[redacted]

SYSTEM IMPACT STUDY

September 2, 2005

SOUTHERN CALIFORNIA
EDISON®
An *EDISON INTERNATIONAL®* Company

Prepared by
Daniel H. Bustamante

Southern California Edison Company

(original signed by Patricia Arons)
Approved by Patricia Arons

CONFIDENTIAL: CRITICAL ENERGY
INFRASTRUCTURE INFORMATION

EXECUTIVE SUMMARY

INTRODUCTION

[redacted] requested Southern California Edison Company (SCE) to perform a System Impact Study for a new [redacted] project, an 80 MW wind generating facility interconnected to SCE's Victor-Black Mountain-Soport-Southcap-Southdown 115-kV line. The System Impact Study was performed to determine the adequacy of SCE's transmission system to accommodate the proposed installation of 80 MW.

The study accuracy and the results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by the customer. Any changes from the customer's data could void the study results.

Since all generation north of Lugo substation is part of the Southern California Import Transmission (SCIT) flow, the [redacted] may be required to schedule generation according to the SCIT nomogram.

The System Impact Study results indicate that the system is not adequate to accommodate the additional 80 MW of generation without modifications. A Facilities Study is required for the [redacted] Project.

LOAD FLOW STUDY RESULTS

The power flow study results show that the [redacted] Project contributes to overloads for base case, N-1, and N-2 contingencies.

Base Case

The [redacted] Project contributes to a pre-project overload on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer. Previously proposed facility upgrades, which were proposed to mitigate these base case overloads that were caused by a project ahead in queue, will also mitigate the contribution to the overloads from the [redacted] Project. The [redacted] Project also increases system losses by 8 MW in spring conditions and 6 MW in summer conditions.

Single Contingencies

The [redacted] Project causes an overload on the Inyo 115-kV Phase Shifter for the loss of Kramer-Inyokern 115-kV line. This overload may be mitigated by a post-contingency operating procedure, or a Special Protection Scheme to trip the [redacted] Project if an operating procedure is found to be not feasible.

The [redacted] Project contributed significantly to pre-project overloads on the Lugo-Victor 230-kV lines, the Kramer-Lugo 230-kV lines, and the Lugo 500/230-kV transformer banks for various N-1 contingencies. The [redacted] Project will be required to participate in existing Special Protection Schemes north of Lugo substation to mitigate these overloads.

The [redacted] Project also contributes to N-1 overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer, but the contribution is found to be negligible.

Double Contingencies

The [redacted] Project contributed significantly to pre-project overloads on the Lugo-Victor 230-kV lines, the Kramer-Lugo 230-kV lines, and the Kramer 230/115-kV transformer banks for the following N-2 contingencies: N-2 of both Kramer-Lugo 230-kV lines, and N-2 of both Lugo-Victor 230-kV lines. The [redacted] Project will be required to participate in existing Special Protection Schemes north of Lugo substation to mitigate these overloads.

The [redacted] Project also contributes to N-2 overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer. Previously proposed facility upgrades for projects ahead of the [redacted] Project in queue will mitigate for these N-2 overloads.

Sensitivity: Owens Gorge Generation

The [redacted] Project contributes to overloads on the Inyo 115-kV phase shifter when Owens Gorge Generation is offline. During spring conditions, overloading the phase shifter will initiate restricted operation of the [redacted] Project when Owens Gorge is not running. During summer conditions, the [redacted] Project will be required to participate in generation curtailments per approved curtailment procedure for these conditions.

Power Factor Correction Requirements

Studies show that without adequate power factor correction, the [redacted] Project decreases the voltage at Black Mountain 115-kV bus by as much as 4.5%. Power factor correction will be required for the [redacted] Project; the determination of the MVARs needed to maintain a .95 buck to .95 boost power factor at the point of interconnection will be determined in the Facilities Study.

POST TRANSIENT STUDY RESULTS

The post transient study did not find significant impacts of the [redacted] Project to the post transient voltage profile of the system.

TRANSIENT STABILITY STUDY RESULTS

The study did not find significant impacts of the [redacted] Project to the transient stability of the system.

Equipping the wind turbines with the optional 0.3 per-unit under voltage ride-through capability resolves the [redacted] Project sympathetic generation tripping for all three-phase-to-ground bus faults. The [redacted] Project would be required to provide 0.3 per-unit under-voltage ride-through capability to satisfy the WECC Voltage Ride-Through requirements.

FACILITIES STUDY

A Facilities Study is required for the [redacted] Project. The scope of the Facilities Study will need to include the following:

1. Evaluate the feasibility and cost of installing a Special Protection Scheme to trip the [redacted] Project for the following contingencies in the North of Lugo 230-kV corridor to protect against overloads and instability:

   N-1 of a Lugo-Victor 230-kV line (overload)
   N-1 of a Lugo 500/230-kV transformer bank (overload)
   N-1 of a Kramer-Lugo 230-kV line (overload)
   N-2 of both Lugo-Victor 230-kV lines (overload)
   N-2 of both Kramer-Lugo 230-kV lines (overload)
   N-2 of both Lugo 500/230-kV transformer banks (post-transient voltage stability)

2. Evaluate the feasibility and cost of installing a Special Protection Scheme to trip the [redacted] Project for the N-1 of the Inyokern-Kramer 115-kV line to mitigate an overload on the Inyo 115-kV phase shifter.

3. Determine the amount of reactive support needed to maintain a .95 buck to .95 power factor at the point of interconnection at Daggett 115-kV bus.

4. Conduct a power quality investigation to evaluate any adverse effects of the [redacted] Project on the quality of the voltage at sensitive large customer substations, namely Black Mountain and Southdown. Determine what additional facility upgrades, beyond the facility upgrades needed to meet SCE's power factor requirement, that would be necessary to ensure that the industrial processes at these facilities are not interrupted or adversely impacted by the addition of the [redacted] Project.

CONTENTS

SOUTHERN CALIFORNIA EDISON COMPANY
[redacted] PROJECT
SYSTEM IMPACT STUDY

September 2, 2005

INTRODUCTION

[redacted] requested Southern California Edison Company (SCE) to perform a System Impact Study for a new [redacted] an 80 MW wind generating facility interconnected via tap to SCE's Victor-Black Mountain-Soport-Southcap-Southdown 115-kV line. The System Impact Study was performed to determine the adequacy of SCE's transmission system to accommodate the proposed installation of 80 MW. The in-service date proposed by [redacted] is October 1, 2006.

The results of the System Impact Study will be used as the basis to determine project cost allocation for facility upgrades in the Facilities Study. ***The study accuracy and the results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by the customer.*** Any changes from the customer's data could void the study results.

The System Impact Study indicates that the system cannot accommodate the 80 MW of generation without modifications. A Facilities Study will be required for the [redacted] New facilities or upgrades are required to maintain system reliability in accordance with the California Independent System Operator's (CAISO) Reliability Criteria to accommodate this project.

The study was performed for two system conditions. These conditions reflect the most critical expected loading conditions for the transmission system north of Lugo substation:

- 2006 heavy summer load forecast (one-in-ten-year heat wave assumption) with maximum generation north of Lugo substation.

- 2006 spring load forecast with maximum generation north of Lugo substation. (For SCE's bulk power system, spring loads were assumed at 65% of 2006 summer peak load. Specifically for the transmission system north of Lugo substation, minimum spring loads were assumed at 50% of 2006 summer peak load.)

STUDY CONDITIONS AND ASSUMPTIONS

A. Planning Criteria

The supplemental study was conducted by applying the California Independent System Operator (CAISO) Reliability Criteria. More specifically, the main criteria applicable to this study are as follows:

Power Flow Assessment

The following contingencies are considered for transmission and subtransmission lines and 500/230 kV transformer banks ("AA-Banks"):

- Single Contingencies (loss of one line or one AA-Bank)
- Double Contingencies (loss of two lines or one line and one AA-Bank)
  (Outages of two AA-Banks are beyond the Planning Criteria)

The following criteria are used:

Transmission Lines	Base Case	Limiting Component Normal Rating
	N-1	Limiting Component A-Rating
	N-2	Limiting Component B-Rating
AA-Banks	Base Case	Normal Loading Rating
	Long Term & Short Term	As defined by SCE Operation Bulletin

System upgrades or Special Protection Schemes for transmission lines are generally recommended only for base case overloads, single contingency overloads in excess of the A-rating, and common mode failure double contingencies in excess of the B-rating.

Congestion Assessment

The following principles were used in determining whether congestion management, special protection schemes, or facility upgrades are required to mitigate base case, single contingency, or double contingency overloads:

- Congestion management, as a means to mitigate base case overloads, can be used if it is determined to be manageable and the CAISO concurs with the implementation.

- Facility upgrades will be required if it is determined that the use of congestion management is unmanageable as defined in the congestion management section that follows.

- Special protection schemes (SPS), in lieu of facility upgrades, will be recommended if the scheme is effective, does not jeopardize system integrity, does not exceed the current CAISO single and double contingency tripping limitations, does not adversely effect existing or proposed special protection schemes in the area, and can be readily implemented.

- Facility upgrades will be required if use of protection schemes is determined to be ineffective, the amount of tripping exceeds the current CAISO single and double contingency tripping limitations, adverse impacts are identified on existing or currently proposed special protection schemes, or the scheme cannot be readily implemented.

- Congestion management in preparation for the next contingency will be required, with CAISO concurrence, if no facility upgrades or special protection schemes are implemented.

The following study method was implemented to assess the extent of possible congestion:

a) Under Base Case with all transmission facilities in service, the system was evaluated with all existing interconnected generation and all generation requests in the area that have a queue position ahead of this request (pre-project).

b) Under Base Case with all transmission facilities in service, the system was reevaluated with the inclusion of the [redacted] (post-project).

If the normal loading limits of facilities are exceeded in (a), the overload is identified as an existing overload that was triggered by a project in queue ahead of the [redacted] Project. If the normal loading limits of facilities are exceeded in (b) and were not exceeded in (a), the overload is identified as triggered by the addition of the [redacted] Project. The [redacted] Project, assuming it is a market participant, and other market participants in the area may be subjected to congestion management, potential upgrade cost and/or participation of any proposed special protection scheme if the project addition aggravates or triggers the overload. Additionally, the [redacted] Project may have to participate in mitigation of overloads triggered by subsequent projects in queue, subject to FERC protocols and policies.

In order for congestion management to be a feasible alternative to system facilities, all of the following factors need to be satisfied:

- Time requirements for necessary coordination and communication between the CAISO operators, scheduling operators and SCE operators.

- Distinct Path/Corridor rating should be well defined so monitoring and detecting congestion and implementing congestion of the contributing generation resources can be performed when limits are exceeded.

- Sufficient amount of market generation in either side of the congested path/corridor should be available to eliminate market power.

- Manageable generation in the affected area is necessary so that operators can implement congestion management if required (i.e. the dispatch schedule is known and controllable).

The results of these studies should identify:

a. if capacity is available to accommodate the proposed [redacted] Project and all projects ahead in queue without the need for congestion management, special protection schemes, or facility upgrades

b. if overloads exist in the area after the addition of all projects in queue ahead of the [redacted] Project and all facilities in service

c. if congestion exists in the area with the addition of the [redacted] Project and all projects ahead in queue under single and double element outage conditions assuming no new special protection schemes are in place

d. if sufficient capacity is maintained to accommodate all Must-Run and Regulatory Must-Take generation resources with all facilities in service

e. if sufficient capacity is maintained to accommodate the total output of any one generation resource which is not classified as Must-Run.

B. [redacted] Wind Project

The proposed [redacted] Project is geographically located approximately 6 miles southwest of SCE's Gale Substation in San Bernardino County. The Project is proposed to be radially connected to the Victor-Black Mountain-Soport-Southcap-Southdown 115-kV line on a normally open circuit tie between Black Mountain and Gale Substations. To connect to this line, a new 115-kV pole switch will have to be installed just west of Gale substation, which would operate normally open. The existing 115-kV pole switch near Black Mountain substation will be changed from normally open to normally closed. A map showing the location of the proposed project is shown in Appendix C.

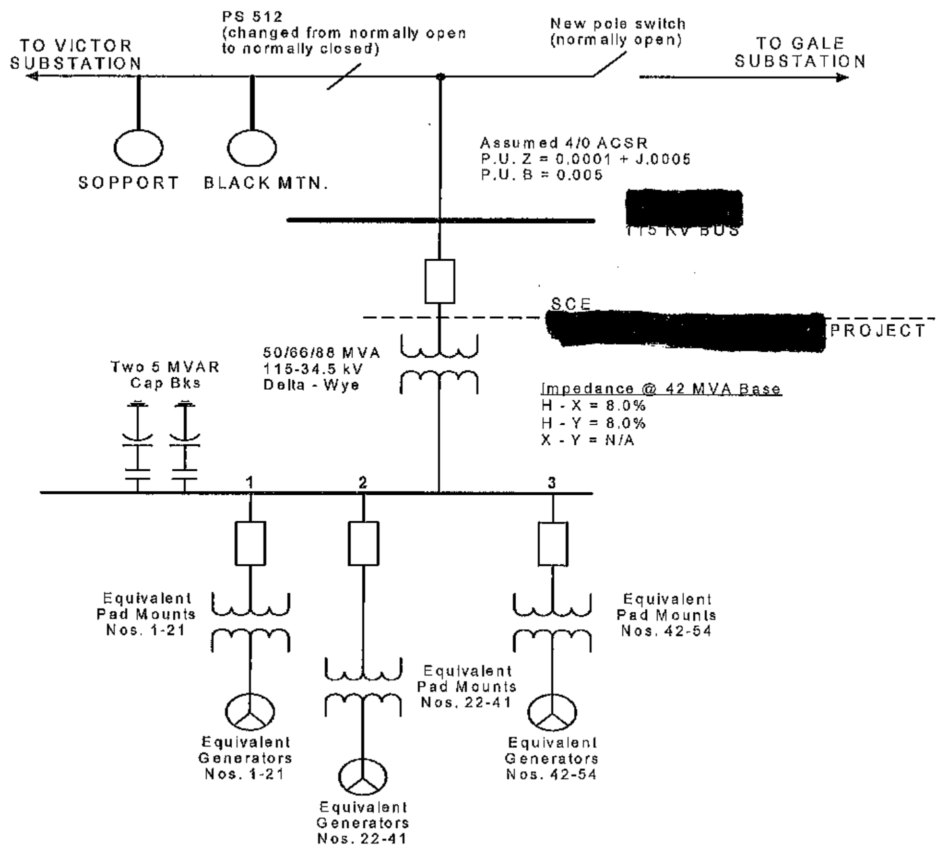
With the interconnection application submitted, [redacted] did not provide detailed information about the exact construction of the proposed 115-kV line to be connected from the 115-kV tap point to the [redacted] Project. Based on the geographic map submitted by [redacted] the length of the 115-kV line is assumed to be less than 300 ft and its impedance is considered to be a negligible value compared to the impedance of the 115-kV line from the tap point to Victor substation. A one-line diagram of the project is provided in Figure 1 below.

The generators, the generator step-up transformers, and the 34.5 kV feeder circuits were modeled using equivalents based on the information provided by [redacted] The 34.5-kV feeders were modeled as follows:

Distribution Feeder Electrical Parameters

Circuit No.	Feeder Length (feet)	No. Turbines	Positive Sequence Impedance (per-unit)	Line Charging (B)
1	13,000	21	0.02671 + j0.03548	0.00392
2	5,000	20	0.01027 + j0.01365	0.00131
3	1,000	13	0.00206 + j0.00273	0.00026

FIGURE 1
[redacted] PROJECT
SINGLE LINE DIAGRAM



C. System Conditions

To simulate the SCE transmission system for analysis, the study selected the databases that were used to conduct the CAISO Controlled Transmission 2002-2006 Assessment.

The bulk power study considered scenarios that evaluated maximum generation from Qualified Facilities north of Lugo substation. These conditions were evaluated to identify worst scenarios that would stress SCE's transmission system network in the vicinity of Lugo substation. In addition, the study considered two system load conditions: 2006 heavy summer and 2006 light spring. The summer peak load forecast was based on the SCE's 2002 Transmission Substation Transformer Capacity Assessment, and reflects a one-in-ten-year heat wave assumption. The spring load forecast assumed 65% of the heavy summer load forecast. For the system north of Lugo substation, 50% of the heavy summer peak load was used to model light spring load conditions.

D. Power Flow Study

Load flow studies were conducted under 2006 heavy summer and 2006 spring load conditions with and without th[redacted]project for a total of 4 cases. Further description of the case assumptions follows:

a). 2006 Heavy Summer:

- Case 1 **without** the[redacted]project 80 MW addition.
- Case 2 **with** the [redacted]project 80 MW addition.

2006 heavy summer load with maximum generation in SCE's electrical system north of Lugo substation. Generation included: all market and all regulatory must-take units ahead of the proposed project increase. Generation patterns were maximized in the area north of Lugo substation to fully stress the Lugo AA-Banks in order to identify extent of potential congestion on the bulk power system with the 80 MW addition from the[redacted]project.

b). 2006 Spring:

- Case 3 **without** the[redacted]project 80 MW addition.
- Case 4 **with** the [redacted]project 80 MW addition.

2006 spring load (65% of summer peak for the total system and minimum load of 50% of summer peak load for the system north of Lugo substation) with maximum generation in SCE's electrical system north of Lugo substation. Generation included: all market and all regulatory must-take units ahead of the proposed project increase. Generation patterns were maximized in the area north of Lugo substation to fully stress the Lugo AA-Banks in order to identify extent of potential congestion on the bulk power system with the 80 MW addition from the[redacted]project.

With the addition of the[redacted]Project, SCE area total generation, imports, loads, and losses for cases 1-4 are summarized in the table below. For each of the four cases, load flow simulations of the bulk power system were conducted for the base case, single contingencies and double contingencies for lines and 500/230-kV transformer banks to determine impacts to the SCE system. All single and double contingencies were simulated without implementation of applicable existing SPS.

SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW)				
	2006 Spring		2006 Summer	
	Case 1 (without project)	Case 2 (with project)	Case 3 (without project)	Case 4 (with project)
Generation	9,721	9,729	17,206	17,212
Import	4,488	4,488	4,533	4,533
Load	13,845	13,845	21,226	21,226
Losses	364	372	513	519

Simulations

For each of the four cases, load flow simulations of the bulk power system were conducted for the base case, single contingencies and double contingencies for lines and 500-230 kV transformer banks to determine impacts to the SCE system. A total of 269 single and 301 double contingencies were studied with system performance monitored for criteria violations on the SCE 500-kV, 230-kV, and 115-kV systems. Existing SPS and potential mitigation options for projects ahead of the [redacted] 80 MW installation were considered out-of-service to identify the incremental increase in line and transformer loading that are due to the [redacted] project 80 MW installation.

To identify new facilities, facility upgrades, manual curtailment procedures, generator ramping schemes, special protection schemes, the study assumed that all projects with interconnection applications preceding the [redacted] project are in-service; however, potential system enhancements or modifications resulting from such projects, if any, are not assumed. The pre-project and post-project conditions identified, indicate whether [redacted] project triggered the need for upgrades or a project preceding the [redacted] project triggered the need for upgrades.

Sensitivity Study for Inyo Phase Shifter

A sensitivity study was conducted to determine the impact of the [redacted] project 80 MW installation on the SCE-LADWP Inyo tie phase shifter under normal and contingency conditions when Owens Gorge generating units in LADWP's service area are out of service. The same 2006 heavy summer and 2006 light spring cases were used for this sensitivity study with the exception that the Owens Gorge units in LADWP's service area were considered to be out of service.

Power Factor Correction Requirements

A load flow study was performed to determine the need for power faction correction to achieve a minimum of .95 buck power factor at the point of interconnection a[redacted] 115-kV bus. A .95 buck power factor was assumed at the generators, with the two 5-MVAR capacitors at the 34.5 kV bus. Reactive sources, if needed, were then added at [redacted] 115-kV bus to determine the amount of reactive support needed to achieve the minimum .95 buck power factor at the point of interconnection at [redacted] 115-kV bus. Voltages were also monitored at Black Mountain 115-kV customer substation to ensure that adequate voltage was maintained.

E. Post Transient Voltage Study

Those contingencies that show significant voltage deviations in the power flow analysis are selected for further analysis using governor power flow analysis. The voltage deviations are compared to the SCE guidelines of 7% for single contingency outages and 10% for double contingency outages.

F. Transient Stability Study

WECC currently is in the process of adopting Generator Electrical Grid Fault Ride Through Capability Criteria. SCE currently supports a Low Voltage Ride-Through Criteria to ensure continued reliable service. A proposed Criteria that SCE supports, is as follows:

1. Generator is to remain in-service during system faults (three phase faults with normal clearing and single-line-to-ground with delayed clearing) unless clearing the fault effectively disconnects the generator from the system.

2. During the transient period, generator is required to remain in-service for the low voltage and frequency excursions specified in WECC Table W-1 as applied to load bus constraint. These performance criteria are applied to the generator interconnection point, not the generator terminals.

3. Generators may be tripped after the fault period if this action is intended as part of a special protection scheme.

4. This Standard will not apply to individual units or to a site where the sum of the installed capabilities of all machines is less than 10MVA, unless it can be proven that reliability concerns exist.

5. The performance criteria of this Standard may be satisfied with performance of the generators or by installing equipment to satisfy the performance criteria.

6. The performance criterion of this Standard applies to any generation independent of the interconnected voltage level.

7. No exemption from this Standard will be given because of minor impact to the interconnected system.

8. Existing generators that go through any refurbishments or any replacements are then required to meet this Standard.

Table W-1
WECC DISTURBANCE-PERFORMANCE TABLE
OF ALLOWABLE EFFECTS ON OTHER SYSTEMS

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (Outage/Year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post-Transient Voltage Deviation Standard (See Note 2)
A				
B				
C				
D				

Note 2: As a
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G. Short Circuit Duty Study

No Short Circuit Duty (SCD) analysis was performed as part of this study on the assumption that the SCD contribution of the [redacted] Project is negligible.

POWER FLOW STUDY RESULTS

A. Spring Results

The power flow study identified base case, N-1, and N-2 overloads in the 2006 spring case. All percentages in the following results are expressed as percent loading of nominal value unless stated otherwise.

The [redacted] project increase may be subjected to congestion management, participation in operating procedures and/or installation of a Special Protection Scheme (SPS) if the incremental increase aggravates the overloads identified. Additionally, the [redacted] project increase may be required to participate in the mitigation of overloads triggered by subsequent projects in queue, subject to FERC protocols and policies, e.g. future congestion management.

BASE CASE

For spring conditions, the [redacted] project contributes to two existing base case overloads.

With the addition of the [redacted] Project, the loading of the Eldorado 230/115-kV transformer bank no.1 increases from 110% to 111%. This transformer has a normal rating of 102 MVA. The overload was triggered by another project ahead in the queue, and the recommended facility upgrade was to install a new 230/115-kV 280 MVA transformer bank to replace the 102 MVA transformer. This facility upgrade will also mitigate the contribution of the [redacted] Project to this overload.

With the addition of [redacted] Project, the loading of the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line increases from 136% to 137%. The portion of this line that is overloaded is the 4/0 ACSR conductor located between Eldorado and Mountain Pass tap; this segment of line is rated for 415 Amps normal, 530 Amps emergency rating. This overload was triggered by another project ahead in the queue, and the recommended facility upgrade was to upgrade this section of the line to 605 ACSR. This facility upgrade will also mitigate the contribution of the [redacted] Project to this overload.

The [redacted] Project also increases system losses by 8 MW in spring conditions.

SINGLE CONTINGENCIES

With the addition of the [redacted] Project, the power flow study identified three transmission lines and three transformers with N-1 overloads during spring conditions. See Appendix A for detailed results.

Lugo-Victor 230 kV Line

The 80 MW installation of the [redacted] project contributed to an existing overload of a Lugo-Victor 230 kV line for the loss of the remaining Lugo-Victor 230-kV line (both lines are alike in impedance and rating). The loading increased from 2089 Amps (168% of 1240 Amps normal rating) pre-project to 2235 Amps (180% of 1240 Amps normal rating) post-project. Each Lugo-Victor 230-kV line has a long term emergency rating of 1431 Amps. The installation of an SPS to trip all 80 MW of th[redacted]Project for this outage will mitigate the contribution of the [redacted]roject to this overload.

Lugo 500/230 kV Transformer Banks

The 80 MW addition of the [redacted] project increased the loading of the Lugo 500/230kV transformer from 1904 MVA (170% of 1120 MVA normal rating) to 1971 MVA (176% of 1120 MVA normal rating) under the outage of the other Lugo 500/230kV transformer (both transformer banks are identical). Each 500/230kV transformer bank at Lugo substation has emergency loading capabilities of 1230 MVA (long-term) and 1680 MVA[redacted] The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of th[redacted] Project to this overload.

Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line

There are [redacted] N-1 contingencies identified in which the 80 MW installation of the [redacted] project contributes to the loading of the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line. These post-project loadings range from 132% to 157%. The details are shown in Appendix A. The portion of this line that is overloaded is the 4/0 ACSR conductor located between Eldorado and Mountain Pass tap; this segment of line is rated for [redacted]s normal, [redacted] emergency rating. Upgrading the overloaded portion of this line to 605 ACSR will relieve all N-1 overloads identified. The contribution of the [redacted] project to the loading of this line is considered insignificant for spring N-1 conditions.

Inyo 115-kV Phase Shifter

The 80 MW addition of the [redacted] project causes an N-1 overload of the Inyo 115-kV phase shifter from [redacted] to [redacted] under the outage of the Inyokern-Kramer 115kV line. The Inyo phase shifter has an emergency loading capability o[redacted] for long-term and [redacted] for one hour. The installation of an SPS to trip al[redacted]f th[redacted] Project for this outage will mitigate the contribution of the [redacted]roject to this overload.

Kramer-Lugo 230 kV lines

The 80 MW installation of the [redacted] project increased the loading of a Kramer-Lugo 230 kV line from 2073 Amps (167% of 1240 Amps normal rating) to 2100 Amps (169% of 1240 Amps normal rating) under the outage of the other Kramer-Lugo 230 kV line (both lines are identical). Each Kramer-Lugo 230-kV line has a long term emergency rating of 1431 Amps. The installation of an SPS to trip all 80 MW of the [redacted]Project for this outage will mitigate the contribution of the [redacted] Project to this overload.

Eldorado 230/115 kV Transformer

The [redacted] project significantly contributes to the overload of the Eldorado 230/115 kV transformer fo[redacted] N-1 conditions. The loadings on the transformer range from 109% to 129%. Replacing this transformer bank with a new 280 MVA transformer will mitigate all overloads for N-1 conditions. The contribution of the [redacted] project to the loading of this transformer is considered insignificant for spring N-1 conditions.

DOUBLE CONTINGENCIES

With the addition of the [redacted] Project, the power flow study identified [redacted] transmission lines and [redacted] transformer in which the project contributed significantly to N-2 overloads found during spring conditions. [redacted] N-2 contingencies did not converge in the load flow study: Lugo-Victor 230 kV N-2, Kramer-Lugo 230 kV N-2, and Control-Haiwee-Inyokern 230 kV N-2. The load flows for these N-2 contingencies converged after existing SPS were modeled. See Appendix A for detailed results.

Lugo-Victor 230 kV Lines

Either Lugo-Victor 230-kV line (both have identical electrical characteristics) overloads for three N-2 outages; the loadings range from 180% to 208%. These overloads are attributable to the N-1 of a Lugo-Victor 230-kV line; mitigation for the N-1 will also mitigate the contribution of the [redacted] Project to these N-2 overloads (see Spring Single Contingencies). See Appendix A for specific overloads and contingencies. The overloaded portion of the Lugo-Victor line is the 1033 ACSR conductor.

A fourth outage, the N-2 of both Kramer-Lugo 230-kV lines, is known to contribute to overloads on the Lugo-Victor 230-kV lines, but the overload was not able to be determined due to the non-convergence of the load flow case. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will likely mitigate the contribution of the [redacted] Project to this overload.

Lugo 500/230 kV Transformer Banks

The 80 MW addition of the [redacted] project contributed to overloads of the Lugo 500/230kV transformers for three N-2 outages. The loadings on the transformers in the post-project case range from 176% to 182%. Each 500/230kV transformer bank at Lugo substation has emergency loading capabilities of 1230 MVA (long-term) and 1680 MVA (one hour). These overloads are attributable to the N-1 of a Lugo 500/230-kV transformer bank; facility upgrades recommended for the N-1 overload will also mitigate the contribution of the [redacted] Project to these N-2 overloads.

Eldorado 230/115 kV Transformer

The [redacted] project significantly contributes to the loading of the Eldorado 230/115 kV transformer fo[redacted] N-2 conditions. The loadings on the transformer range from

113% to 132%. See Appendix A for details on overloads and contingencies. Replacing the existing transformer with a new 280 MVA transformer to mitigate base case overloads will also mitigate all N-2 overloads (see Spring Base Case results). The contribution of the [redacted] project to the loading of this transformer is considered insignificant for spring N-2 conditions.

Kramer-Lugo 230 kV lines

The [redacted] Project contributes to overloads found on the Kramer-Lugo 230-kV lines for [redacted] N-2 conditions. The loading on the Kramer-Lugo 230-kV line ranges from 169% to 176%. See Appendix A for detailed results. Each Kramer-Lugo 230-kV line has a short term emergency rating of 1670 Amps. These overloads are attributable to the N-1 of a Kramer-Lugo 230-kV line; facility upgrades recommended for the N-1 overload will also mitigate the contribution of th[redacted] Project to these N-2 overloads.

A fourth outage, the N-2 of both Lugo-Victor 230-kV lines, is known to contribute to overloads on the Kramer-Lugo 230-kV lines, but the overload was not able to be determined due to the non-convergence of the load flow case. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will likely mitigate the contribution of the [redacted] Project to this overload.

Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line

Th[redacted]80 MW installation contributes significantly to overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line fo[redacted] N-2 contingencies. The overloaded portion of the line is the branch from Eldorado to Mountain Pass tap. The loadings on this section range from 124% to 163%. The contribution of the [redacted] project to the loading of this line is considered insignificant for spring N-2 conditions.

SENSITIVITY: LADWP's OWENS GORGE GENERATION

With Owens Gorge generation online, an overload on the Inyo 115kV phase shifter was caused for a single contingency condition by the 80 MW addition of [redacted] Project, as mentioned earlier.

With Owens Gorge generation offline, the Inyo 115kV phase shifter loads to 66 MVA (118% of 56 MVA normal rating) without the 80 MW addition of th[redacted] Project. The 80 MW addition of the [redacted] project results in an increase of the base case overload on the Inyo 115kV phase shifter. Loading on the phase shifter increases to 67 MVA (120% of 56 MVA normal rating) with the project's 80 MW addition. Overloading the phase shifter will initiate restricted operation of the project when Owens Gorge is not running.

POWER FACTOR CORRECTION REQUIREMENTS

Under spring conditions, the addition of the [redacted] Project, with no reactive support other than the 10 MVAR a[redacted]34.5 kV bus, lowers the voltage substantially at Black Mountain 115-kV bus under base case conditions. See Appendix F for details. The voltage at Black Mountain 115-kV bus decreases from 113.4 kV pre-project to 108.2 kV post-project. Approximately 10.5 MVAR was added to achieve a .95 buck power factor at th[redacted]115-kV bus. Power factor correction will be required for the [redacted]Project; the determination of the MVARs needed to maintain a .95 buck to .95 boost power factor at the point of interconnection will be determined in the Facilities Study.

Additional reactive support, beyond what is needed to maintain a necessary power factor, may be required to ensure the quality of service at the large industrial substations of Black Mountain and Southdown. A power quality investigation will be required to evaluate any adverse effects of the[redacted]Project on the quality of the voltage at these sensitive large customer substations; this can be determined in the Facilities Study. The Facilities Study should also determine what additional facility upgrades, beyond the facility upgrades needed to meet SCE's power factor requirements, that would be necessary to ensure that the industrial processes at these facilities are not interrupted or adversely impacted by the addition of the[redacted]Project.

B. Summer Results

The power flow study identified base case, N-1, and N-2 overloads in the 2006 summer case. All percentages in the following results are expressed as percent loading of nominal value unless stated otherwise.

BASE CASE

With the addition of the[redacted]Project, the loading of the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line increases from 113% to 115%. The portion of this line that is overloaded is the 4/0 ACSR conductor located between Eldorado and Mountain Pass tap; this segment of line is rated for 415 Amps normal, 530 Amps emergency rating. This overload was triggered by another project ahead in the queue, and the recommended facility upgrade was to upgrade this section of the line to 605 ACSR. This facility upgrade will also mitigate the contribution of the[redacted] Project to this overload.

The[redacted]Project also increases system losses by 6 MW in summer conditions.

SINGLE CONTINGENCIES

With the addition of the[redacted]Project, the power flow study identified three transmission lines and two transformers with N-1 overloads during summer conditions. See Appendix A for detailed results.

Lugo-Victor 230 kV Lines

The 80 MW installation of the [redacted]project increased the loading of a Lugo-Victor 230 kV line from 1578 Amps (127% of 1240 Amps normal rating) to 1729 Amps (139% of 1240 Amps normal rating) under the outage of the other Lugo-Victor 230 kV line (both lines are identical). Each Lugo-Victor 230-kV line has a long term emergency rating of 1431 Amps. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Lugo 500/230 kV Transformer Bank

The 80 MW addition of the [redacted] project increased the loading of the Lugo 500/230kV transformer from 1613 MVA (144% of 1120 MVA normal rating) to 1680 MVA (150% of 1120 MVA normal rating) under the outage of the other Lugo 500/230kV transformer (both transformer banks are identical). Each 500/230kV transformer bank at Lugo substation has emergency loading capabilities of 1230 MVA (long-term) and 1680 MVA (one hour). The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Kramer-Lugo 230 kV line

The 80 MW installation of the [redacted] project increased the loading of a Kramer-Lugo 230 kV line from 1891 Amps (152% of 1240 Amps normal rating) to 1899 Amps (153% of 1240 Amps normal rating) under the outage of the other Kramer-Lugo 230 kV line (both lines are identical). Each Kramer-Lugo 230-kV line has a long term emergency rating of 1431 Amps. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line

There are [redacted] N-1 contingencies identified in which the 80 MW installation of the [redacted] project contributes to an overload on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line. These loadings range from 116% to 133%. The detailed are shown in Appendix A. The portion of this line that is overloaded is the 4/0 ACSR conductor located between Eldorado and Mountain Pass tap; this segment of line is rated for 415 Amps normal, 530 Amps emergency rating. Upgrading the overloaded portion of this line to 605 ACSR will relieve all N-1 overloads identified. The contribution of the [redacted] project to the loading of this line is considered insignificant for summer N-1 conditions.

Eldorado 230/115 kV Transformer

The [redacted] Project significantly contributes to the overload of the Eldorado 230/115 kV transformer for the loss of a Kramer-Lugo 230-kV line. Replacing this transformer bank with a new 280 MVA transformer will mitigate this overload. The contribution of the [redacted] project to the loading of this transformer is considered insignificant for this overload.

DOUBLE CONTINGENCIES

With the addition of the [redacted] Project, the power flow study identified three transmission lines and three transformers with N-2 overloads during summer conditions. Two N-2 contingencies, the N-2 of both Kramer-Lugo 230-kV lines and the N-2 of both Control-Inyokern 230-kV lines, did not converge in the load flow. See Appendix A for detailed results.

Lugo-Victor 230 kV Lines

Either Lugo-Victor 230-kV line (both have identical electrical characteristics) overloads for [redacted] N-2 outages; the loadings range from 139% to 162%. See Appendix A for specific overloads and contingencies. Of the three outage conditions, the [redacted] Project triggers an overload for one of them: the N-2 of a Lugo-Victor 230-kV line and a Lugo 500/230-kV transformer bank. The overloaded portion of the Lugo-Victor line is the 1033 ACSR conductor. These N-2 overloads are attributable to the N-1 of a Lugo-Victor 230-kV line; mitigation for the N-1 will also mitigate the contribution of the [redacted] Project to these N-2 overloads. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to these overloads.

A fourth outage, the N-2 of both Kramer-Lugo 230-kV lines, is known to contribute to overloads on the Lugo-Victor 230-kV lines, but the overload was not able to be determined due to the non-convergence of the load flow case. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Kramer-Lugo 230 kV lines

The [redacted] Project contributes to overloads found on the Kramer-Lugo 230-kV lines for three N-2 conditions. The loading on the Kramer-Lugo 230-kV line ranges from 153% to 167%. See Appendix A for detailed results. Each Kramer-Lugo 230-kV line has a short term emergency rating of 1670 Amps. These N-2 overloads are attributable to the N-1 of a Kramer-Lugo 230-kV line; mitigation for the N-1 will also mitigate the contribution of the [redacted] Project to these N-2 overloads.

A fourth outage, the N-2 of both Lugo-Victor 230-kV lines, is known to contribute to overloads on the Kramer-Lugo 230-kV lines, but the overload was not able to be determined due to the non-convergence of the load flow case. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Lugo 500/230 kV Transformer Banks

The 80 MW addition of the [redacted] project causes an overload of the Lugo 500/230kV transformers for the N-2 outage of a Lugo-Victor 230-kV line and a Lugo 500/230-kV transformer bank. The loading on the transformer increases from 144% pre-project to 150% post-project. Each 500/230kV transformer bank at Lugo substation has emergency loading capabilities of 1230 MVA (long-term) and 1680 MVA (one hour). These overloads are attributable to the N-1 of a Lugo 500/230-kV transformer bank;

facility upgrades recommended for the N-1 overload will also mitigate the contribution of the [redacted] Project to these N-2 overloads.

Kramer 230/115 kV Transformers

The 80 MW installation of the [redacted] project increased the overloads of both no.1 and no.2 Kramer 230/115-kV transformers for the N-2 of both Lugo-Victor 230-kV lines. See Appendix A for details. The long term emergency ratings for the no.1 and no.2 transformers are 287 and 327 MVA, respectively. The installation of an SPS to trip all 80 MW of the [redacted] Project for this outage will mitigate the contribution of the project to this overload.

Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line

The [redacted] 80 MW installation contributes to overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV Line for seven N-2 contingencies. The project contributes significantly to the overload on this line for the loss of both Lugo-Victor 115-kV lines. For this contingency, the line loading increases from 155% pre-project to 166% post-project. The overloaded portion of the line is the branch from Eldorado to Mountain Pass tap. The post-project loadings on this section range from 116% to 166%.

Eldorado 230/115 kV Transformer

The [redacted] project contributes to the loading of the Eldorado 230/115 kV transformer for [redacted] N-2 conditions. The loadings on the transformer range from 113% to 141%. The project contributes significantly to the overload on this transformer for the loss of both Lugo-Victor 115-kV lines. For this contingency, the transformer loading increases from 135% pre-project to 141% post-project. See Appendix A for details on overloads and contingencies. Replacing the existing transformer with a new 280 MVA transformer to mitigate base case overloads will also mitigate all N-2 overloads (see Spring Base Case results).

SENSITIVITY: LADWP's OWENS GORGE GENERATION

With Owens Gorge generation offline, the Inyo 115kV phase shifter loads to 57 MVA (101% of 56 MVA normal rating) without the 80 MW addition of the [redacted] Project. The 80 MW addition of the [redacted] project results in an increase of the base case overload on the Inyo 115kV phase shifter. Loading on the phase shifter increases to 58 MVA (103% of 56 MVA normal rating) with the project's 80 MW addition. Overloading the phase shifter under these conditions will initiate generation curtailments per approved curtailment procedure.

POWER FACTOR CORRECTION REQUIREMENTS

Under summer conditions, the addition of the [redacted] Project, with no reactive support other than the 10 MVAR at [redacted] 34.5 kV bus, lowers the voltage substantially at Black Mountain 115-kV bus under base case conditions. See Appendix F for details.

The voltage at Black Mountain 115-kV bus decreases from 112.8 kV pre-project to 111.3 kV post-project. Approximately 9 MVAR was added to achieve a .95 buck power factor at the [redacted] 115-kV bus. Power factor correction will be required for the [redacted] Project; the determination of the MVARs needed to maintain a .95 buck to .95 boost power factor at the point of interconnection will be determined in the Facilities Study.

Additional reactive support, beyond what is needed to maintain a necessary power factor, may be required to ensure the quality of service at the large industrial substations of Black Mountain and Southdown. A power quality investigation will be required to evaluate any adverse effects of the [redacted] Project on the quality of the voltage at these sensitive large customer substations; this can be determined in the Facilities Study. The Facilities Study should also determine what additional facility upgrades, beyond the facility upgrades needed to meet SCE's power factor requirements, that would be necessary to ensure that the industrial processes at these facilities are not interrupted or adversely impacted by the addition of the [redacted] Project.

POST TRANSIENT VOLTAGE STUDY RESULTS

Critical N-1 and N-2 contingencies and applicable SPS schemes were modeled in the post transient study.

The following scenarios did not identify any criteria violations or significant changes to the post-transient voltage plot with the addition of the [redacted] Project:

N-1 of Lugo-Victor 230-kV line with existing SPS
N-1 of Kramer-Lugo 230-kV line with existing SPS
N-1 of Kramer-Inyokern-Randsburg 115-Kv line with existing SPS
N-1 of Lugo 500/230-kV Bank with existing SPS
N-2 of Lugo-Victor 230-kV line and Kramer-Lugo 230-kV line with existing SPS
N-2 of Control-Inyokern 115-kV lines with existing SPS
N-1 of Lugo-Mohave 500-kV line
N-1 of Eldorado-Lugo 500-kV line
N-1 of Lugo-Vincent 500-kV line
N-2 of both Kramer-Lugo 230-kV lines with existing SPS
N-2 of both Lugo-Victor 230-kV lines with existing SPS

One scenario did not converge in the pre-project and post-project cases for spring conditions: the N-2 of both Lugo 500/230-kV transformer banks with existing SPS. All projects ahead in queue were tripped, but this still resulted in a non-convergent solution. This is believed to be a programming solution problem. The [redacted] Project may be required to participate in a Special Protection Scheme for this contingency.

TRANSIENT STABILITY STUDY RESULTS

A. GE PSLF Version 14.2 Models

GE PSLF Version 14.2 supports the wind generation turbine type proposed by [redacted] for the [redacted] project.

gewtg
This model is used to represent the generator/converter model for the GE wind turbines.

wndtge
This model is used to represent the wind turbine and turbine controls for the GE wind turbines.

exwtge
This model is used to represent the excitation (converter) controls for the GE wind turbines.

The parameter values for each of the [redacted] models were provided by [redacted] and verified with GE as appropriate parameters for the GE 1.5 MW turbines. The parameters that determine sympathetic generation tripping during faulted conditions are the under-voltage trip settings (voltage and time duration). As discussed with GE, there are [redacted] under-voltage settings that govern whether the machine remains on-line or is "tripped off". The [redacted] under-voltage setting deals with prolonged under-voltage conditions while the [redacted] deals with prolong voltage recovery after faulted conditions. The [redacted] under-voltage setting deals with the "instantaneous" tripping of the wind generator depending on the generator terminal voltage. Standard wind generators without "under-voltage ride through capability" are designed to allow the generator to remain on-line as long as the voltage at the turbine terminals does not dip more than 30 percent of nominal (0.7 per-unit terminal voltage). An option can be purchased by the developer to improve the under voltage ride-through capability to allow turbines to remain in-service even under voltage dips as large as 70 percent of nominal (0.3 per-unit terminal voltage).

In order to determine the low-voltage ride through requirement for the [redacted] Project, transient stability studies were performed assuming the "instantaneous" under-voltage trip timer was increased to 0.75 seconds. This increase in time will ensure that, in simulation, the fault is cleared thereby allowing sufficient time for the voltage to recover prior to evaluating if the wind turbine should be tripped. In real practice, the timer cannot be adjusted and therefore terminal voltage values less than 0.7 per unit (standard) or 0.3 per-unit (with the low voltage ride through option) will result in the actual tripping of the wind turbines. Additional simulations were made with the appropriate "instantaneous" under voltage trip settings for those cases which would result in voltage terminal values less than 0.3 per-unit to demonstrate actual wind turbine generation tripping even with the inclusion of the under-voltage ride through capability option.

B. <u>Sympathetic Generation Tripping Results</u>

Stability studies were conducted by applying a three-phase-to-ground bus fault at critical locations. These critical locations included the 115-kV buses in the Victor-Kramer 115-kV system, the 230-kV buses at Victor, Lugo, Kramer, Eldorado, and Pisgah substations, and the 500-kV buses at Eldorado and Lugo substations.

For each three-phase-to-ground bus fault applied, the bus voltages at the [redacted] Project point of interconnection (the [redacted] 115-kV bus) and at the terminals of the [redacted] Project generators were recorded. This was to determine the "reach" of sympathetic unplanned generation tripping of the [redacted] Project. The following table shows the point of interconnection voltage and the [redacted] Project generator terminal voltages for various three-phase-to-ground bus faults.

	Spring Conditions		Summer Conditions	
Fault Location	Voltage @ Point of Interconnect	Voltage @ Generator Terminals	Voltage @ Point of Interconnect	Voltage @ Generator Terminals
Victor 115	0.172	0.429[1]	0.172	0.429[1]
Victor 230	0.319	0.527[1]	0.317	0.525[1]
Lugo 500	0.527	0.668[1]	0.532	0.67[1]
Lugo 230	0.399	0.582[1]	0.402	0.583[1]
Kramer 230	0.758	0.792	0.773	0.803
Kramer 115	0.748	0.782	0.756	0.788
Roadway 115	0.555	0.654[1]	0.561	0.66[1]
Eldorado 500	0.777	0.818	0.817	0.844
Eldorado 230	0.884	0.888	0.914	0.907
Savage 115	0.583	0.671[1]	0.589	0.677[1]
Phelan 115	0.669	0.731	0.674	0.736
Pisgah 230	0.952	0.93	0.957	0.934

(1) Sympathetic tripping will occur with standard under-voltage ride-through capability

(2) Sympathetic tripping will occur with improved (0.3 per unit) under-voltage ride-through capability

Assuming that the [redacted] Project generators are equipped with no additional under-voltage ride-through capability beyond the standard 0.7 per unit, a three-phase-to-ground-fault at six locations will result in sympathetic unplanned generation tripping of the [redacted] Project. These locations include the 115-kV buses at Victor, Roadway, and Savage substations, the 230-kV buses at Victor and Lugo substations, and the 500-kV bus at Lugo substation.

Equipping the wind turbines with the optional 0.3 per-unit under voltage ride-through capability resolves the [redacted] Project sympathetic generation tripping for all three-phase-to-ground bus faults. The [redacted] Project would be required to provide 0.3 per-unit under-voltage ride-through capability to satisfy the WECC Voltage Ride-Through requirements.

C. <u>Transient Stability Study Results</u>

Transient stability studies were run for all critical N-1 and N-2 contingencies. There are [redacted] Special Protection Schemes North of Lugo substation that are used to mitigate overloads and system instability due to high generation in the area. These Special Protection schemes were modeled in the transient stability study to determine the impact of the [redacted] Project on these existing mitigation measures.

If the stability pre-project case was found to be unstable with existing Special Protection Schemes modeled, then subsequent generation projects ahead of the [redacted] Project in queue were tripped until a stable plot could be found.

Twelve contingencies were simulated in the dynamic study for both summer and spring conditions.

The following scenarios did not identify any criteria violations or significant changes to the transient voltage plot with the addition of th[redacted] Project:

- N-1 of Lugo-Victor 230-kV line with existing SPS
- N-1 of Kramer-Lugo 230-kV line with existing SPS
- N-1 of Kramer-Inyokern-Randsburg 115-Kv line with existing SPS
- N-1 of Lugo 500/230-kV Bank with existing SPS
- N-2 of Lugo-Victor 230-kV line and Kramer-Lugo 230-kV line with existing SPS
- N-2 of Control-Inyokern 115-kV lines with existing SPS
- N-1 of Lugo-Mohave 500-kV line
- N-1 of Eldorado-Lugo 500-kV line
- N-1 of Lugo-Vincent 500-kV line
- N-2 of both Lugo-Victor 230-kV lines

The other two scenarios are discussed below:

<u>N-2 of both Kramer-Lugo 230-kV lines with existing SPS</u>

The dynamic plot was unstable for the spring pre-project case; projects ahead in queue were tripped in reverse order until a stable plot was achieved. The [redacted] roject did not show significant contributions to the instability of the system.

The dynamic plot was stable for the summer pre-project case.

<u>N-2 of both Lugo 500/230-kV transformer banks with existing SPS</u>

The dynamic plot was unstable for both summer and spring pre-project cases; projects ahead in queue were tripped in reverse order until a stable plot was achieved. The [redacted] Project did not show significant contributions to the instability of the system. Since this is not a credible N-2 outage, the WECC Category C Voltage criteria do not apply.

CONCLUSIONS

A. Power Flow Study Conclusions

The power flow study results show that [redacted] Project contributes to overloads for base case, N-1, and N-2 contingencies.

Base Case

The [redacted] Project contributes to a pre-project overload on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer. Previously proposed facility upgrades, which were proposed to mitigate these base case overloads that were caused by a project ahead in queue, will also mitigate the contribution to the overloads from [redacted] Project.

[redacted] Project also increases system losses by 8 MW in spring conditions and 6 MW in summer conditions.

Single Contingencies

The [redacted] Project causes an overload on the Inyo 115-kV Phase Shifter for the loss of Kramer-Inyokern 115-kV line. This overload may be mitigated by a post-contingency operating procedure, or a Special Protection Scheme to trip the [redacted] Project if an operating procedure is found to be not feasible.

The [redacted] Project contributed significantly to pre-project overloads on the Lugo-Victor 230-kV lines, the Kramer-Lugo 230-kV lines, and the Lugo 500/230-kV transformer banks for various N-1 contingencies. The [redacted] Project will be required to participate in existing Special Protection Schemes north of Lugo substation to mitigate these overloads.

The [redacted] Project also contributes to N-1 overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer, but the contribution is found to be negligible.

Double Contingencies

The [redacted] Project contributed significantly to pre-project overloads on the Lugo-Victor 230-kV lines, the Kramer-Lugo 230-kV lines, the Lugo 500/230-kV transformer banks, and the Kramer 230/115-kV transformer banks for various N-2 contingencies. Additionally, the [redacted] Project triggers an overload on the Lugo-Victor 230-kV line for the loss of the remaining Lugo-Victor 230-kV line and a Lugo 500/230-kV transformer bank. [redacted] Project will be required to participate in existing Special Protection Schemes north of Lugo substation to mitigate these overloads.

Th[redacted]Project also contributes to N-2 overloads on the Eldorado-Baker-Cool Water-Dunn Siding-Mountain Pass 115-kV line and Eldorado 230/115-kV transformer, but the contribution is found to be negligible.

Sensitivity: Owens Gorge Generation

The[redacted]Project contributes to overloads on the Inyo 115-kV phase shifter when Owens Gorge Generation is offline. During spring conditions, overloading the phase shifter will initiate restricted operation of the [redacted]Project when Owens Gorge is not running. During summer conditions, th[redacted]Project will be required to participate in generation curtailments per approved curtailment procedure for these conditions.

Power Factor Correction Requirements

Studies show that without adequate power factor correction, th[redacted]Project decreases the voltage at Black Mountain 115-kV bus by as much as 4.5%. Power factor correction will be required for th[redacted]Project; the determination of the MVARs needed to maintain a .95 buck to .95 boost power factor at the point of interconnection will be determined in the Facilities Study.

B. Post Transient Study Conclusions

The post transient study did not find significant impacts of th[redacted]Project to the post transient voltage profile of the system. However, th[redacted]Project may be required to participate in existing Special Protection Scheme to mitigate overloads and instability for the loss of both Lugo 500/230-kV transformer banks.

C. Transient Stability Study Conclusions

The study did not find significant impacts of the[redacted]Project to the transient stability of the system.

Equipping the wind turbines with the optional 0.3 per-unit under voltage ride-through capability resolves the[redacted] Project sympathetic generation tripping for all three-phase-to-ground bus faults. Th[redacted]Project would be required to provide 0.3 per-unit under-voltage ride-through capability to satisfy the WECC Voltage Ride-Through requirements.

FACILITIES STUDY

A Facilities Study is required for the [redacted] Project. The scope of the Facilities Study will need to include the following:

1. Evaluate the feasibility and cost of installing a Special Protection Scheme to trip the [redacted] Project for the following contingencies in the North of Lugo 230-kV corridor to protect against overloads:

> N-1 of a Lugo-Victor 230-kV line (overload)
> N-1 of a Lugo 500/230-kV transformer bank (overload)
> N-1 of a Kramer-Lugo 230-kV line (overload)
> N-2 of both Lugo-Victor 230-kV lines (overload)
> N-2 of both Kramer-Lugo 230-kV lines (overload)
> N-2 of both Lugo 500/230-kV transformer banks (post-transient voltage stability)

2. Evaluate the feasibility and cost of installing a Special Protection Scheme to trip the [redacted] Project for the N-1 of the Inyokern-Kramer 115-kV line to mitigate an overload on the Inyo 115-kV phase shifter.

3. Determine the amount of reactive support needed to maintain a .95 buck to .95 power factor at the point of interconnection a[redacted] 115-kV bus.

4. Conduct a power quality investigation to evaluate any adverse effects of the [redacted] Project on the quality of the voltage at sensitive large customer substations, namely Black Mountain and Southdown. Determine what additional facility upgrades, beyond the facility upgrades needed to meet SCE's power factor requirement, that would be necessary to ensure that the industrial processes at these facilities are not interrupted or adversely impacted by the addition of th[redacted] Project.

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