[redacted]

SYSTEM IMPACT STUDY

April 18, 2005

SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL™ Company

Prepared by:

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SOUTHERN CALIFORNIA EDISON COMPANY

EXECUTIVE SUMMARY

[redacted] applied to Southern California Edison ("SCE") for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] will own and operate a 300 MW generating facility [redacted] to be interconnected at SCE's Highgrove Substation. Distribution service pursuant to the WDAT is proposed to be from SCE's 115 kV Highgrove Substation to the California Independent System Operator ("ISO") grid at SCE's 230 kV Vista Substation. The proposed in-service date of [redacted] is May 2007.

The [redacted] is a generation system consisting of [redacted] 100 MW Brush Electrical Machines Ltd. Gas Turbine Generators, with a net generation export of 300 MW. As requested by [redacted] SCE performed a System Impact Study to identify the general electrical system impacts of the [redacted] and possible mitigation measures to maintain conformance with SCE, ISO, or other applicable reliability planning criteria.

The study consisted of a power flow analysis and a short circuit duty analysis (Phase I study scope) to determine whether the energy associated with [redacted] can be transmitted through SCE's distribution system to the ISO grid at Vista Substation, without creating the need for modifications to SCE's distribution system and/or the ISO grid. The study showed that, with the [redacted] on-line:

- Thermal loadings on the SCE facilities used to provide the requested distribution service are all within criteria limits.
- Three-phase short-circuit duties increase by 0.1 kA or more at [redacted] 115 kV buses, [redacted] 230 kV buses, and [redacted] 500 kV buses that have duty levels above 60% of their nameplate three-phase ratings.
- Single line-to-ground short-circuit duties increase by 0.1 kA or more at [redacted] 115 kV bus that have duty levels above 60% of their nameplate single line-to-ground ratings. The evaluation of the single line-to-ground duty increases for the 230 kV and 500 kV buses will be conducted as part of the Facilities Study.

Based on these results, SCE concludes that a Facilities Study will be required to evaluate the need for circuit breaker replacements at the 115 kV, 230 kV, and 500 kV levels as a result of the [redacted]. The Facilities Study should include the following scope:

- Evaluate the need for circuit breaker replacement and develop detailed costs for any identified breaker replacement at the following [redacted] 115 kV buses, [redacted] 230 kV buses, and [redacted] 500 kV buses where the [redacted] increases three-phase short-circuit duties by 0.1 kA or more and where duty levels are above 60% of three-phase ratings:
    - Devers 500 kV
    - Lugo 500 kV
    - Miraloma 500 kV
    - Serrano 500 kV

- Stagecoach 500 kV
- Barre 230 kV
- Chino 230 kV
- Del Amo 230 kV
- Devers 230 kV
- Etiwanda 230 kV
- Huntington Beach B 230 kV
- La Fresa 230 kV
- Lugo 230 kV
- Mira Loma E 230 kV
- Mira Loma W 230 kV
- Olinda 230 kV
- Padua 230 kV
- San Onofre 230 kV
- San Bernardino 230 kV
- Serrano 230 kV
- Stagecoach 230 kV
- Villa Park 230 kV
- Vista 230 kV
- Altwind 115 kV
- Calectric 115 kV
- Highgrove 115 kV
- Homart 115 kV
- Pepper 115 kV
- Shandin 115 kV
- Vista 115 kV
- Devil Canyon 115 kV
- Mojave Siphon (Cdwr) 115 kV
- San Benardino 115 kV

- Evaluate the need for circuit breaker replacement and develop detailed costs for any identified breaker replacement at the following [redacted] 115 kV substations where the [redacted] increases single line-to-ground short-circuit duties by 0.1 kA or more and where duty levels are above 60% of single line-to-ground ratings:

  - Calectric 115 kV
  - Highgrove 115 kV
  - Shandin 115 kV
  - San Bernardino 115 kV
  - Vista 115 kV

- The evaluation of the single line-to-ground duty increases for the 230 kV and 500 kV buses will be conducted as part of the Facilities Study.

Preliminary cost estimates to replace all of the circuit breakers at the identified substations are included in Table 1 and Table 2 of this System Impact Study. Detailed costs will be developed in the Facilities Study.

Phase II of this System Impact Study (i.e., stability study and post-transient voltage study) will not be required unless requested by a third party.

CONTENTS

CALIFORNIA PORTLAND CEMENT COMPANY
SYSTEM IMPACT STUDY

March 31, 2005

1. INTRODUCTION

[redacted] applied to Southern California Edison ("SCE") for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] will own and operate a 300 MW generating facility [redacted] to be interconnected at SCE's Highgrove Substation. Distribution service pursuant to the WDAT is proposed to be from SCE's 115 kV Highgrove Substation to the California Independent System Operator ("ISO") grid at SCE's 230 kV Vista Substation. The proposed in-service date o[redacted] is May 2007.

The [redacted] is a generation system consisting of [redacted] 100 MW Brush Electrical Machines Ltd. Gas Turbine Generators, with a net generation export of 300 MW. As requested by [redacted] SCE performed a System Impact Study to identify the general electrical system impacts of th[redacted] and possible mitigation measures to maintain conformance with SCE, ISO, or other applicable reliability planning criteria.

The study consisted of a power flow analysis and a short circuit duty analysis (Phase I study scope) to determine whether the energy associated with the [redacted] can be transmitted through SCE's distribution system to the ISO grid at Vista Substation, without creating the need for modifications to SCE's distribution system and/or the ISO grid. This report describes the study conditions and assumptions and presents the results of the power flow and short circuit duty analyses. Based on these results, the report concludes that a Facilities Study will be required to evaluate the need for circuit breaker replacements at the 115 kV and 230 kV levels as a result of the [redacted]. Phase II of this System Impact Study (i.e., stability study and post-transient voltage study) will not be required unless requested by a third party.

2. STUDY CONDITIONS AND METHODOLOGY

A. *Planning Criteria*

The study was conducted by applying SCE's planning criteria to the SCE facilities used to provide the requested distribution service. Specifically, the main criteria applicable to this study are as follows:

Power Flow Criteria

Line loading should not exceed 100% of a conductor's thermal rating with all facilities in service (base case).

Line loading should not exceed 135% of a conductor's thermal rating with one line out of service (N-1).

Short-Circuit Duty Criteria

Short-circuit duty should not exceed a circuit breaker's interrupting capability with maximum area generation on-line.

B. System Load Conditions

The study considered three system load conditions: peak loads, light loads, and very light load or evening loads. The peak load forecast was based on SCE's 2005-2014 Distribution Substation Plan. The light load forecast was assumed to be 50% of the peak load forecast and the very light load was assumed to be 35% of the peak load forecast. Two scenarios were considered for each load condition, the first scenario was the 2007 Vista system configuration and the second scenario was the 2009 Vista system configuration.

C. Power Flow Study

This study evaluated [redacted] impact on line loadings for base case and N-1 conditions. Line loadings were monitored both with and without the [redacted] to determine if the addition of the [redacted] causes any violations of SCE's thermal loading criteria.

D. Short-Circuit Duty Study

This study evaluated the [redacted] impact on short-circuit duties seen by substation circuit breakers at the 115 kV, 230 kV, and 500kV levels. Symmetrical three-phase fault currents and single line-to-ground fault currents were calculated both with and without the [redacted] to determine if the addition of the [redacted] causes any violations of SCE's short-circuit duty criteria.

The dataset used for the short-circuit study represented all existing generation and all projects in the queue (up to and including the [redacted] as on-line. Substations where the [redacted], [redacted] increases three-phase short-circuit duties by 0.1 kA or more and where duty levels are above 60% of circuit breaker nameplate three-phase ratings were identified for a more detailed review of asymmetrical duties in the Facilities Study. Similarly, substations where the [redacted] [redacted] increases single line-to-ground short-circuit duties by 0.1 kA or more and where duty levels are above 60% of circuit breaker nameplate single line-to-ground ratings were identified for a more detailed review of asymmetrical duties in the Facilities Study.

3. DISCUSSION OF STUDY RESULTS

A. Power Flow Study

For peak load, light load and very light load conditions for both the 2007 and 2009 Vista system configurations, the addition of the [redacted] causes no violations of SCE's thermal loading criteria to the Vista 115kV system.

The [redacted] has the largest incremental impact on thermal loading of SCE's two Vista-Highgrove 115 kV lines. These two 115 kV lines along with four others are used to provide subtransmission service to the Highgrove facility. For peak load, light load and very light load conditions for the 2007 scenario, the addition of the Project *decreases* thermal loading on these lines by about 20-25 MW each, due to power being exported from Highgrove once the [redacted] [redacted]

plant is on-line rather than being imported. Thermal loading on the remaining lines in the Vista 115 kV system are relatively unchanged with the addition of the [redacted] for the 2007 scenarios.

For the 2009 Vista system configuration scenario the [redacted] has the largest incremental impact on thermal loading of SCE's [redacted] Vista-Highgrove 115 kV lines. For peak load condition for the 2009 scenario, the addition of the Project *decreases* thermal loading on these lines by about 30 MW each, due to power being exported from Highgrove once the [redacted] is on-line rather than being imported. For the light load and very light load conditions for the 2009 scenario, the addition of the Project *increases* thermal loading on these lines by about 45-70 MW each, due to power being exported from Highgrove once the [redacted] is on-line rather than being imported. Thermal loading on the remaining lines in the Vista 115 kV system are relatively unchanged with the addition of the [redacted] for the 2009 scenarios.

B. ***Short-Circuit Duty Study***

Table 1 summarizes the impact of the [redacted] on symmetrical three-phase short-circuit duties and X/R ratios at various 115 kV and 230 kV buses on the SCE system [redacted] 115 kV buses, [redacted] 230 kV buses, an[redacted] 500 kV buses were identified for which the Project increases three-phase duties by 0.1 kA or more and where duty levels are above 60% of nameplate three-phase ratings:

- Devers 500 kV
- Lugo 500 kV
- Miraloma 500 kV
- Serrano 500 kV
- Stagecoach 500 kV
- Barre 230 kV
- Chino 230 kV
- Del Amo 230 kV
- Devers 230 kV
- Etiwanda 230 kV
- Huntington Beach B 230 kV
- La Fresa 230 kV
- Lugo 230 kV
- Mira Loma E 230 kV
- Mira Loma W 230 kV
- Olinda 230 kV
- Padua 230 kV
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- San Bernardino 230 kV
- Serrano 230 kV
- Stagecoach 230 kV
- Villa Park 230 kV
- Vista 230 kV
- Altwind 115 kV
- Calectric 115 kV
- Highgrove 115 kV
- Homart 115 kV
- Pepper 115 kV
- Shandin 115 kV
- Vista 115 kV

- Devil Canyon 115 kV
- Mojave Siphon (Cdwr) 115 kV
- San Benardino 115 kV

Table 2 summarizes the impact of the [redacted] on symmetrical single line-to-ground short-circuit duties and X/R ratios at various 115 kV buses on the SCE system. [redacted] 115 kV substations were identified for which the Project increases three-phase duties by 0.1 kA or more and where duty levels are above 60% of nameplate single line-to-ground ratings:

- Calectric 115 kV
- Highgrove 115 kV
- Shandin 115 kV
- San Bernardino 115 kV

The evaluation of the single line-to-ground duty increases for the 230 kV and 500 kV buses will be conducted as part of the Facilities Study.

A more detailed review of asymmetrical duties and circuit breaker interrupting capabilities at these substations will be required in the Facilities Study to evaluate the need for circuit breaker replacements as a result of the [redacted]

4. CONCLUSIONS

The results of this System Impact Study showed that, with the Highgrove Plant on-line:

- Thermal loadings on the SCE facilities used to provide the requested distribution service are all within criteria limits.
- Three-phase short-circuit duties increase by 0.1 kA or more at [redacted] 115 kV buses, [redacted] 230 kV buses, an[redacted] 500 kV buses that have duty levels above 60% of their nameplate three-phase ratings.
- Single line-to-ground short-circuit duties increase by 0.1 kA or more at [redacted] 115 kV bus that have duty levels above 60% of their nameplate single line-to-ground ratings. The evaluation of the single line-to-ground duty increases for the 230 kV and 500 kV buses will be conducted as part of the Facilities Study.

Based on these results, SCE concludes that a Facilities Study will be required to evaluate the need for circuit breaker replacements at the 115 kV, 230 kV, and 500 kV levels as a result of the [redacted] The Facilities Study should include the following scope:

- Evaluate the need for circuit breaker replacement and develop detailed costs for any identified breaker replacement at the following [redacted] 115 kV buses, [redacted] 230 kV buses, and [redacted] 500 kV buses where the [redacted] increases three-phase short-circuit duties by 0.1 kA or more and where duty levels are above 60% of three-phase ratings:
  - Devers 500 kV
  - Lugo 500 kV
  - Miraloma 500 kV
  - Serrano 500 kV
  - Stagecoach 500 kV
  - Barre 230 kV

[redacted]

- Chino 230 kV
- Del Amo 230 kV
- Devers 230 kV
- Etiwanda 230 kV
- Huntington Beach B 230 kV
- La Fresa 230 kV
- Lugo 230 kV
- Mira Loma E 230 kV
- Mira Loma W 230 kV
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  - Calectric 115 kV
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  - San Bernardino 115 kV
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Preliminary cost estimates to replace all of the circuit breakers at the identified substations are included in Table 1 and Table 2 of this System Impact Study. Detailed costs will be developed in the Facilities Study.

Phase II of this System Impact Study (i.e., stability study and post-transient voltage study) will not be required unless requested by a third party.

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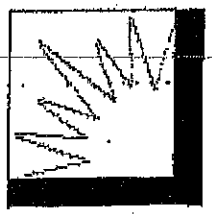
SYSTEM IMPACT STUDY
TRANSMISSION ASSESSMENT

April 7, 2005



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[redacted]

SYSTEM IMPACT STUDY - TRANSMISSION ASSESSMENT

EXECUTIVE SUMMARY

The [redacted] applied to the California Independent System Operator (CAISO) for Interconnection. The [redacted] proposed to interconnect [redacted] gas turbine generators, each with a maximum operating rating at 108.19 MW. The generator auxiliary load is 1 MW and net capacity of the project is rated at 323.57 MW. The [redacted] proposed to interconnect the project [redacted] to the 115-kV bus at SCE's Highgrove Substation. The in-service date proposed by AES is January 1, 2007.

Southern California Edison's (SCE's) Transmission and Interconnection Planning (TIP) department has performed a System Impact Study to determine the adequacy of SCE's transmission system to accommodate the [redacted] The study indicates that the system is not adequate to accommodate the 323.57 MW of generation without modifications. A Facilities Study will be required for th[redacted]

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*** [redacted] Any changes from the attached data could void the study results.

SCE's Field Engineering department has performed a System Impact Study on the SCE affected distribution network.

POWER FLOW STUDY RESULTS

The power flow study results show that overloading problems are found on several transmission lines for base-case, single and double contingencies. Specifically:

Base case

Under spring conditions, the project increased prior base case overloads from 113% to 114% on the Devers – Valley 500 kV line causing a net 1% increase.

Under summer conditions there were no base case overloads

Single Contingency

Single contingency overload problems are found on a total of six transmission lines. Under spring conditions, the Etiwanda – Vista 230 kV line was overloaded from 90% - 97% to 103% - 107% of the nominal rating. Prior overloads on the other lines were increased from 104% - 135% to 100% - 140% of the nominal ratings of the lines.

Under summer conditions, the project increased prior overloads on the Devers – Valley 500 kV line ranging from 100 – 102% to 102% - 104 %.

Double Contingency

Double contingency overload problems are found on a total of [redacted] transmission lines. Under spring conditions, the project overloaded the Serrano – Valley 500 kV line from 90% to 101% of its nominal rating for one double contingency. Also, the project overloaded the Etiwanda – Vista 230 kV line from 96% - 135% to 110% - 150%of its nominal rating. The project increased prior overloads on the rest of the lines from 105% - 163% to 110% - 175%. In particular, the project increased a prior overload on the San Bernardino – Vista 230 kV line from 163% to 175% - which is in excess of the line's N-2 conductor rating..

Under summer conditions, the Devers – Valley 500 kV line was overloaded from 103% - 106% to 105% - 108% of its nominal rating.

Most overloads were due to the existing wave trap limitations and other limitations on the GIS line terminals located at Valley Substation. The exception is the San Bernardino – Vista 230 kV line, where overloads exceeded the N-2 emergency limit on the line conductor.

TRANSIENT STABILITY STUDY RESULTS

No transient stability voltage violations were found with the addition of th[redacted] Project.

SHORT CIRCUIT DUTY STUDY

The data provided by the [redacted] has been used to study the Short Circuit Duty contribution. The addition of the Project has impacted 17 substations with increases in the short circuit duty. These impacts require further study to determine the need for circuit breaker upgrades.

SCOPE OF WORK

The scope of upgrades to accommodate the generation interconnection on the SCE network is listed below. This study has not assumed overload mitigation requirements for projects ahead of the queue.

- Upgrades of the 3000A wave traps and line terminals at Valley Substation 4000A on the Devers – Valley 500 kV line.
- Upgrades of line terminals at Serrano & Valley substations on the Serrano - Valley 500 kV line.
- Upgrades of line terminals at Vista and San Bernardino substations on the Vista – San Bernardino 230 kV line from 2300A to 3000A (or greater) line terminals.

- Upgrades of line terminals at Vista Substation on the Etiwanda and Mira Loma #1 230 kV lines
- Upgrade of line terminals at Barre & Lewis Substations on the Barre – Lewis 230 kV line.
- Upgrade the wave traps at Etiwanda Substation on the Vista 230 kV line.
- Upgrade the wave traps at Walnut Substation on the Mira Loma 230 kV line.
- Replacement of transmission line conductors on the San Bernardino – Vista 230 kV line.
    - Note: The San Bernardino – Vista 230 kV line conductors are overloaded over its N-2 rating.

The following items 1 – 4 also need to be evaluated for replacement or upgrade in the Facilities Study.

1. Breakers & Disconnects at Devers Substation on the Valley 500 kV line.
2. Breakers & Disconnects at Etiwanda Substation on the Vista 230 kV line.
3. Breakers at Mira Loma & Vista Substations on the Mira Loma - Vista 230 kV line.
4. Breakers & Disconnects at Walnut Substation on the Mira Loma 230 kV line.

Note:
Study results may change due to changes in other projects ahead of the queue in the area. A re-study may be required if there are changes in the project queue or the scope of projects ahead in the queue.

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[redacted]

GENERATION INTERCONNECTION

SYSTEM IMPACT STUDY
TRANSMISSION ASSESSMENT

INTRODUCTION

The [redacted] applied to the California Independent System Operator (CAISO) for Interconnection. The [redacted] proposed to interconnect [redacted] gas turbine generators, each with a maximum operating rating at 108.19 MW. The generator auxiliary load is 1 MW and net capacity of the project is rated at 323.57 MW. The [redacted] proposed to interconnect the project [redacted] to the 115-kV bus at SCE's Highgrove Substation. The in-service date proposed by [redacted] is January 1, 2007.

Southern California Edison's (SCE's) Transmission and Interconnection Planning (TIP) department has performed a System Impact Study to determine the adequacy of SCE's transmission system to accommodate the [redacted] The study indicates that the system is not adequate to accommodate the 323.57 MW of generation without modifications. A Facilities Study will be required for the [redacted]

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*** [redacted] Any changes from the attached data could void the study results.

SCE's Field Engineering department has performed a System Impact Study on the SCE affected distribution network.

The study was performed for two system conditions: (a) 2007 heavy summer load conditions (once in-ten-year heat wave assumption) with maximum eastern area generation, and (b) 2007 spring load conditions (65% of 2007 heavy summer peak load) for the total transmission system. These conditions reflected the most critical expected loading condition for the transmission system in SCE's eastern area.

STUDY CONDITIONS AND ASSUMPTIONS

A. Planning Criteria

The 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 or sub-transmission lines and 500/230 kV transformer banks ("AA-Bank"):

Assuming both San Onofre Units 2 and 3 in service and then:

- Single Contingencies (N-1 Line or N-1 AA-Bank)
- Double Contingencies (N-2 Two Lines, N-1 Line and N-1 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
500-230 kV Transformer Banks	Base Case	Normal Loading Rating
	Long & Short Term	As Defined by SCE Operating Bulletins

Table 2.1

System upgrades or Special Protection Systems 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, outlined below, were used for interconnecting generation into the SCE transmission system, which fall under CAISO jurisdiction (these principles may be subject to change for future interconnection projects).

- 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] 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] The [redacted] 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] 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] 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] and all facilities in service

c. if congestion exists in the area with the addition of the [redacted] 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]

[redacted] The Project is proposed to be connected radially to the Highgrove 115 kV bus. Appendix A displays the proposed [redacted] in the form of a one line diagram, submitted by th[redacted] as part of the CAISO Generation Interconnection Application package.

The [redacted] proposes to add a net total of 323.57 MW of generation interconnected at the Highgrove 115kV bus. A total of [redacted] gas turbine generators will produce a rated output put of 108.19 MW each. The generator auxiliary load is specified at 1 MW. The generator and transformer data for the proposed generating turbines, as provided by the [redacted] is shown in Appendix C.

C. <u>System Conditions</u>

To simulate the SCE transmission system for analysis, the study selected the databases that were used to conduct the CAISO Controlled Transmission 2004-2008 Assessment. Load flow studies considered the existing system arrangement without the SDGE proposed Rainbow-Valley 500 kV transmission project and to reflect other transmission projects.

For example:

- Palo Verde – Devers 500 kV Line #2 was in service.
- All four West of Devers 230 kV Lines have been upgraded.
- The Etiwanda – San Bernardino 230 kV line #1 rating will be increased to 2480 Amps / 988 MVA after the current wave trap removal project is completed.

The bulk power study considered scenarios that evaluated maximum EOR/WOR imports and maximum generation from Qualified Facilities in the eastern area. These conditions were evaluated to identify worst case scenarios that would stress the SCE 500-kV transmission system network in the eastern area. In addition, the study considered two system load conditions: 2007 heavy summer and light spring. The summer peak load forecast was based on SCE's 2004 Transmission Substation Transformer Capacity Assessment, and reflects a one-in-ten-year heat wave assumption. The 2004 – 2008 heavy summer load forecast is shown in Table 2.2. The 2004 - 2008 spring forecast assumed 65% of summer load forecast.

D. Power Flow Study

Power flow studies were conducted under 2007 heavy summer and 2007 spring load conditions with and without th[redacted] for a total of [redacted]ase cases. Further descriptions of the base case assumptions are as follows:

a) 2007 Heavy Summer: Case 1 **without** the [redacted] and Case 2 **with** maximum generation in SCE's eastern area electrical system and maximum EOR/WOR power flow. Generation included: all market and all regulatory must-take units. Generation patterns were maximized in the eastern area to fully stress the system in order to identify extent of potential congestion on the bulk power system with the addition of the [redacted]

b) 2007 Spring: Case 3 **without** the [redacted] Case 4 **with** 2007 spring load (65% of summer peak for the total system) was used with maximum generation in SCE's eastern area and maximum EOR/WOR power flow. Generation included: all market and all regulatory must-take units. Generation patterns were maximized in the eastern area to fully stress the system in order to identify the extent of potential congestion on the bulk power system with the addition of the [redacted]

With the addition of the [redacted] SCE's area total generation, imports, loads, and losses for each case are summarized in table below:

SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW)				
	2007 Heavy Summer		2007 Light Spring	
	Case 1	Case 2	Case 3	Case 4
Generation	14983	14983	8160	8169
Imports	8313	8313	6613	6612
Load	22690	22690	14154	14154
Losses	507	512	519	529

Table 2.2

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 [redacted] single and [redacted] double contingencies in the SCE system were studied with system performance monitored for criteria violations on the SCE 500-kV and 230-kV systems.

E. Short Circuit Duty

The data provided by the AES Corporation has impacted [redacted] substations with increases in the short circuit duty. These impacts require further study to determine the need for circuit breaker upgrades.

POWER FLOW STUDY RESULTS

A. 2007 Spring Results

The power flow study identified base case, N-1 and N-2 overloads in the 2007 spring case. All percentages in the following results are expressed as percent loading of nominal value unless stated otherwise.

Base Case

There was one spring base case overloads triggered by projects ahead in queue. The addition of the [redacted] caused an insignificant overload. See Appendix B, Table 1 for detailed results.

The addition of the [redacted] caused the Devers – Valley 500 kV circuit to be overloaded from 113% to 114%; the difference being 1% is therefore deemed insignificant.

Light Spring Single Contingencies (N-1)

With the addition of the [redacted] the power flow study identified [redacted] transmission lines with N-1 overloads during spring conditions. See Appendix B, Table 2 for detailed results.

Two of these overloads (the Etiwanda-Vista 230-kV and Mira Loma-Walnut 230-kV lines) are limited by existing 2000 A wave traps at Vista and Walnut substations. Upgrade of both of these 2000A wave traps to 3000A will be sufficient to mitigate spring N-1 overloads on these lines. The conductor on the terminations at Barre & Lewis substations is the limiting factor on the Barre – Lewis 230 kV line. Upgrading these terminations from 3000A to 4000A will mitigate the N-1 overloads on the Barre – Lewis 230 kV line. The Mira Loma – Vista 230 kV line #1 is also overloaded due to the conductor and terminations at Vista substation. Upgrading these will mitigate the N-1 overloads.

The Devers – Valley 500 kV line is also overloaded to 117% of its nominal rating. The limiting factors are the wave traps at both Devers & Valley Substations and the GIS termination equipment at Valley substation. Upgrading the wave traps & GIS termination equipment from 3000A to 4000A will mitigate the N-1 overloads.

Light Spring Double Contingencies (N-2)

With the addition of th[redacted] the power flow study identified [redacted] transmission lines with N-2 overloads during spring conditions. See Appendix B, Table 3 for detailed results.

Two of these overloads (the Devers-Valley 500-kV line and Serrano – Valley 500 kV line) will be mitigated by upgrades of the wave traps at both Devers & Valley Substations on the Devers-Valley 500-kV line. Also The GIS termination equipment at Valley substation is required to be upgraded from 3000A to 4000A on the Serrano and Devers positions.

The San Bernardino Vista 230 kV line is overloaded to 175% of its nominal rating. It will need to be re-conductored to mitigate the N-2 overloads.

The Etiwanda – Vista 230 kV line is limited by the wave trap & terminations at Etiwanda Substation. Upgrading these from 2000A to 3000A will mitigate the N-2 contingency overloads.

Also, the Mira Loma – Vista 230 kV line #1 is limited by the line drop at Vista substation. Upgrading the line drop from 2300A to 3000A will mitigate the N-2 overloads on this line.

B. 2007 Summer Results

Base Case

There were no significant changes to the base case with the addition of the [redacted]

Heavy Summer Single Contingencies (N-1)

With the addition of the [redacted] the study identified only one transmission lines with N-1 contingency overloads during summer conditions. See Appendix B, Table 4 for detailed results.

The Devers – Valley 500 kV line is overloaded to 102% of its nominal rating. The limiting factors are the wave traps at both Devers & Valley Substations and the GIS termination equipment at Valley substation. Upgrading the wave traps & GIS termination equipment from 3000A to 4000A will mitigate the N-1 and N-2 overloads. See the Spring Results section above for details

Heavy Summer Double Contingencies (N-2)

With the addition of the [redacted], the study identified only one transmission lines with N-2 contingency overloads during summer conditions. See Appendix B, Table 5 for detailed results.

The Devers – Valley 500 kV line is overloaded to 108% of its nominal rating. The limiting factors are the wave traps at both Devers & Valley Substations and the GIS termination equipment at Valley substation. Upgrading the wave traps & GIS termination equipment from 3000A to 4000A will mitigate the N-1 and N-2 overloads. See the Spring Results section above for details

Note:

Additional overloads were identified on the disconnect switches and circuit breakers. However, these overloads will be addressed through Edison's internal Substation Equipment Replacement Program (SERP)

TRANSIENT AND POST TRANSIENT VOLTAGE STUDY RESULTS

There were no transient stability and post-transient voltage violations found with the addition of the [redacted].

SHORT CURCUIT DUTY STUDY RESULTS

Short Circuit Duty Study

The results of the maximum symmetrical three-phase short circuit duty at the critical buses in the SCE bulk transmission system are summarized in table 3.6 (the short circuit duty sheet).

The additional 323.57 MW [redacted] has increased the short circuit duty at the substation facilities listed below for future review. However, study results may change due to other projects ahead of the queue in the area. A new study may be required when those projects are revised.

Three Phase (3PH) Short Circuit Duty Study Results

Bus Name	Bus kV
DEVERS	500
LUGO	500
MIRALOMA	500
SERRANO	500
BARRE	230
CHINO	230
DELAMO	230
DEVERS	230
ETIWANDA	230
HUNTBCHB	230
LA FRESA	230
LUGO	230
MRLOMA E	230
MRLOMA W	230
OLINDA	230
PADUA	230
S.ONOFRE	230
SANBRDNO	230
SERRANO	230
VILLA PK	230
VISTA	230
ALTWIND	115

Notes:

- **No Equivalencing was made of the Vista Sub-transmission system.**

CONCLUSIONS

A. Power Flow Study Conclusions

Load flow studies were conducted under 2007 heavy summer and 2007 light spring load conditions with and without the [redacted] for a total of 4 cases.

Palo Verde – Devers 500 kV Line #2 was assumed to be in service and all four West of Devers 230 kV Lines were assumed had been upgraded.

Base case

No base case overload problems were found under the light spring and heavy summer conditions with the addition of the [redacted]

N-1

Under spring conditions, the project overloaded the Devers – Valley 500 kV line to 117% and the Etiwanda – Vista 230 kV line to 107%. The Etiwanda – San Bernardino 230 kV, Mira Loma – Walnut 230 kV and Mira Loma – Vista 230 kV lines were overloaded to 140%, 110% and 124% respectively. Also, the Barre – Lewis 230 kV line was overloaded to 124%. Under summer conditions the Devers – Valley 500 kV line was overloaded to 104%.

N-2

Under spring conditions, the project overloaded the Devers – Valley and Serrano – Valley 500 kV lines to 129% and 101% respectively. The Etiwanda – Vista, Mira Loma – Vista and San Bernardino – Vista 230 kV lines were overloaded to 150%, 137% and 175% respectively. Under heavy summer conditions, the Devers – Valley 500 kV line was overloaded to 108%.

B. Transient Stability and Post Transient Voltage Study Conclusions

There were no transient stability and post-transient voltage violations found with the addition of the [redacted]

C. Short Circuit Duty Study Conclusions

The additional 323.57 MW [redacted] has increased the short circuit duty at the substation facilities listed below for further review. However, study results may change due to other projects ahead of the queue in the area. A new study may be required when those projects are revised.

Affected Substations:

A total of [redacted] substations have been affected with increases in short circuit duty. Refer to table 3.6 – Short Circuit Duty Sheet for details.

The Lines & elements overloaded from contingencies and MW required to be tripped / curtailed are listed below.

Table 4

Single Contingencies

Out of Service Transmission Element	Overloaded Transmission Element	Maximum MW Generation to be tripped or manually curtailed
Mira Loma -Vista 230 kV ck2	Etiwanda-Vista 230 kV ck1	108.19 MW
Mira Loma -Olinda 230 kV ck2	Mira Loma – Walnut 230 kV ck1	323.57 MW
Etiwanda – San Bernardino 230 kV ck1	Etiwanda-Vista 230 kV ck1	108.19 MW
Mira Loma -Vista 230 kV ck1	Etiwanda-Vista 230 kV ck1	108.19 MW
	Devers-Valley 500 kV ck1	323.57 MW
Barre – Villa Park 230 kV ck1	Barre – Lewis 230 kV ck1	323.57 MW
Mira Loma – Serrano 500 kV ck1	Devers-Valley 500 kV ck1	323.57 MW
Serrano – Valley 500 kV ck1	Etiwanda-San Bernardino 230 kV ck1	323.57 MW
	Mira Loma – Vista 230 kV ck1	323.57 MW
	Etiwanda-Vista 230 kV ck1	108.19 MW
Devers – Valley 500 kV ck1	Etiwanda-San Bernardino 230 kV ck1	323.57 MW
	Mira Loma – Vista 230 kV ck1	323.57 MW
	Etiwanda-Vista 230 kV ck1	108.19 MW

Table 4 contd.

Double Contingencies

Out for Service Transmission Element	Overloaded Transmission Element	MW Generation to be tripped or manually curtailed
Chino - Serrano 230 kV ckt & Mira Loma - Olinda 230 kV ckt	Devers-Valley 500 kV ckt	323.57 MW
Etiwanda – San Bernardino 230 kV ckt & Mira Loma - Vista 230 kV ckt	Etiwanda - Vista 230 kV ckt	323.57 MW
	Devers-Valley 500 kV ckt	323.57 MW
Etiwanda – San Bernardino 230 kV ckt & Mira Loma - Vista 230 kV ck2	Etiwanda - Vista 230 kV ckt	323.57 MW
	Devers-Valley 500 kV ckt	323.57 MW
	Mira Loma - Vista 230 kV ckt	323.57 MW
Etiwanda - San Bernardino 230 kV ckt & Etiwanda – Vista 230 kV ckt	Devers-Valley 500 kV ckt	323.57 MW
	Mira Loma - Vista 230 kV ckt	323.57 MW
Devers - San Bernardino 230 kV ck2 & Etiwanda - San Bernardino 230 kV ckt	Devers-Valley 500 kV ckt	323.57 MW
Devers – Vista 230 kV ck2 & Vista – Devers 230 kv ckt	San Bernardino – Vista 230 kV ck2	323.57 MW
	Serrano – Valley 500 kV ckt	108.19 MW
	Devers-Valley 500 kV ckt	323.57 MW
Etiwanda – San Bernardino 230 kV ckt & Lugo – Serrano 500 kV ckt	Devers-Valley 500 kV ckt	323.57 MW
Etiwanda – San Bernardino 230 kV ckt & Lugo – Mira Loma 500 kV ckt	Devers-Valley 500 kV ckt	323.57 MW
Devers-Valley 500 kV ckt Devers 500 / 230 kV Bank #1	Etiwanda-Vista 230 kV ckt	108.19 MW
Mira Loma - Vista 230 kV ckt & Mira Loma - Vista 230 kV ck2	Devers-Valley 500 kV ckt	323.57 MW

SCOPE OF WORK FOR FACILITIES STUDY

The scope of upgrades to accommodate the generation interconnection on the SCE network is listed below. This study has not assumed overload mitigation requirements for projects ahead of the queue.

- Upgrades of the 3000A wave traps and line terminals at Valley Substation 4000A on the Devers – Valley 500 kV line.
- Upgrades of line terminals at Serrano & Valley substations on the Serrano - Valley 500 kV line.
- Upgrades of line terminals at Vista and San Bernardino substations on the Vista – San Bernardino 230 kV line from 2300A to 3000A (or greater) line terminals.
- Upgrades of line terminals at Vista Substation on the Etiwanda and Mira Loma #1 230 kV lines
- Upgrade of line terminals at Barre & Lewis Substations on the Barre – Lewis 230 kV line.
- Upgrade the wave traps at Etiwanda Substation on the Vista 230 kV line.
- Upgrade the wave traps at Walnut Substation on the Mira Loma 230 kV line.
- Replacement of transmission line conductors on the San Bernardino – Vista 230 kV line.
    - Note: The San Bernardino – Vista 230 kV line conductors are overloaded over its N-2 rating.

The following items 1 – 4 also need to be evaluated for replacement or upgrade in the Facilities Study.

1. Breakers & Disconnects at Devers Substation on the Valley 500 kV line.
2. Breakers & Disconnects at Etiwanda Substation on the Vista 230 kV line.
3. Breakers at Mira Loma & Vista Substations on the Mira Loma - Vista 230 kV line.
4. Breakers & Disconnects at Walnut Substation on the Mira Loma 230 kV line.

Note:
Study results may change due to other projects ahead of the queue in the area. A new study may be required if projects ahead of the queue are changed.

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APPENDIX C
GOOD FAITH COST ESTIMATE

All items include 18% A&G but no ITCC Tax.

1) Upgrade of wave trap at Valley Substation on the Devers 500 kV line.
   Replacement of 500 kV Wave Trap: $90,000
2) Upgrade of line drops at Vista & San Bernardino substations.
   Replacement of 230 kV line drops: $120,000 ($60,000 each).
3) Upgrade of line drops at Barre & Lewis substations.
   Replacement of 230 kV line drops: $120,000 ($60,000 each).
4) Upgrade of wave trap at Etiwanda Substation on the Vista 230 kV line.
   Replacement of 230 kV Wave Trap: $80,000
5) Upgrade of wave trap at Walnut Substation on the Mira Loma 230 kV line.
   Replacement of 230 kV Wave Trap: $80,000

TOTAL : $490,000

Note:
Per the transmission assessment of th[redacted], it is not possible to estimate the GIS equipment upgrades and line reconductoring at this time. However, the GIS equipment upgrades will be addressed in the facilities study.

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APPENDIX D

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