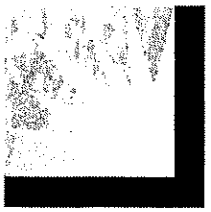
[redacted]

# WHOLESALE DISTRIBUTION ACCESS TARIFF

## SYSTEM IMPACT STUDY
## TRANSMISSION ASSESSMENT

October 31, 2006



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# SYSTEM IMPACT STUDY - TRANSMISSION ASSESSMENT

## EXECUTIVE SUMMARY

[redacted]pplied to Southern California Edison ("SCE") for Distribution Service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted]new generating facility in the City of Industry, California ("Project"), with a maximum operating rating of 49.9 MW. [redacted]proposed to connect the Project to an existing SCE 66 kV line for the delivery of energy to the ISO Grid at SCE's 230 kV Walnut Substation. The in-service date proposed by [redacted]

Southern California Edison's (SCE's) Transmission and Interconnection Planning (TIP) department has performed a Feasibility Study to determine the adequacy of SCE's transmission system to accommodate the Project. The study indicates that the system is not adequate to accommodate the 49.9 MW of generation without modifications. A Facility Study will be required for the Project.

The results of this 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 single and double contingencies.

**Base case**

Under light spring and heavy summer conditions, there were no base case overloads attributed to the Project.

**Single (N-1) Contingencies**

Under light spring conditions, the study identified two single contingency overloads which were aggravated, but not triggered by the [redacted] These pre-project overloads were eliminated by moving the displacing energy from Ventura area to the North of Lugo area or assuming both line circuit breakers in-service under N-1 contingencies.

Under heavy summer conditions, there were no overloads attributed to the Project.

**Double (N-2) Contingencies**

Under light spring conditions, the study identified three double contingency overloads which were aggravated, but not triggered by the [redacted] These pre-project overloads were eliminated by assuming both line circuit breakers in-service under N-2 contingencies

Under heavy summer conditions, there were no overloads attributed to the Project.

## TRANSIENT AND POST TRANSIENT STUDIES

SCE used study finding from earlier Interconnection Studies, for larger projects electrically proximate to the Project, to conclude that there are no post-transient or stability impacts to the SCE transmission system from the Project

## SHORT CIRCUIT DUTY STUDY

The data provided by [redacted] has been used to study the Short Circuit Duty contribution. The addition of the Project has impacted 12 substations with short circuit duty increases greater than 0.1 kA. Engineering evaluated circuit breakers at all transmission and sub-transmission buses where the [redacted] contribution to the Short Circuit Duty resulted in an increase of 0.1 kA or more.

The initial engineering assessment concluded that there are circuit breaker replacements and upgrades required that were triggered by projects in queue ahead of the [redacted] and by [redacted] is to upgrade three breakers on the Barre 220 kV at a cost of $576,000.

The breakers identified that were triggered by projects ahead of the queue tha[redacted] has contributed to the short circuit duty includes replacing 3 breakers and upgrading 20 breakers at Etiwanda substation and replacing of 23 breakers at Mesa substation at a cost if $17,911,000.

## SCOPE OF WORK

The scope of circuit breaker replacements and 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.

Case A

1. Upgrade three 220 kV breakers at Barre substation with TRV's.

Case B

1. Replace three 220 kV breakers and upgrade twenty 220 kV breakers at Etiwanda substation.
2. Replace twenty three 220 kV breakers at Mesa substation.

**Note:**
Study results may be affected by 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.

## COST OF UPGRADES

The following costs are given in Year 2008 Level Dollars and do not include 35 % ITCC Tax.

CASE A - Triggered by [redacted]

| STATION | Replace | Upgrade | Sets of TRV's required | Cost of CB | Cost of TRV set of 3 | Sub-Total CB | Sub-Total TRV | GRAND TOTAL |
|---|---|---|---|---|---|---|---|---|
| Barre - 220kV | | 3 | 4 | $ - | $ 144,000 | $ - | $ 576,000 | $ 576,000 |

CASE B - Triggered by earlier Projects ahead of [redacted] in the Application Queue

| STATION | Replace | Upgrade | Sets of TRV's required | Cost of CB | Cost of TRV set of 3 | Sub-Total CB | Sub-Total TRV | GRAND TOTAL |
|---|---|---|---|---|---|---|---|---|
| Etiwanda - 220kV | 3 | 20 | 14 | $ 476,000 | $ 144,000 | $ 1,428,000 | $ 2,016,000 | $ 3,444,000 |
| Mesa - 220kV | 23 | | | $ 629,000 | $ - | $14,467,000 | $ - | $ 14,467,000 |
| | | | | | | $15,895,000 | $ 2,016,000 | $ 17,911,000 |

**Note:**
The estimates are rough order of magnitude and are non binding cost estimates only.

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**WHOLESALE DISTRIBUTION ACCESS TARIFF**

**SYSTEM IMPACT STUDY**
**TRANSMISSION ASSESSMENT**

## INTRODUCTION

[redacted] applied to Southern California Edison ("SCE") for Distribution Service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] generating facility in the City of Industry, California ("Project"), with a maximum operating rating of 49.9 MW. [redacted] proposed to connect the Project to an existing SCE 66 kV line for the delivery of energy to the ISO Grid at SCE's 230 kV Walnut Substation. The in-service date proposed by [redacted]

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 Project. The study indicates that the system is not adequate to accommodate the 49.9 MW of generation without modifications. A System Impact Study and a Facility Study will be required for the Project.

The results of the Feasibility Study is a precursor to the more complete System Impact Study which 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 representing: (a) 2007 heavy summer load (once in-ten-year heat wave assumption) with maximum study area generation, and (b) spring load (65% of 2008 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:

**Table 2.1**

| | | |
|---|---|---|
| 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 |

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 Project (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 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 Project. The 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 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 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 Project and all facilities in service

c. if congestion exists in the area with the addition of the 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] Facility in the City of Industry, California**

[redacted] proposed to connect the Project to an existing SCE 66 kV line for the delivery of energy to the ISO Grid at SCE's 230 kV Walnut Substation. The in-service date proposed by [redacted] Appendix A displays the equivalent one line diagram that Transmission & Interconnection Planning used to model the new generation.

**Table 2.2 [redacted] Project**

| | |
|---|---|
| 1 Single Generator | 49.9 MW |
| Auxiliary Load | 1000 kW |
| Net Plant Output | 48.9 MW |

**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 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 critical 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: 2006 heavy summer and light spring. The summer peak load forecast was based on SCE's 2005 Transmission Substation Transformer Capacity Assessment, and reflects a one-in-ten-year heat wave assumption. The 2005 – 2009 heavy summer load forecast is shown in Table 2.2. The 2005 - 2009 spring forecast assumed 65% of summer load forecast.

## D. Power Flow Study

Power flow studies were conducted under 2007 heavy summer and 2008 spring load conditions with and without the Project for a total of 4 base cases. Further descriptions of the base case assumptions are as follows:

a) 2007 Heavy Summer: The Pre-Project case is **without** the [redacted] and Post-Project case is **with** the [redacted] Each case scenario was studied 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 Project. A power flow plot is provided in Appendix C.

b) 2008 Light Spring: The Pre-Project case is **without** the [redacted] and Post-Project case is **with** the [redacted] Each case scenario was studied with 2008 spring load (65% of summer peak for the total system) and 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 Project. A power flow plot is provided in Appendix C.

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

**Table 2.2**

| SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW) | | | | |
|---|---|---|---|---|
| | 2007 Heavy Summer | | 2008 Light Spring | |
| | Pre-Project | Post-Project | Pre-Project | Post-Project |
| **Generation** | 16,624 | 16,623 | 11,999 | 12,000 |
| **Imports** | 8,611 | 8,610 | 4,893 | 4,893 |
| **Load** | 24,534 | 24,534 | 16,241 | 16,241 |
| **Losses** | 701 | 699 | 651 | 652 |

*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 262 single and 292 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 [redacted] has impacted 12 substations with increases in the short circuit duty. These impacts require an initial engineering assessment to determine the need for circuit breaker replacements and upgrades.

## POWER FLOW STUDY RESULTS

### A. 2008 Light Spring Results

The power flow study identified N-1 and N-2 overloads in the 2008 Light Spring case.

**Base Case**

There were no base case overloads attributed to the Project.

**Light Spring Single (N-1) and Double (N-2) Contingencies**

Non-convergent Power Flows

[redacted]

[redacted]

The study identified that the Project aggravated pre-project overloads but did not trigger the violation of criteria on SCE's bulk power system.

See Appendix B, Table 1 and 2 for detailed results.

### B. 2007 Heavy Summer Results

**Base Case**

There were no base case overloads attributed to the Project.

**Heavy Summer Single (N-1) and Double (N-2) Contingencies**

The study identified that the Project aggravated pre-project overloads by more than 1%, but did not trigger the violation of criteria on SCE's bulk power system.

## TRANSIENT AND POST TRANSIENT RESULTS

SCE used study findings from earlier Interconnection Studies, for larger projects electrically proximate to the Project, to conclude that there are no post-transient or stability impacts to the SCE transmission system from the Project

## SHORT CURCUIT DUTY STUDY RESULTS

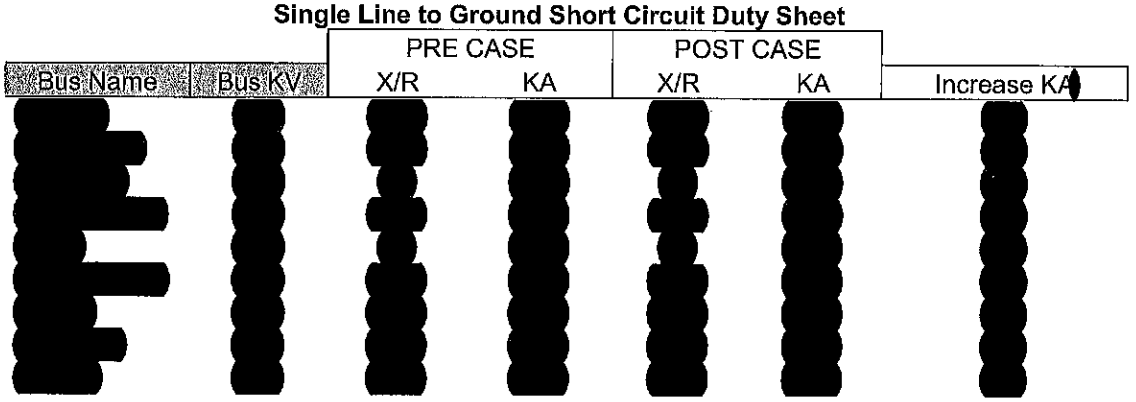
### Short Circuit Duty Study

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 4.1. The results of the maximum single line to ground short circuit duty at the critical buses in the SCE bulk transmission system are summarized in Table 4.2.

The additional 49.9 MW Project 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.

**Table 4.1**
**Three Phase Short Circuit Duty Sheet**


**Table 4.2**
**Single Line to Ground Short Circuit Duty Sheet**



## CONCLUSIONS

### A. Power Flow Study Conclusions

Load flow studies were conducted under conditions representing 2007 heavy summer and 2008 light spring load with and without the Project 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**

Under spring and summer conditions, there were no base case overloads attributed to the Project.

**Single (N-1) and Double (N-2) contingencies**

Under spring and summer conditions, the Project aggravates pre project overloads but did not trigger any upgrades.

See Appendix B, Table 1 and 2 for detailed results.

### B. Short Circuit Duty Study Conclusions

The data provided by [redacted] has been used to study the Short Circuit Duty contribution. The addition of the Project has impacted 12 substations with short circuit duty increases greater than 0.1 kA. Engineering evaluated circuit breakers at all transmission and sub-transmission buses where the [redacted] contribution to the Short Circuit Duty resulted in an increase of 0.1 kA or more.

The initial engineering assessment concluded that there are circuit breaker replacements and upgrades required that were triggered by projects in queue ahead of the [redacted] and by [redacted] is to upgrade three breakers on the Barre 220 kV.

The breakers identified that were triggered by projects ahead of the queue that [redacted] has contributed to the short circuit duty includes replacing 3 breakers and upgrading 20 breakers at Etiwanda substation and replacing of 23 breakers at Mesa substation.

Refer to table 4.1 and table 4.2 – Short Circuit Duty Sheet for details.

## SCOPE OF WORK FOR FACILITIES STUDY

The scope of circuit breaker replacements and 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.

Case A

2. Upgrade three 220 kV breakers at Barre substation with TRV's.

Case B

1. Replace three 220 kV breakers and upgrade twenty 220 kV breakers at Etiwanda substation.
2. Replace twenty three 220 kV breakers at Mesa substation.

An Operational Study will also need to be performed based on in-service-year, as opposed to interconnection application queue order. The Operational Study will evaluate the need for having circuit breaker upgrades and mitigation of overloaded facilities in-service prior to Project interconnection, even if these upgrades are assigned to earlier-queued projects that may have later in-service dates.

**Note:**
Study results may be affected by 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.

# APPENDIX B
# POWER FLOW RESULTS

## TABLE 1 – Light Spring N-1

| *Equipment* | *Normal Rating (Amps)* | *Emergency Rating (Amps)* | *Pre-Project* | *% of Normal rating* | *% of Emerg. rating* | *Post-Project* | *% of Normal rating* | *% of Emerg. rating* | *Contingency Description* | *Comments* |
|---|---|---|---|---|---|---|---|---|---|---|
| Mesa - Walnut 230 kV # 1 | 2000 | 2000 | **2486** | 124 | 124 | **2553** | 128 | 128 | Center - Olinda 230 kV # 1 | OK with both line CBs in service |
| Center - Olinda 230 kV # 1 | 1800 | 2000 | **2010** | 112 | 101 | **2084** | 116 | 104 | Mesa - Walnut 230 kV # 1 | Generation Dispatch Scenario |

## TABLE 2 - Light Spring N-2

| *Equipment* | *Normal Rating (Amps)* | *Emergency Rating (Amps)* | *Pre-Project* | *% of Normal rating* | *% of Emerg. rating* | *Post-Project* | *% of Normal rating* | *% of Emerg. rating* | *Contingency Description* | *Comments* |
|---|---|---|---|---|---|---|---|---|---|---|
| Mesa - Walnut 230 kV # 1 | 2000 | 2000 | **2448** | 122 | 122 | **2513** | 126 | 126 | Center-Mesa 230 kV # 1 & Center-Olinda 230 kV # 1 | OK with both line CBs in service |
| Mesa - Walnut 230 kV # 1 | 2000 | 2000 | **2434** | 122 | 122 | **2488** | 124 | 124 | Barre-Villa Park 230 kV # 1 & Barre-Lewis 230 kV # 1 | OK with both line CBs in service |
| Mesa - Walnut 230 kV # 1 | 2000 | 2000 | **2429** | 121 | 121 | **2486** | 124 | 124 | Lugo-Vincent 500 kV # 1 & Lugo-Vincent 500 kV # 2 | OK with both line CBs in service |

*Under Heavy Summer conditions, the study identified that the Project aggravated pre-project overloads by less than 1%, but did not trigger the violation of criteria on SCE's bulk power system.

# APPENDIX C
# LOAD FLOW DIAGRAMS