[redacted]

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WDT440

WDAT
SYSTEM IMPACT STUDY

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SOUTHERN CALIFORNIA
EDISON
An *EDISON INTERNATIONAL*℠ Company

Prepared by:

Edgar Ramirez
Roger Salas, P.E.
Distribution Field Engineering

Approved by:

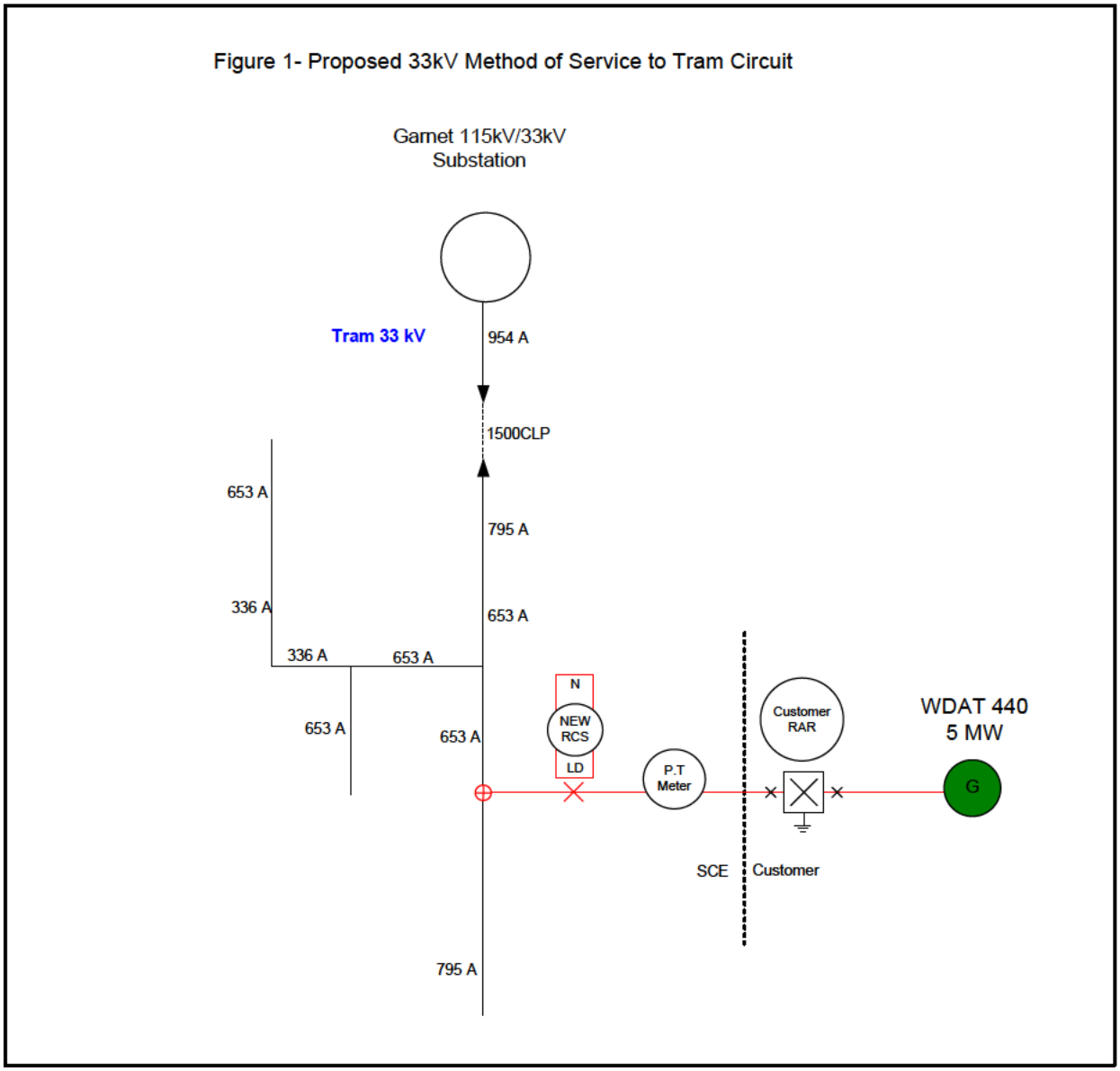
Randy R. Smith
Distribution Field Engineering Manager

SOUTHERN CALIFORNIA EDISON COMPANY

EXECUTIVE SUMMARY

[redacted] applied to Southern California Edison ("SCE") for interconnection and wholesale distribution service for its proposed Solar Project pursuant to SCE's Wholesale Distribution Access Tariff ("WDAT") Small Generator Interconnection Procedures. SCE performed a System Impact Study as requested by [redacted] for a 33kV interconnection and distribution service from an existing 33 kV distribution line ("Tram 33 kV"). The interconnection is to be located [redacted] from Garnet Substation on the Tram 33 kV circuit out of SCE's Garnet 115/33kV Substation. The request is for a WDAT photovoltaic ("PV") generation facility with a total capacity of 5 MW. The initial request is for service to commence by [redacted]

Figure 1- Proposed 33kV Method of Service to Tram Circuit



The new generation, consisting of photovoltaic panels, [redacted], will receive interconnection service from SCE's existing 33 kV circuitry on the Tram 33 kV out of Garnet Substation via an Over Head line extension to the applicant-owned Remote Automatic Re-Closer (RAR). The generated power would be delivered to the California Independent System Operator ("CAISO") grid at the 115 kV bus of SCE's Garnet Substation.

The purpose of this System Impact Study is to determine the effect of the proposed generation addition on the SCE distribution system and the portion of SCE's electrical system that is part of the CAISO controlled grid, and to identify in general additional Interconnection Facilities, Distribution Upgrades, additions or modifications, or other facilities required to provide the requested service. The study was performed in two parts: Part A (performed by SCE's Distribution Field Engineering department) examines impacts related to that part of the SCE distribution system energized at less than 115kV and also briefly summarizes the results of Part B, while Part B (performed by SCE's Generation Interconnection Planning department) examines impacts and facilities related to the portion of the SCE distribution system energized at 115 kV (the bulk power system), and impacts and facilities associated with the CAISO controlled portion of the SCE grid. This is the Part A study report; a detailed report of the Part B study results is included as Attachment B.

The Part A study was performed for expected year 2012 through 2020 projected peak load conditions as well as 2012 through 2020 minimum load conditions.

The Part A System Impact Study consisted of a power flow analysis, three-phase short circuit duty analysis and circuit voltage profile analysis. The analyses were performed to determine whether the energy associated with the [redacted] can be transmitted through SCE's distribution system to the ISO grid at the 115kV bus of Garnet Substation without creating the need for modifications to SCE's distribution system and/or to the ISO grid. The study showed that, with the [redacted] on-line:

- For both peak load and light load conditions, the addition of the 5 MW [redacted] resulted did not result in any violation of SCE's thermal loading criteria under both base case conditions for the SCE distribution system under peak loading and low loading conditions. However, a thermal overload is calculated under N-1 conditions. In the event of an N-1 condition, the [redacted] will be switched off if SCE deems it necessary.

- The addition of the 5 MW [redacted] resulted in no additional protection requirements.

- The addition of the 5 MW [redacted] resulted in minimal voltage rise not exceeding allowable Rule 2 limits.

- The addition of the 5 MW [redacted] resulted in the increase of three-phase short-circuit duties of 0.1kA or more at zero (0) distribution substation. The circuit breaker interrupting capabilities were reviewed at this substation and it was determined that zero (0) circuit breakers will be required to be upgraded. However, there are one (1) 4 kV breaker at Holiday 33/4 kV Substation and five (5) 4 kV breakers at Sunny Dunes

33/4 kV, which require replacement under a SCE project prior to energizing the [redacted]

- The power flow study results did not identify any impact on SCE bulk system serving the subtransmission system where the project is interconnected.

- In addition, the study identified that the inclusion of the project did not require any modification to existing Special Protection System (SPS).

- The Short Circuit Duty (SCD) analysis determined there is no impact on SCE's high-voltage bulk power system after inclusion of the project.

- Non-binding order of magnitude cost estimates for the required interconnection facilities and 33 kV system upgrades are as follows

Interconnection Facilities/Automation	$ 150 K[1]
o Remote Controlled Switch	
o 33 KV line extension	
o secondary wire	
o Pole Top Metering	
33 kV Distribution Upgrades	$ 135 K[1]
o Intercept-Structures	
Telemetry Requirements	$ 151 K[1]
o Remote Terminal Unit	
o Telecommunication System for RTU	
Total non-binding order of magnitude cost estimate	$ 436 K[1]

[1] Cost estimate includes 35% ITCC.
[2] Cost Estimate for telemetry may be reduced if alternative method of telemetry is found.

CONTENTS

I. INTRODUCTION TO PART A

[redacted] applied to Southern California Edison ("SCE") for interconnection and wholesale distribution service for its proposed Solar Project pursuant to SCE's Wholesale Distribution Access Tariff ("WDAT") Small Generator Interconnection Procedures. SCE performed a System Impact Study as requested by [redacted] for a 33kV interconnection and distribution service from an existing 33 kV distribution line ("Tram 33 kV"). The interconnection is an applicant owned ("RAR") Remote Automatic Re-closer, which will be located [redacted] from Garnet Substation on the Tram 33 kV circuit out of SCE's Garnet 115kV/33kV Substation. The request is for a WDAT photovoltaic ("PV") generation facility with a total capacity of 5 MW. The initial request is for service to commence by June, 06 2012.

The new generation, [redacted], would receive interconnection service from SCE's existing 33 kV circuitry on the Tram 33 kV out of Garnet Substation via an Over Head line extension to the interconnection facility. The generated power would be delivered to the California Independent System Operator ("CAISO") grid at the 115kV bus of SCE's Garnet Substation.

The purpose of this System Impact Study is to determine the impact of the proposed generation addition on the SCE distribution system and to identify in general additional Interconnection Facilities, Distribution Upgrades, additions or modifications, or other facilities required to provide the requested service. This study was performed for expected year 2012 through 2020 peak load conditions as well as low demand conditions

II. PART A: SYSTEM IMPACT STUDY CONDITIONS & METHODOLOGY

Planning Criteria

The thermal rating of any conductor, connector, or apparatus should not exceed 100% of its normal rated capacity with all facilities in service (base case).

The thermal rating of any conductor, connector, or apparatus should not exceed 100% of its emergency rating under N-1 conditions.

Operational flexibility and reliability of the distribution system shall be maintained at all times.

Circuit voltage profiles should be maintained to comply within CPUC's Rule 2 requirements.

System Conditions

The power factor for the new generation facility was assumed to be improved to within WDAT requirements of 0.95 lagging or leading, except as specifically enumerated herein

Expected loading on the distribution system as projected by the SCE 2012 – 2020 plan was used.

Distributed Generation resources connected to the distribution system are analyzed offline and online during peak load and minimum load conditions during the day as to determine worst case scenario.

Short circuit contribution from generation system provided by applicant includes contribution from inverter system.

III. PART A: SYSTEM IMPACT STUDY RESULTS

Short Circuit Analysis

Using the short circuit models from the inverter systems being utilized in this solar generation system it was calculated that the short circuit contribution at 33kV substation bus was less than 0.1kA thus a breaker analysis was not required due to this generation. However, there are one (1) 4 kV breaker at Holiday 33/4 kV Substation and five (5) 4 kV breakers at Sunny Dunes 33/4 kV, which require replacement under a SCE project prior to energizing the [redacted]

System Protection Considerations

With this proposed method of service, no changes to the protection system of the SCE electrical system are required.

Thermal Loading

The line section between the customer's facility and the 33 kV Point of Interconnection is expected to experience a reverse power flow of approximately 5 MW during minimum loading. Of that 5MW, approximately 4.7 MW will flow back into the 33 kV bus at Garnet 115/33 kV Substation during minimum loading. No thermal overloads are calculated due to this reverse power flow under base case. However, a thermal overload is calculated under N-1 conditions. In the event of an N-1 condition, the [redacted] will be switched off if SCE deems it necessary.

Distribution Voltage Control

The Tram 33kV is not expected to experience a voltage rise exceeding allowable Rule 2 requirements, from the controlled voltage at Garnet 33kV bus.

Harmonic impact

The harmonic impact of the subject inverter based generation was not studied, however, despite the relatively low THD (<3%) of the equipment, impacts on voltage distortion levels are believed to be possibly significant due to the high penetration level of the generation facility with respect to the local distribution grid strength. As with all equipment connected to the SCE distribution system, the installation will be subject to the provisions of Rule 2.E, allowing SCE to require customer mitigation of interference with SCE service, including harmonic impacts, if interference occurs. The provided THD values are for individual inverters and not for the total generation requested. In order to better establish whether mitigation will be required in this case, a harmonic impact study may be require to be provided to SCE by the Interconnection Customer. Interconnection Customer shall commission such a study, discuss study structure with SCE prior to commencing study, and provide results to SCE with adequate lead time for SCE to direct any needed mitigation prior to detailed project design and construction.

IV. PART A: GENERAL DESCRIPTION OF IDENTIFIED UPGRADES

Distribution Upgrades

Distribution upgrades are required. Distribution upgrades include the installation of intercept-structures on the mainline system to tap off to the customer's solar site. The cost estimate for the required distribution upgrades is $ 135 K

Interconnection Facilities

Electrical Systems

Interconnection facilities include the installation of a new overhead Remote Controlled Switch, Pole Top Metering, a 33kV line extension of approximately 300' over-head between existing 33kV line and applicant's RAR, metering CTs, meters, and associated wiring. The cost estimate for the required interconnection facilities is $150 K.

Telemetry requirements

Real-time telemetry will be required. In order to provide the adequate telemetry requirements, a RTU and Telecom will be required. The cost estimate required by PSC and Telecom is $151.0 K. This cost estimate assumes that the local phone company will be able to provide a T1 line to the project location. If local phone company cannot provide a T1 line, then the cost estimate may increase significantly. Applicant should be aware of the monthly service fees for the leasing of the T1 line.

Alternative method of telemetry can discussed during the results meeting to determine if the applicant can propose an alternate method of telemetry that will acceptable to SCE. If the alternate method of telemetry is accepted, then this cost may significantly be reduced.

Customer Equipment

The interface protection will be provided by the applicant and will include a 33 kV overhead Remote Automatic Re-closer. The pole-head configuration will be reviewed and approved by SCE Field Engineering. The applicant's protection must be coordinated with SCE's System circuit breaker controls to provide adequate protection for the distribution system. The relay settings are subject to SCE approval prior to setting and certified timed trip testing report results using primary injection will need to be provided to SCE to verify relay and circuit breaker performance prior to energizing the service.

Applicant generation interconnection equipment must comply with SCE's Interconnection Handbook in regards to generation protection and lockable, visible open disconnecting means at the point of interconnection.

Additionally, the applicant will be responsible for the installation and costs of certain underground facilities (i.e., ducts, structures, etc.) to the extent required by the final design. The construction of the underground facilities will be as per SCE's project drawings.

System Study

A Facilities Study will be performed to conclusively determine the detailed scope and cost of facilities required to interconnect the project.

V. NON-BINDING ORDER OF MAGNITUDE COST ESTIMATE

- Non-binding order of magnitude cost estimates for the required interconnection facilities and 33 kV system upgrades are as follows

Interconnection Facilities/Automation	$ 135 K[2]
o Remote Controlled Switch	
o 33 KV line extension	
o Secondary wires	
o Pole Top Metering	
33 kV Distribution Upgrades	$ 150 K[2]
o Intercept-Structures	
Telemetry Requirements	$ 151 K[2]
o Remote Terminal Unit	
o Telecommunication System for RTU	
Total non-binding order of magnitude cost estimate	$ 436 K[2]

[2] Cost estimate includes 35% ITCC.

[3] Cost Estimate for telemetry may be reduced if alternative method of telemetry is found.

VI. PART A: SUMMARY

The Part A System Impact Study showed:

1. Distribution Upgrades will be required. Distribution upgrades include the installation of intercept-structures on mainline system to tap off to the customer's solar site.

2. Interconnection facilities include the installation of a new overhead Remote Controlled Switch, Pole Top Metering, a 33kV line extension of approximately 300' OH between existing 33kV line and applicant's RAR, metering CTs, meters, and associated wiring.

3. Real time telemetry will be required.

4. Non-binding order of magnitude cost estimates for the required interconnection facilities and 33 kV system upgrades are as follows

Interconnection Facilities/Automation	$ 135 K[3]
o Remote Controlled Switch	
o 33 KV line extension	
o Secondary wires	
o Pole Top Metering	
33 kV Distribution Upgrades	$ 150 K[3]
o Intercept-Structures	
Telemetry Requirements	$ 151 K[3]
o Remote Terminal Unit	
o Telecommunication System for RTU	
Total non-binding order of magnitude cost estimate	$ 436 K[3]

5. The preliminary, non-binding estimated time to complete the construction of the required interconnection facilities and distribution upgrades is 6-9 months after executing a Small Generator Interconnection Agreement ("SGIA") and associated Distribution Service Agreement.

6. Upgrades identified are general and preliminary descriptions only. The costs indicated are non-binding order of magnitude only. The schedule is projected and preliminary.

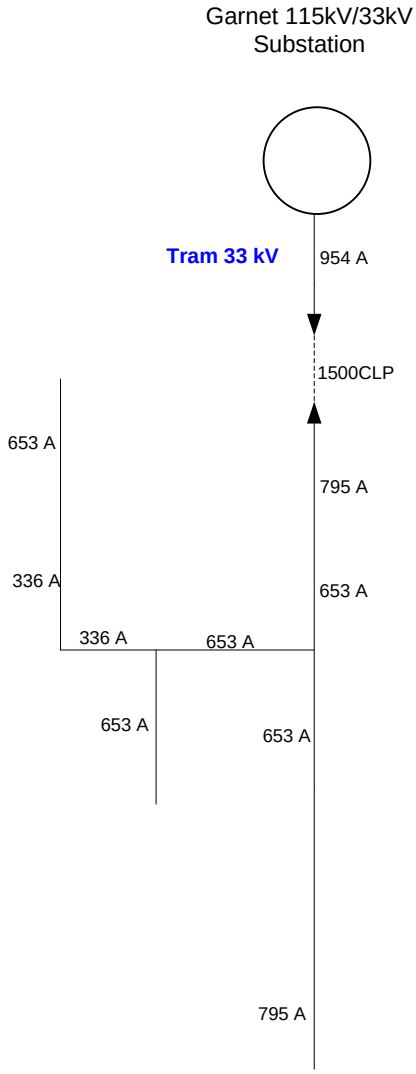
[3] Cost estimate includes 35% ITCC.
[4] Cost Estimate for telemetry may be reduced if alternative method of telemetry is found.

7. A Facility Study detailing required scope and cost of the identified upgrades is required to proceed with the project.

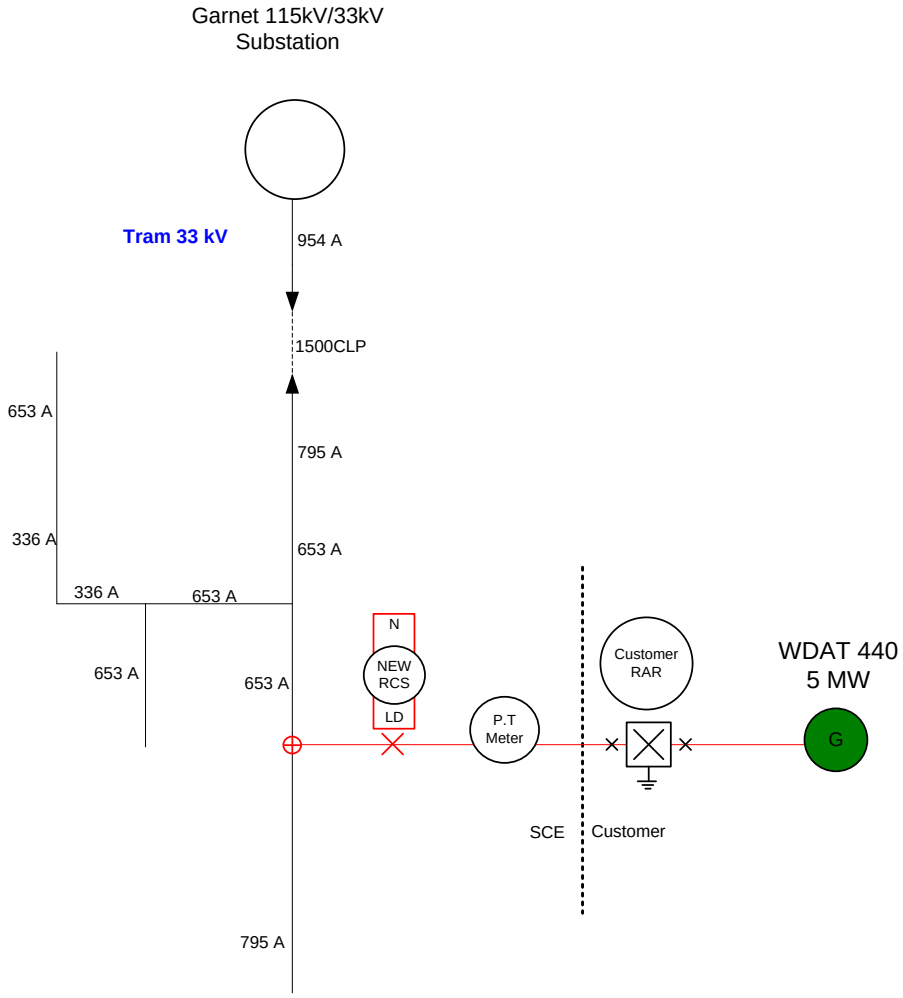
8. This System Impact Study is based on various technical data previously provided by the applicant. If any of that information changes significantly, as determined by SCE, the results of this study may no longer be appropriate and may necessitate a new study.

9. Current distribution standards are being updated to address generation interconnection systems. The proposed method of service on this report may change according on final design to comply with the updated distribution design standards.

A2 – System without Proposed Method of Service



A2 – System without Proposed Method of Service



ATTACHMENT B – BULK POWER SYSTEM IMPACT STUDY REPORT

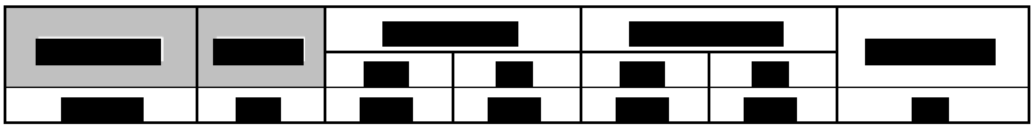
CAISO Controlled Bulk System Impact

Short Circuit Duty (SCD)

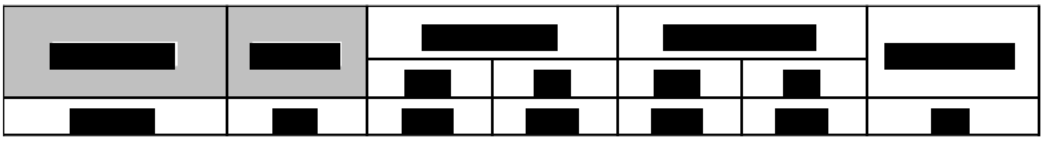
SCD Results

The short circuit duty analysis used the latest short circuit duty case available at this time regarding all active TC Phase II, Queue Cluster #1 Phase 1, Queue Cluster #2 Phase 1, and higher queued SGIP projects in the area. Changes in the status of higher queued projects may change the short circuit duty study results for the Project. The results of the SCD analysis are shown in the tables below.

3PH SCD impacts of Project
(based on available data of higher queued projects)



SLG SCD impacts of Project
(based on available data of higher queued projects)



The results of the SCD analysis identified that the duty at Devers and Garnet was increased by at least 0.1 kA. Such duty increase indicates that the SCD impact of the Project is not negligible.

SCD Mitigation Measures:

The results of the SCD analysis identified that the duty at Devers and Garnet was increased by at least 0.1 kA. At this time the SCD impacts associated with the addition of the Project appear to already be mitigated by upgrades triggered by higher queued projects and are in progress. Therefore, the SCD analysis determined that with that no impact on SCE's high-voltage bulk power system after inclusion of the project.

Power Flow

Power Flow Study Results

The power flow study analysis focused on identifying system thermal overload problems within SCE bulk system. The power flow study results did not identify any impact on SCE bulk system serving the sub-transmission system where the project is interconnected. In addition, the study identified that the inclusion of the project did not require any modification to existing Special Protection System (SPS).