CA 94568

Re: Q1073 Mission Rock Energy Center (fka Mission Rock Energy Center Flex) Project
Cluster 7 Phase I Interconnection Study

Dear Mr. Weinberg:

Attached is the Cluster 7 Phase I Interconnection Study Report for the interconnection of the proposed Mission Rock Energy Center (fka Mission Rock Energy Center Flex) Project to the CAISO Controlled Grid. The CAISO and SCE performed the Phase I Interconnection Study in accordance with the CAISO's Generator Interconnection and Deliverability Allocation Procedures (GIDAP) tariff.

Please review the report and prepare comments and questions for the Results Meeting. The Phase I Interconnection Study Results Meeting will be coordinated and scheduled within 30 calendar days following receipt of this Phase I Interconnection Study report.

Sincerely,

Robert Sparks
Manager, Regional Transmission – South

Attachment(s)

Appendix A – Q1073

Mission Rock Energy Center, LLC

Mission Rock Energy Center

QUEUE CLUSTER 7 PHASE I REPORT

December 17, 2014

This study has been completed in coordination with Southern California Edison per CAISO Tariff Appendix DD Generator Interconnection and Deliverability Allocation Procedures (GIDAP)

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Attachments:

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2. Escalated Cost and Time to Construct for Interconnection Facilities, Reliability Network Upgrades, Delivery Network Upgrades, and Distribution Upgrades
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4. Participating TO Interconnection Handbook
5. Short Circuit Calculation Study Results (see Appendix H of the Area Report)
6. Interconnection Customer Provided Project Dynamic Data
7. SCE Northern Hemisphere Import Nomogram

A. Introduction

Mission Rock Energy Center, LLC, the Interconnection Customer (IC), has submitted a completed Interconnection Request (IR) to the California Independent System Operator Corporation (CAISO) for their proposed Mission Rock Energy Center (Project) interconnecting to the CAISO Controlled Grid. The Project plans to have a total output of 305 MW at the generating facility. The Project's requested Point of Interconnection (POI) is Southern California Edison Company's (SCE) Santa Clara 220kV[1] Substation located in Ventura County, California. The IC requested Full Capacity Deliverability Status for the Project, and desires an In-Service Date (ISD) and Commercial Operation Date (COD) of September 1, 2018 and March 1, 2019 respectively. Such dates are specified in the Project Interconnection Request (IR). Actual ISD and COD will depend on design and construction requirements to interconnect the Project.

In accordance with Federal Energy Regulatory Commission (FERC) approved CAISO Tariff Appendix DD Generator Interconnection and Deliverability Allocation Procedures (GIDAP), the Project was grouped with Queue Cluster 7 (QC7) Phase I projects to determine the impacts of the group as well as impacts of the Project on the CAISO Controlled Grid.

An Area Report has been prepared separately identifying the combined impacts of all projects in the group on the CAISO Controlled Grid. This report focuses only on the impacts or impact contributions of the Project, and it is not intended to supersede any contractual terms or conditions specified in an Interconnection Agreement.

The report provides the following:

1. Transmission system impacts caused by the Project;

2. System reinforcements necessary to mitigate the adverse impacts caused by the Project under various system conditions;

3. A list of required facilities and a good faith estimate of the Project's cost responsibility and time to construct[2] these facilities. Such information is provided in Attachment 1 and Attachment 2 as separate documents in the Appendix A Project report package.

All the equipment and facilities comprising the Project located in Santa Paula, California, as disclosed by the IC in its IR, as may have been amended during the Interconnection Study process, which consists of (1) one steam turbine generator (80 MW) and (1) one combustion turbine generator (235 MW) for combined gross/rated output of 315 MW with an auxiliary load of 10 MW for a total net output of 305 MW at the generating facility, (ii) the associated infrastructure, (iii) meters and metering equipment, (iv) appurtenant equipment, and (v) auxiliary loads.

The Project shall consist of the Generating Facility and the IC's Interconnection Facilities as illustrated below in Figure A-1. Similarly, the Project information is summarized in Table A.1 below. The location of the Project was assumed as specified in the IR provided by the IC. The Project shall not exceed the total net output.

[1] Identification of facility voltages (220kV) in this QC7 Phase I Study are shown consistent with SCE System Operating Bulletin 123. However, all studies were predicated on the base voltages reflected in the Western Electricity Coordinating Council (WECC) base cases. For the SCE bulk power system, the WECC base cases reflect 230kV and 500kV base voltages; consequently, all per-unit calculations presented were based on 230kV and 500kV voltages

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

Figure A.1: Project IC Facilities One-Line Diagram

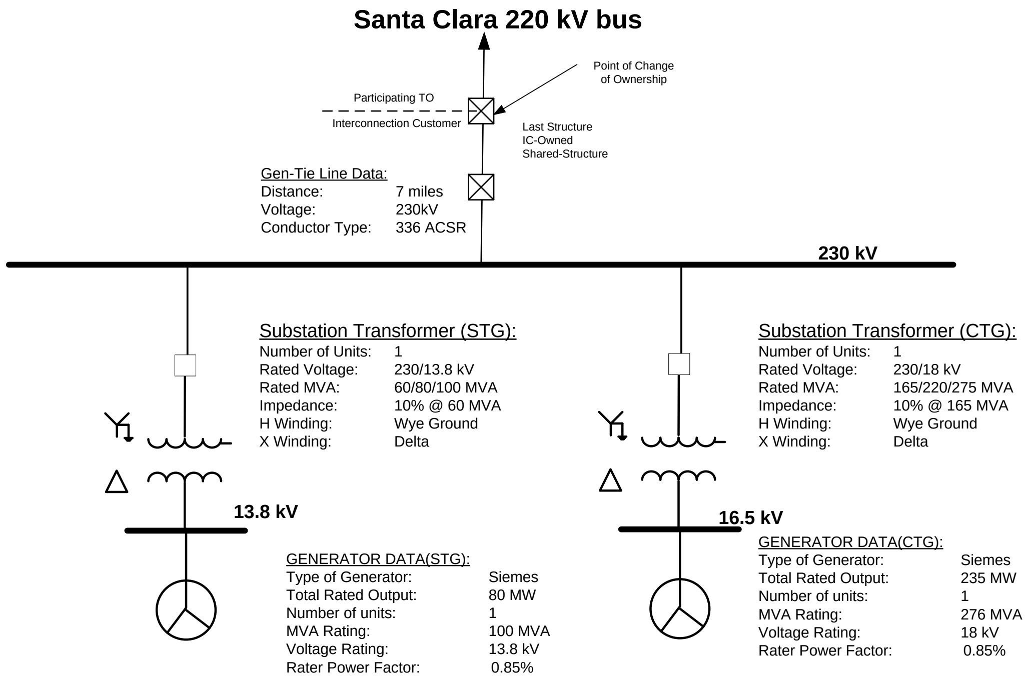

Table A.1: Project General Information

Project Location	1025 Mission Rock Santa Paula, CA Ventura County
Participating TO's Planning Area	SCE Northern system
Number and Types of Generators	One Siemens Combustion Turbine (235 MW) and One Siemens Steam Turbine (80 MW)
Interconnection Voltage	220kV
Maximum Generator Output	315 MW
Generator Auxiliary Load	10 MW
Maximum Net Output	305 MW
Power Factor Range	Lead 0.95 / Lag 0.85 at POI per interconnection application
Step-up Transformer(s)	Main Transformers (CTG1) 220/18kV (YG-D), 165/220/275 MVA H-X Impedance Value: 10% @ 165 MVA Main Transformers (STG1) 220/13.8kV (YG-D), 60/80/100 MVA H-X Impedance Value: 10% @ 60 MVA
POI	Participating TO's Santa Clara 220kV Substation
IC Requested COD	March 1, 2019

B. Study Assumptions

For detailed assumptions regarding the group cluster analysis, please refer to the QC7 Phase I Area Report. Below are the assumptions specific to the Project.

1. The following is the Plan of Service (POS) assumed for the Project in the Phase I Study:

   The project was modeled as interconnecting 305 MW of net generation to the CAISO controlled grid at the Santa Clara Substation 220kV Bus via one 220kV generation tie-line (gen-tie).

2. The following Facilities will be installed by SCE and **are included** in this Phase I Study:

   - The new 220kV position at Santa Clara Substation.
   - The segment of 220kV gen-tie line inside the Santa Clara Substation property line.
   - The segments of each one of the two telecommunication paths inside the Santa Clara Substation property line.
   - The required retail load meters.
   - Lightwave, channel, and associated equipment at Santa Clara Substation and at the Generating Facility.

   NOTE: SCE installation does not include metering voltage, and current transformers. The SCE meters will be connected to the generator – owned voltage and current transformers to be installed for their CAISO metering.

3. The following Facilities will be installed by the IC and **are not included** in this Phase I Study:

   - The 220kV gen-tie line from the Generating Facility to the last structure outside the Santa Clara Substation property line.
   - The fiber optic cable lines to provide two diversely routed telecommunication paths required for the line protection relays.
   - The required CAISO metering equipment (voltage and current transformers and CAISO meters).

   NOTE: The metering voltage and current transformers installed for the CAISO metering will also be used for the SCE owned retail meters.

   - The following line protection relays to be installed at the Generating Facility end of the 220kV gen-tie line:
     - One G.E. L90 current differential relay with dual dedicated digital communication channels to Santa Clara Substation.

        - One SEL 311L current differential relay with dual dedicated digital communication channels to Santa Clara Substation.
    - The following SPS Relays to be installed at the Generating Facility:
        - Two G.E. N60 relays (One each for SPS A and B) to trip the main generator breaker.
        - One SEL – 2407 Satellite Synchronized Clock.

4. Additional QC7 Phase I Study and/or Assumption Notes:
    - The Project will need to participate in the Moorpark Area SPS. It should be noted that the new SPS needs to be presented to the WECC RASRS for approval. The WECC RASRS currently meets up to three (3) times a calendar year to review new and modifications to SPS systems. It should also be taken into account that engineering and design for the new SPS for the Participating TO and generator facilities must be finalized prior to presenting to the WECC RASRS for approval.
    - As part of a sensitivity analysis, the system was modeled in a manner where the project area was stressed. The amount of resources dispatched in the area followed the CAISO Technical Bulletin "Clarification of certain Generator Interconnection and Deliverability Allocation Procedures (GIDAP) Study Assumptions for Cluster 7" effective April 30, 2014.

C. Reliability Standards, Study Criteria and Methodology

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

D. Reliability Assessment Results

I. Steady State Power Flow Analysis Results – 220kV and above

1. Thermal Overloads

   The group study indicated that the Project contributes to the following facility overloads or non-convergence problems. The details of the analysis and overload levels are provided in the Area Report.

   - Category "A" (All facilities in service, N-0)
       - None
   - Category "B" (loss of a single element, N-1)
       - None
   - Category "C" (loss of multiple elements, N-2)

- Moorpark-Pardee No.2 or No.3 220kV T/L
- Pardee-Santa Clara 220kV T/L
- Pardee-Vincent No. 2 220kV T/L
- Laguna Bell – Mesa No. 1 220kV T/L

2. Power Flow Non-Convergence

   There were no non-convergence issues under certain contingencies identified with the inclusion of the Project.

3. Voltage Performance

   The Project is required to provide power factor regulation capability of 0.95 lead/ 0.90 lag at the generator terminal to alleviate power flow non-convergence and maintain the south of Vincent transmission transfer capability.

4. Required Mitigations

   A combination of congestion management, the Project providing 0.95 leading/0.90 lagging power factor regulation capability at the generator terminal, and SPS to trip the Project under identified contingency outage conditions is required to mitigate the power flow impacts of the Project described above. The Network Upgrades discussed in the Area Report and assigned to the Project are as follows:

   a. Moorpark Area SPS

      The Project will need to be added as a participant to the proposed Moorpark Area SPS to mitigate the thermal overloads under these outage conditions along with congestion management. The SPS monitors the following lines and will trip off generation under the following contingencies:

      - Moorpark-Pardee No.1 and No.2 220kV T/Ls
      - Moorpark-Pardee No. 1 and No.3 220kV T/Ls
      - Moorpark-Pardee No. 2 and No. 3 220kV T/Ls
      - Pardee-Sylmar No.1 and No.2 220kV T/Ls

   b. Laguna Bell – Mesa No. 1 220kV Line Clearance Mitigation

   Refer to the Scope of Network and Distribution Upgrades Section of the Area Report for additional information.

E. Short Circuit Duty Results

Short circuit studies were performed to determine the fault duty impact of adding the QC7 Phase I projects to the transmission system and to ensure system coordination. The fault duties were calculated with and without the projects to identify any equipment overstress conditions. Once overstressed circuit breakers are identified, the fault current contribution from each individual project in QC7 Phase I is determined. Each project in the cluster will be responsible for its share of the upgrade cost based on the rules set forth in CAISO Tariff Appendix DD.

1. Short Circuit Duty Study Input Data

   The customer provided technical data for the identified inverter (specified in Section 2). If the technical data obtained from the inverter manufacturer by SCE illustrates differences in the Short Circuit Duty (SCD) parameters, then SCE utilized the manufacturer data of the inverter model specified by the IC in the application in the SCD study. SCE utilized the parameters provided by the IC.

   "Synchronous Gen" Data for each generation unit:

   X"1 - positive sequence subtransient reactance: 0.142 PU
   X"2 - negative sequence subtransient reactance: 0.138 PU
   X"0 - zero sequence subtransient reactance: 0.093 PU

   <u>Generation Step-up Transformers (total of 1 units for CTG):</u>

Type	Main Transformer(s)
Phase	3
Quantity	1
Capacity, Each	230/18kV (YG-D), 165/220/275 MVA H-X Impedance Value: 10% @ 165 MVA

   <u>Generation Step-up Transformers (total of 1 units for STG):</u>

Type	Main Transformer(s)
Phase	3
Quantity	1
Capacity, Each	230/13.8kV (YG-D), 60/80/100 MVA H-X Impedance Value: 10% @ 60 MVA

   <u>Generation tie-line:</u>

Length:	7.0 miles
Conductor:	336 ACSR
Z1(p.u.) conductor impedance information:	0.004324386 R, 0.01068129 X, 0.020849 B
Z0(p.u.) conductor impedance information:	0.0003722 R, 0.0026059 X, 0.001393 B

   This generation tie-line impedance was based on calculation provided by the IC in IR.

2. Short Circuit Duty Study Results

All bus locations where the QC7 Phase I projects increase the short-circuit duty by 0.1 kA or more and where duty was found to be in excess of 60% of the minimum breaker nameplate rating are listed in the Area Report (Appendix H). These values have been used to determine if any equipment is overstressed as a result of the inclusion of QC7 Phase I interconnections and corresponding network upgrades, if any.

The responsibility to finance short circuit related Reliability Network Upgrades identified through a Group Study shall be assigned to all Interconnection Requests in that Group Study pro rata on the basis of short circuit duty contribution of each Generating Facility.

Please refer to the QC7 Phase I Area Report for the QC7 Phase I breaker evaluation identified overstressed circuit breakers at the SCE buses, and Attachment 2 for the pro-rata allocation with corresponding estimated costs (if any) for the Project, based on SCD contribution at each location.

3. Preliminary Protection Requirements

   Protection requirements are designed and intended to protect the Participating TO's system only. The preliminary protection requirements were based upon the interconnection plan as shown in the one-line diagram depicted in line item #7 in Attachment 1.

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

F. Transient Stability Evaluation

Limited transient stability studies were conducted using full loop base cases to ensure that the transmission system remains in operating equilibrium, as well as operating in a coordinated fashion; through abnormal operating conditions after the QC7 Phase I projects begin operation. The generator dynamic data used in the study for the Project is shown in Attachment 6.

1. Transient Stability Evaluation Results – 220kV and above

   A number of selected line and generator outages within the Northern System consistent with Category B and Category C requirements were simulated as part of the transient stability evaluation. The transient stability evaluation found that with all proposed system upgrades listed above, the QC7 Phase I projects in SCE's Northern Bulk system would not cause the transmission system to go unstable under Category B and Category C outages.

G. Reactive Power Deficiency Analysis

Reactive Power Deficiency Analysis was conducted using full loop base cases to ensure that there is enough reactive support such that the system (66kV and above) remains in operating equilibrium, as well as operating in a coordinated fashion; through abnormal operating conditions after the QC7 Phase I projects begin operation.

1. Area Study Reactive Power Deficiency Results – 220kV and above

   Refer to Section D in the Area Report for results.

2. Individual Project Power Factor Requirements

The Project is required to be designed to maintain a composite power delivery at continuous rated power at the generator terminal a power factor within the range of 0.95 leading and 0.90 lagging. Additionally, the generation system must be designed to accommodate a VAR schedule provided by SCE. SCE will determine if the VAR schedule is necessary based on future re-arrangements of SCE's Transmission system.

H. Deliverability Assessment Results

1. **On Peak Deliverability Assessment**

   The project contributes to the overloads listed in Section E.1.2 Table E.1.

2. **Off Peak Deliverability Assessment**

   For off-peak deliverability assessment, see Section E.2 in the Area Report.

3. **Required Mitigations**

   The following Local Delivery Network Upgrade is required to support the requested Full Capacity Deliverability Status.

   a. Laguna Bell – Mesa No. 1 220kV Line Clearance Mitigation

   Refer to the Scope of Network and Distribution Upgrades Section of the Area Report for additional information.

I. Interconnection Facilities, Network Upgrades, and Distribution Upgrades

Please see **Attachment 1** for the Interconnection Facilities (IF), Reliability Network Upgrades (RNU), Delivery Network Upgrades (DNU) and Distribution Upgrades (DU) allocated to the Project. Please note that SCE will not “reserve” the identified IF’s for the proposed POI. The identified scope/facilities will be allocated to the project upon the successful execution of the Generation Interconnection Agreement and SCE has completed the final design and engineering of the facilities according to tariff timelines.

J. Cost and Construction Duration Estimates

To determine the cost responsibility of each generation project in QC7 Phase I, the CAISO developed cost allocation factors (Attachment 3) for Reliability Network Upgrades, Local Delivery Network Upgrades and Area Delivery Network Upgrades. Attachment 2 provides the 'constant' 2014 dollars and their escalation to the estimated COD year for Interconnection Facilities, Reliability Network Upgrades, Delivery Network Upgrades, and Distribution Upgrades of which the Project was allocated the cost.

For the QC7 Phase I Study, the estimated COD is derived by assuming the duration of the work element will begin in December 2016, which accounts for the CAISO tariff scheduled completion date of the QC7 Phase II study plus: the TP Deliverability (TPD)[3] allocation, Annual Reassessment effort, and the interconnection agreement signing period and submittal of required funds by the IC.

[3] Transmission Plan Deliverability: Deliverability supported by the CAISO’s Transmission Plan

The IC should note that any Local Delivery Network Upgrades and Area Delivery Network Upgrades allocated to the Project may be assessed 35% Income Tax Component of Contribution (ITCC) pending the results of the TPD allocation Process several months after the QC7 Phase II Study Reports are released, in addition to the 35% ITCC assessed for the IFs, DUs, and RNUs above the $60K/MW repayment cap allocated to the Project. For your information, Attachment 2 contains a potential ITCC estimate[4] based on the Phase I cost in this study. It does not represent the "maximum ITCC exposure" of the Project. Attachment 3 provides an estimated non-reimbursable RNU cost that would be subject to ITCC, taking into account the Network Upgrade maximum cost responsibility. The maximum ITCC warranted by the Project will be addressed, calculated, and included during the Interconnection Agreement development phase once the IC submits the TPD Affidavit confirming the acceptance, partial acceptance, or denial of awarded deliverability assigned to the Project.

K. SCE Technical Requirements

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

L. Environmental Evaluation, Permitting, and Licensing

Please see Appendix K of the QC7 Phase I Area Report.

M. Affected Systems Coordination

Please see Section H of the QC7 Phase I Area Report.

N. Items not covered in this study

1. Conceptual Plan of Service

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

2. IC's Technical Data

   The study accuracy and results for the QC7 Phase I Study are contingent upon the accuracy of the technical data provided by the IC. Any changes from the data provided could void the study results.

3. Study Impacts on Neighboring Utilities

   Results or consequences of this QC7 Phase I Study may require additional studies, facility additions, and/or operating procedures to address impacts to neighboring utilities and/or regional forums. For example, impacts may include but are not limited to WECC Path Ratings, short circuit duties outside of the CAISO Controlled Grid, and sub-synchronous resonance (SSR).

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[4] The maximum ITCC exposure applies ITCC (35%) to assigned IF and DU facilities, Network Upgrades that are not subject to transmission credits incremental to a repayment $/MW cap or an award of 0 MW TPD Allocation, and that SCE will own the facilities in question. The maximum ITCC exposure is calculated by applying the following formula: (IF*35%)+ ((RNU Costs – (Project MW * ($60k/MW)))*35%)+(LDNU*35%)+(ADNU*35%)+(DU*35%)

Refer to Affected Systems Coordination Section of the Area Report.

4. Use of Participating TO Facilities

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

5. Participating TO Interconnection Handbook

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

6. Western Electricity Coordinating Council (WECC) Policies

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

7. System Protection Coordination

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

8. Standby Power and Temporary Construction Power

   The QC7 Phase I Study does not address any requirements for standby power or temporary construction power that the Project may require prior to the In-Service Date of the Interconnection Facilities. Should the Project require standby power or temporary construction power from Participating TO prior to the In-Service Date of the Interconnection Facilities, the IC is responsible to make appropriate arrangements with Participating TO to receive and pay for such retail service.

9. Licensing Cost and Estimated Time to Construct Estimate (Duration)

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

10. Network/Non-Network Classification of Telecommunication Facilities

    The cost for telecommunication facilities that were identified as part of the IC's Interconnection Facilities was based on an assumption that these facilities would be sited, licensed, and constructed by the IC. The IC will own, operate, maintain, and construct diverse telecommunication paths associated with the IC's generation tie line, excluding terminal equipment at both ends. In addition, the telecommunication requirements for SPS were assumed based on tripping of the generator breaker as opposed to tripping the circuit breakers at the Participating TO substation. Due to uncertainties related to telecommunication upgrades for the numerous projects in queue ahead of QC7 Phase I, telecommunication upgrades for higher queued projects were not considered in this study. Depending on the outcome of interconnection studies for higher queued projects, the telecommunication upgrades identified for QC7 Phase I may be reduced. Any changes in these assumptions may affect the cost and schedule for the identified telecommunication facilities.

11. Applicability

    This document has been prepared to identify the impact(s) contributions of the Project on the SCE electrical system; as well as establish the technical requirements to interconnect the Project to the POI that was evaluated in the QC7 Phase I Study for the Project. Nothing in this report is intended to supersede or establish terms/conditions specified in interconnection agreements agreed to by SCE, CAISO and the IC.

12. Process for synchronization/trial operations and commercial operations of the Project

    The IC is reminded that the CAISO has implemented a New Resource Implementation (NRI) process that ensures that a generation resource meets all requirements before synchronization/trial operations and commercial operations. The NRI uses a bucket system for deliverables from the IC that are required to be approved by the CAISO. The first step of this process is to submit an "ISO Initial Contact Information Request form" at least 7 months in advance of the planned initial synchronization. Subsequently an NRI project number will be assigned to the project for all future communications with the CAISO. The PTOs have 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 CAISO 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

13. Potential Changes in Cost Responsibility

    The IC is hereby placed on notice that interconnection of its proposed generating facility may be dependent upon certain Network Upgrades which are currently the cost responsibility of projects ahead of the proposed generating facility in the interconnection application queue. Section 14.2.2 of the GIDAP provides that should Network Upgrades required for queued-ahead projects be included in an executed GIA (or unexecuted GIA filed at FERC) at the time of withdrawal of the earlier queued generating facility, and the upgrades are determined to still be needed by later queued generating facilities, the financial responsibility for such upgrades falls to the Participating Transmission Owner. However, if the Network Upgrades required by earlier queued generating facilities are not subject to an executed GIA (or unexecuted GIA filed at

FERC) the financial responsibility for such upgrades may fall to the IC. Section 14.2.2 also discusses how Network Upgrades required by interconnection customers selecting Option (B) might be required to be reapportioned among interconnection customers selecting Option (B) in the case of withdrawals of earlier queued generating facilities. Changes in costs allocated to the IC could also arise as the result of the CAISO's reassessment process described in Section 7.4 of the GIDAP. SCE encourages the IC to review Sections 7.4 and 14.2.2 of the GIDAP for the rules and processes under which the financial responsibility might be reapportioned to the IC. Potential changes in the IC's cost responsibility resulting from application of the provisions of these Sections of GIDAP are not included in this Phase I study, nor are the potential impacts to the IC's maximum cost responsibility outlined.

Attachment 1

Interconnection Facilities, Network Upgrades and Distribution Upgrades

Please refer to separate document.

Queue Cluster 7 Phase I - Attachment 1
Q1073– Mission Rock Energy Center Project
Interconnection Facilities, Network Upgrades and Distribution Upgrades

To determine the cost responsibility of each project in QC7, the California Independent System Operator Corporation (CAISO) developed cost allocation factors (Attachment 3) for Reliability Network Upgrades and Local Delivery Network Upgrades. The CAISO developed the $/MW cost rate for incremental Area Delivery Network Upgrades. The cost rate multiplied by the requested deliverable MW capacity provides the cost estimate for the Area Delivery Network Upgrades. The Interconnection Facilities are the sole cost responsibility of the Project. The Interconnection Facilities, Network Upgrades, and Distribution Upgrades allocated to the project are listed below[1].

1. Interconnection Facilities.

(a) **Interconnection Customer's Interconnection Facilities.** The Interconnection Customer shall:

(i) Install a substation with two (2) 220/13.8kV main step-up transformers with a 10 percent impedance on a 165 MVA base.

(ii) Install a new 7 mile 220kV generation tie-line from the Generating Facility to a position designated by the Participating TO, outside of the Participating TO's Santa Clara Substation, where Interconnection Customer shall install a structure designed and engineered in accordance with the Participating TO's specifications ("Last Structure"). This generation tie-line will be referred to as the Q1073– Santa Clara 220kV Transmission Line. The right-of-way for the Q1073– Santa Clara 220kV Transmission Line shall extend up to the edge of the Santa Clara Substation property line.

(Note: Q1073– Santa Clara 220kV Transmission Line name is subject to change by the Participating TO based upon its transmission line naming criteria. Should the Q1073– Santa Clara 220kV Transmission Line name be changed, this LGIA may be amended to reflect such change.)

(iii) Install optical ground wire ("OPGW") on the Q1073– Santa Clara 220kV Transmission Line to a point designated by the Participating TO near the Participating TO's Santa Clara Substation to provide one of two telecommunication paths required for the line protection scheme, the Remote Terminal Units and one of the two required telecommunication paths required for the SPS. A minimum of eight (8) strands within the OPGW shall be provided for the Participating TO's exclusive use into Santa Clara Substation.

(iv) Install appropriate fiber optic cable from the Generating Facility to a point designated by the Participating TO near the Participating TO's Santa Clara Substation to provide the second telecommunication path required

[1] Such descriptions are subject to modification to reflect the actual facilities that are constructed and installed following the Participating TO's final engineering and design, identification of field conditions, and compliance with applicable environmental and permitting requirements.

for the line protection scheme and the SPS. A minimum of eight (8) strands within the fiber optic cable shall be provided for the Participating TO's exclusive use. The telecommunication path shall meet the Applicable Reliability Standards criteria for diversity.

(v) Own, operate and maintain both telecommunication paths (including OPGW, any fiber optic cables, and appurtenant facilities), with the exception of the terminal equipment at both Santa Clara Substation and at the Generating Facility, which terminal equipment will be installed, owned, operated and maintained by the Participating TO.

(vi) Allow the Participating TO to review the Interconnection Customer's telecommunication equipment design and perform inspections to ensure compatibility with the Participating TO's terminal equipment and protection engineering requirements; allow the Participating TO to perform acceptance testing of the telecommunication equipment and the right to request and/or to perform correction of installation deficiencies.

(vii) Provide required data signals, make available adequate space, facilities, and associated dedicated electrical circuits within a secure building having suitable environmental controls for the installation of the Participating TO's RTU in accordance with the Interconnection Handbook.

(viii) Make available adequate space, facilities, and associated dedicated electrical circuits within a secure building having suitable environmental controls for the installation of the Participating TO's telecommunications terminal equipment in accordance with the Interconnection Handbook.

(ix) Extend the OPGW and fiber optic cable for the two telecommunication paths to an Interconnection Customer provided and installed patch panel located adjacent to the Participating TO's telecommunications terminal equipment specified above.

(x) Install all required CAISO-approved compliant metering equipment at the Generating Facility, in accordance with Section 10 of the CAISO Tariff.

(xi) Install a revenue metering cabinet and revenue metering equipment (typically, voltage and current transformers) at the Generating Facility to meter the Generating Facility retail load, as specified by the Participating TO. The metering cabinet must be placed at a location that would allow twenty-four hour access for the Participating TO's metering personnel.

(xii) Allow the Participating TO to install, in the revenue metering cabinet provided by the Interconnection Customer, revenue meters and appurtenant equipment required to meter the retail load at the Generating Facility.

(xiii) Install relay protection to be specified by the Participating TO to match the relay protection used by the Participating TO at Santa Clara Substation, in order to protect the Q1073– Santa Clara 220kV Transmission Line, as follows:

1. Two (2) current differential relays connected via diversely routed dedicated digital communication channels to Santa Clara Substation. The make and type of current differential relays will be specified by

the Participating TO during final engineering of the Participating TO's Interconnection Facilities.

(xiv) Install necessary relays and satellite clock to support the SPS requirements for the Generating Facility. The make and type of SPS relays and satellite clock will be specified by the Participating TO during final engineering of the Participating TO's Interconnection Facilities.

(xv) Install disconnect facilities in accordance with the Participating TO's Interconnection Handbook to comply with the Participating TO's switching and tagging procedures.

(b) **Participating TO's Interconnection Facilities.** The Participating TO shall**:**

(i) **Santa Clara Substation.**

1. Install facilities for a new 220kV switchrack position to terminate the Q1073– Santa Clara 220kV Transmission Line. This work includes the following:
   a. One (1) 220kV dead-end substation structure.
   b. Three (3) 220kV coupling capacitor voltage transformers. ("CCVTs") with steel pedestal support structures.
   c. Three (3) 220kV line drops.
2. Install the following relays to protect the Q1073– Santa Clara 220kV Transmission Line:
   a. Two (2) current differential relays connected via diversely routed dedicated digital communications channels to the Generating Facility.

(ii) **Q1073– Santa Clara 220kV Transmission Line.**
Install an appropriate number of 220kV transmission tower structures including insulator/hardware assemblies, and appropriate number of spans of conductor and fiber optic cable between the Last Structure and the dead-end substation structure at Santa Clara Substation. The actual number and location of the transmission tower structures and spans of conductor and fiber optic cable will be determined by the Participating TO following completion of final engineering of the Participating TO's Interconnection Facilities. The Phase I Interconnection Study assumed one (1) transmission structure and two (2) spans of conductor and fiber optic cable.

(iii) **Telecommunications.**

1. Install all required lightwave, channel, and associated equipment (including terminal equipment), supporting protection, SPS, and SCADA requirements at the Generating Facility and Santa Clara Substation for the interconnection of the Generating Facility. Notwithstanding that certain telecommunication equipment, including the telecommunications terminal equipment, will be located on the Interconnection Customer's side of the Point of Change of Ownership,

the Participating TO shall own, operate and maintain such telecommunication equipment as part of the Participating TO's Interconnection Facilities.

2. Install appropriate length of fiber optic cable, including conduit and vaults, from the point designated by the Participating TO near the Participating TO's Santa Clara Substation to extend the fiber optic cable into the communication room at Santa Clara Substation. The actual location and length of fiber optic cable and conduit, and location and number of vaults, will be determined during final engineering of the Participating TO's Interconnection Facilities.
3. Install appropriate length of fiber optic cable, including conduit and vaults, to extend the Interconnection Customer's diverse telecommunications from the point designated by the Participating TO near the Participating TO's Santa Clara Substation into the communication room at Santa Clara Substation. The actual location and length of fiber optic cable and conduit, and location and number of vaults, will be determined during final engineering of the Participating TO's Interconnection Facilities.

(iv) **Real Properties,Transmission Project Licensing, and Corporate Environmental Health and Safety.**
Obtain easements and/or acquire land, obtain licensing and permits, and perform all required environmental activities for the installation of the Participating TO's Interconnection Facilities, including any associated telecommunication equipment for the Q1073– Santa Clara 220kV Transmission Line.

(v) **Metering.**
Install revenue meters and appurtenant equipment required to meter the retail load at the Generating Facility. Notwithstanding that the meters and appurtenant equipment will be located on the Interconnection Customer's side of the Point of Change of Ownership, the Participating TO shall own, operate and maintain such facilities as part of the Participating TO's Interconnection Facilities.

(vi) **Power Systems Control.**
Install one (1) RTU at the Generating Facility to monitor typical generation elements such as MW, MVAR, terminal voltage and circuit breaker status for the Generating Facility and plant auxiliary load, and transmit the information received thereby to the Participating TO's grid control center. Notwithstanding that the RTU will be located on the Interconnection Customer's side of the Point of Change of Ownership, the Participating TO shall own, operate and maintain the RTU as part of the Participating TO's Interconnection Facilities.

2. Network Upgrades.

(a) **Stand Alone Network Upgrades.**
None identified in this Phase I Study.

(b) **Other Network Upgrades.**

(i) **Participating TO's Reliability Network Upgrades.** The Participating TO shall**:**

1. **Santa Clara Substation.**
   a. Engineer and construct a new position at Santa Clara 220kV Substation, which will include the following elements:
      i. Two (2) 220kV circuit breakers
      ii. Four (4) sets of 220kV disconnects
   b. Protection Relays:
      i. Two (2) LBFB relays
2. **Power Systems Control.**
   a. Substation Automation System (SAS) point additions to the existing Santa Clara Substation SAS.

3. **Moorpark SPS.**
Refer to Area Report for scope information and Attachment 2 for associated costs assigned to the Project.

4. **Short Circuit Duty (SCD) Mitigation – RNU.**
Refer to Area Report for scope information and Attachment 2 for associated costs assigned to the Project.

(ii) **Participating TO's Delivery Network Upgrades.**

1. **Area Delivery Network Upgrades.**
None identified in this Phase I Study.

2. **Local Delivery Network Upgrades.**
Mesa-Laguna Bell 220kV No.1 Emergency Rating Increase.
Refer to Area Report for scope information and Attachment 2 for associated costs assigned to the Project.

3. Distribution Upgrades.
(a) **Short Circuit Duty (SCD) Mitigation – DU.**
Refer to Area Report for scope information and Attachment 2 for associated costs assigned to the Project.

4. Affected System.
Not used.

5. Point of Change of Ownership.

(a) **Q1073– Santa Clara 220kV Transmission Line:** The Point of Change of Ownership shall be the point where the conductors of the Q1073– Santa Clara 220kV Transmission Line are attached to the Last Structure, which will be connected on the side of the Last Structure facing Santa Clara Substation. The Interconnection Customer shall own and maintain the Last Structure, the conductors, insulators and jumper loops from such Last Structure to the Interconnection Customer's Generating Facility. The Participating TO will own and maintain the new position at Santa Clara Substation, including all the circuit breakers, disconnects, relay facilities and metering within the Santa Clara Substation, together with the line drop, in their entirety, from the Last Structure to Santa Clara Substation. The Participating TO will own the insulators that are used to attach the Participating TO-owned conductors to the Last Structure.

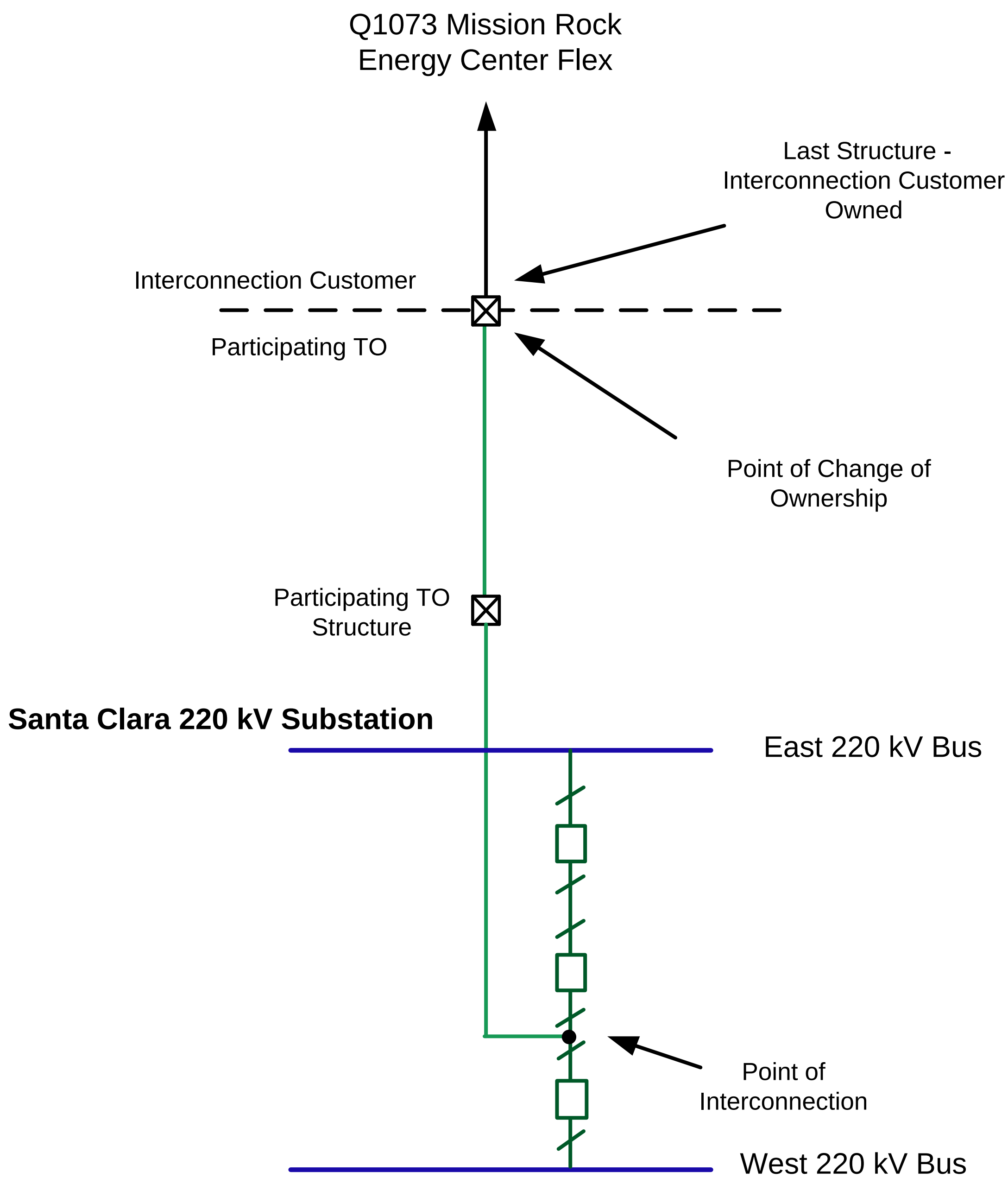
(b) **Telecommunication OPGW:** The Point of Change of Ownership shall be the point where the OPGW for the Q1073– Santa Clara 220kV Transmission Line is attached to the Last Structure.

(c) **Telecommunication diverse fiber optic cable:** The Point of Change of Ownership shall be the point at an Interconnection Customer installed and owned pole located at a position designated by the Participating TO outside the Participating TO's substation, or a Participating TO owned vault, where the Interconnection Customer's fiber optic cable is connected to the Participating TO's fiber optic cable.

6. **Point of Interconnection.** The Participating TO's Santa Clara 220kV Substation at the 220kV bus.

7. **One-Line Diagram of Interconnection to Santa Clara 220kV Substation.**

Interconnection Facilities, Network Upgrades and Distribution Upgrades



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.

QC7 Phase I Study Report Attachment #2

Application Queue Short Circuit Duty (SCD) Analysis Results - Project Allocations

Reliability Network Upgrades - SCD Mitigations

Project	Eldorado 500kV	
	%	Allocated Cost (x1000) 2014 Dollars
1073	5.94%	$491

Duration (months)	24

Total Constant Dollars (2014)	Total COD Escalted Duration
$491	24

Ground Grid Study Costs: $35

Distribution Upgrades - SCD Mitigations

Project	Barre 66kV		Johanna 66kV		Villa Park 66kV		Johanna 12kV		Santa Barbara 12kV	
	%	Allocated Cost (x1000) 2014 Dollars	%	Allocated Cost (x1000) 2014 Dollars	%	Allocated Cost (x1000) 2014 Dollars	%	Allocated Cost (x1000) 2014 Dollars	%	Allocated Cost (x1000) 2014 Dollars
1073	0.00	$33	0.00	$9	0.01	$5	0.00	$0	0.00	$0
Duration (months)	24		24		24		24		24	

Total Constant Dollars (2014)	Total COD Escalated Duration
$47	24

Ground Grid Study Costs: $105

Note: The estimated cost for the SCD Upgrades for the Metro areare highly conceptual and are subject to chage to circumstances out of SCE's control such as licensing and enviromal permitting requirements; which could potentially impact the costs allocation to the Project associated with this upgrade.

Attachment 3

Allocation of Network Upgrades for Cost Estimates

	NU Total Cost (2014 $k)	Project Allocation(%)	Allocated Cost (2014 $k)	Allocated Cost (Escalated $k)
LDNU				
Mesa – Laguna Bell 220kV No. 1 emergency rating increase (Goodrich-Mesa 220kV line)	$62	47.82%	$30	$34
One-time costs associated with Mesa - Laguna Bell line upgrade	$1,042	47.82%	$498	$570
LDNU Total			**$528**	**$604**
RNU				
Eldorado CB upgrade	$8,253	5.94%	$490	$561
Ground grid study to support SCD mitigation	$35	100.00%	$35	$41
Interconnection Plan of Service Network Upgrade	$3,026	100.00%	$3,026	$3,460
New Moorpark SPS: new SPS to trip Moorpark area generation	$2,881	47.69%	$1,374	$1,571
One-time costs associated with Project plan of service	$70	100.00%	$70	$81
New Moorpark SPS - RTU reprogram, SPS test	$173	100.00%	$173	$198
RNU Total			**$5,168**	**$5,912**
Grand Total			**$5,696**	**$6,516**

Attachment 4

Participating TO Interconnection Handbook

Preliminary Protection Requirements for Interconnection Facilities are outlined in the Participating TO Interconnection Handbook.

Please refer to separate document.

Attachment 5

Short Circuit Calculation Study Results

Please refer to the Appendix H of the Area Report.

Attachment 6

Customer Provided Project Dynamic Data

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

genrou 96601 "TOT722G" 16.50 "EQ" : #9 mva=276.0000 "tpdo" 9.8670 "tppdo" 0.0460 "tpqo" 1.0960 "tppqo" 0.0800 "h" 1.8300 "d" 0.0000 "ld" 2.1825 "lq" 2.1213 "lpd" 0.2812 "lpq" 0.4805 "lppd" 0.2187 "ll" 0.1857 "s1" 0.0640 "s12" 0.371 "ra" 0.00243 "rcomp" 0.0000 "xcomp" 0.0000 "accel" 0.5000

esst6b 96601 "TOT722G" 16.50 "EQ" : #9 "tr" 0.0120 "kpa" 22.1 "kia" 4.4 "vamax" 5.900 "vamin" -4.70 "kff" 1.0 "km" 1.0 "kg" 1.0 "tg" 0.020 "vrmax" 5.900 "vrmin" -4.70 "vmult" 0.0 "oelin" 0.0 "ilr" 3.740 "kcl" 1.0 "klr" 30.0 "ts" 0.0

ggov1 96601 "TOT722G" 16.50 "EQ" : #9 mwcap=235.0000 "r" 0.040000 "rselect" 1.000000 "tpelec" 0.1000 "maxerr" 0.050000 "minerr" -0.050000 "kpgov" 27.6000 "kigov" 7.7000 "kdgov" 0.0 "tdgov" 1.000000 "vmax" 1.000000 "vmin" 0.000000 "tact" 0.300000 "kturb" 1.2500 "wfnl" 0.196000 "tb" 0.590000 "tc" 0.0 "flag" 0.000000 "teng" 0.0 "tfload" 3.0000 "kpload" 2.0000 "kiload" 0.670000 "ldref" 10.00 "dm" 0.00 "ropen" 0.10000 "rclose" -0.10000 "kimw" 0.0 "pmwset" 0.0 "aset" 10.00000 "ka" 10.0000 "ta" 0.100000 "db" 0.000000 "tsa" 4.00000 "tsb" 5.00000 "rup" 99.0000 "rdown" -99.0000

pss2b 96601 "TOT722G" 16.50 "EQ" : #9 "j1" 1.0 "k1" 0.0 "j2" 3.0000 "k2" 0.0 "vsi1max" 0.500000 "vsi1min" -0.500 "tw1" 10.000 "tw2" 10.0 "vsi2max" 2.00000 "vsi2min" -2.0000 "tw3" 10.0 "tw4" 0.0 "t6" 0.0 "t7" 10.0 "ks2" 0.940000 "ks3" 1.000000 "t8" 0.600000 "t9" 0.12000 "n" 1.0000 "m" 5.000 "ks1" 20.000 "t1" 0.1400 "t2" 0.0140000 "t3" 0.140000 "t4" 0.014 "t10" 0.0 "t11" 0.0 "vstmax" 0.10 "vstmin" -0.10 "a" 1.0 "ta" 0 "tb" 0 "ks4" 1.0

genrou 29162 "MSSNRKFLX ST" 13.80 "1 " : #9 mva=100.0000 "tpdo" 8.298 "tppdo" 0.0470 "tpqo" 1.0000 "tppqo" 0.0400 "h" 6.04 "d" 0.0000 "ld" 1.7200 "lq" 1.63000 "lpd" 0.2230 "lpq" 0.3810 "lppd" 0.1490 "ll" 0.1190 "s1" 0.1110 "s12" 0.534 "ra" 0.00291 "rcomp" 0.0000 "xcomp" 0.0000 "accel" 0.5000

esac7b 29162 "MSSNRKFLX ST" 13.80 "1 " : #9 "tr" 0.00 "kpr" 33.3 "kir" 66.6 "kdr" 0.0 "tdr" 1.0 "vrmax" 15.750 "vrmin" -15.750 "kpa" 2.000 "kia" 10.0 "vamax" 35.3 "vamin" -28.2 "kp" 0.0 "kl" 10.0 "te" 0.95 "vfemax" 15.750 "vemin" 0.0 "ke" 1.0 "kc" 0.1 "kd" 1.780 "kf1" 0.0 "kf2" 1.0 "kf3" 0.0 "tf" 1.0 "e1" 14.80 "se1" 0.060 "e2" 12.900 "se2" 0.009 "spdmlt" 0.0

ieeeg1 29162 "MSSNRKFLX ST" 13.80 "1 " : #9 "k" 16.0 "t1" 4.5 "t2" 2.0 "t3" 0.939 "uo" 0.1 "uc" -0.1 "pmax" 0.81 "pmin" 0.0 "t4" 0.10 "k1" 0.530 "k2" 0.0 "t5" 0.11 "k3" 0.47 "k4" 0.0 "t6" 3.0 "k5" 0.0 "k6" 0.0 "t7" 0.0 "k7" 0.0 "k8" 0.0 "db1" 0.0 "eps" 0.0 "db2" 0.0 "gv1" 0.0 "pgv1" 0.0 "gv2" 0.0 "pgv2" 0.0 "gv3" 0.0 "pgv3" 0.0 "gv4" 0.0 "pgv4" 0.0 "gv5" 0.0 "pgv5" 0.0 "gv6" 0.0 "pgv6" 0.0

pss2b 29162 "MSSNRKFLX ST" 13.80 "1 " : #9 "j1" 1.0 "k1" 0.0 "j2" 3.0000 "k2" 0.0 "vsi1max" 0.50 "vsi1min" -0.50 "tw1" 10.000 "tw2" 10.0 "vsi2max" 2.000 "vsi2min" -2.00 "tw3" 10.0 "tw4" 0.0 "t6" 0.0 "t7" 10.0 "ks2" 2.120000 "ks3" 1.000000 "t8" 0.600000 "t9" 0.12000 "n" 1.0000 "m" 5.000 "ks1" 5.000 "t1" 0.2500 "t2" 0.0400000 "t3" 0.250000 "t4" 0.040 "t10" 0.18 "t11" 0.03 "vstmax" 0.10 "vstmin" -0.10 "a" 0.0 "ta" 0 "tb" 0 "ks4" 1.0

Attachment 7

SCE Northern Hemisphere Import Nomogram

Please refer to separate document.