[redacted]

SYSTEM IMPACT STUDY

July 19, 2006

Prepared by:

Dan Rizzo – Distribution Engineering

SOUTHERN CALIFORNIA
EDISON
An *EDISON INTERNATIONAL*℠ Company

SOUTHERN CALIFORNIA EDISON COMPANY

Approved by:

Russell A. Neal II

Russell A. Neal II
Engineering Manager

EXECUTIVE SUMMARY

[redacted] applied to Southern California Edison ("SCE") for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] Project will own and operate a 49.9 MW generating facility [redacted] Project) to be interconnected at a new interconnection facility [redacted] Project") to be constructed by SCE. [redacted] Project will be served by looping in SCE's existing Captive-Delano-Mariposa 66 kV line, forming new Captive[redacted] and [redacted] 66 kV lines. Distribution service pursuant to the WDAT is proposed to be from [redacted] Project to the California Independent System Operator ("ISO") grid at SCE's 230 kV Vestal Substation. The proposed in-service date of the [redacted] Project is June 1, 2006.

The [redacted] Project is a generation system consisting of one LM6000 Gas Turbine with a net generation export of 49.9 MW. As requested by [redacted] Project, SCE performed a System Impact Study to identify the general electrical system impacts of the [redacted] Project, possible mitigation measures to maintain conformance with SCE, ISO, or other applicable reliability planning criteria, and non-binding order of magnitude cost estimates for these mitigation measures.

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

- For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under base case conditions.

- For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under N-1 conditions.

- There are 12 other substations where the [redacted] Project increased three-phase short-circuit duties by 0.1 kA or more. The circuit breaker interrupting capabilities were reviewed at these substations and it was determined that no circuit breakers were required to be upgraded as a result of the [redacted] Project.

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

[redacted] Project interconnection facility (66 kV line loop-in)	$2.90M
Protection Upgrades	$0.30M
RTU at [redacted] Project	$0.10M
66 kV system line upgrades	$0.04M
Total non-binding order of magnitude cost estimate	$3.34M

Note: The above costs do not include the 35% ITCC tax. The 66 kV system line upgrades do not include any 131D costs.

CONTENTS

[redacted]

SYSTEM IMPACT STUDY

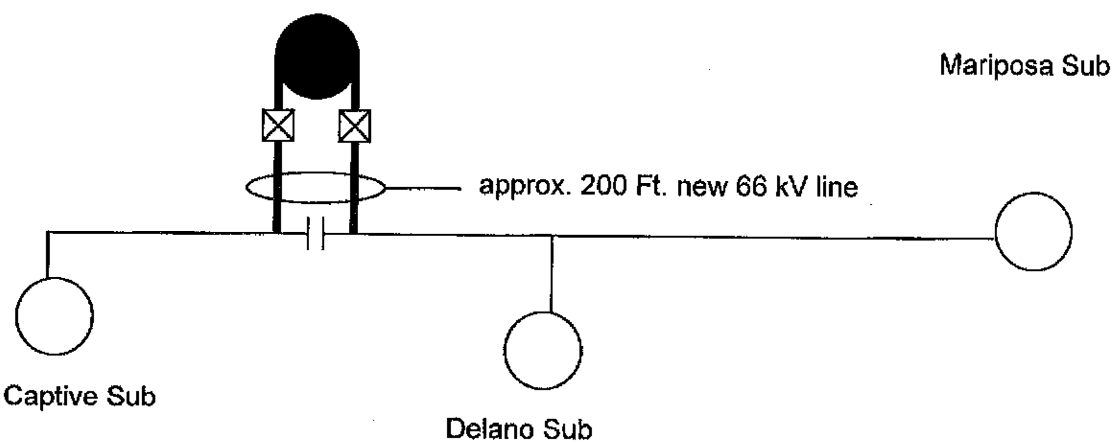
July 19, 2006

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 49.9 MW generating facility [redacted] Project") to be interconnected at a new interconnection facility [redacted] Project") to be constructed by SCE. [redacted]roject will be serv[redacted] existing Captive-Delano-Mariposa 66 kV line, forming new Captive[redacted] an[redacted] 66 kV lines (see Figure 1 below).

Figure 1 – Proposed 66 kV Method of Service to Generic Substation

[redacted] Project



Distribution service pursuant to the WDAT is proposed to be fro[redacted] Project to the California Independent System Operator ("ISO") grid at SCE's 220 kV Vestal Substation. The proposed in-service date of the [redacted] Project is June 1, 2007.

Th[redacted]roject consists of [redacted] LM6000 Gas Turbine which operated in simple cycle mode of operation with a net generation export of 49.9 MW. As requested b[redacted] SCE performed a System Impact Study to identify the general electrical system impacts of the [redacted] possible mitigation measures to maintain conformance with SCE, ISO, and other applicable reliability planning criteria, and non-binding order of magnitude cost estimates for these mitigation measures.

The System Impact Study consisted of a power flow analysis and a three-phase short-circuit duty analysis to determine whether the energy associated with th[redacted] Plant can be transmitted through SCE's distribution system to the ISO grid at Vestal 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 on SCE's Vestal 66 kV subtransmission system. Appendix A details study results for the ISO-controlled transmission grid.

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 WDAT 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 100% of a conductor's emergency 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 considere[redacted]system load conditions: peak loads and light loads. The peak load forecast was based on SCE's 2006-2014 Distribution Substation Plan. The light load forecast was assumed to be 20% of the peak load forecast.

C. *Power Flow Study*

This study evaluated th[redacted]Project's impact on line loadings for base case and N-1 conditions. Both peak load and light load conditions were modeled. Line loadings were monitored both with and without the [redacted]Plant to determine if the addition of the[redacted]Plant caused any violations of SCE's thermal loading criteria.

D. *Short-Circuit Duty Study*

This study evaluated the[redacted]Project's impact on three-phase short-circuit duties seen by substation circuit breakers at the 66 kV level. Symmetrical three-phase fault currents and X/R ratios were calculated both with and without the[redacted]

[redacted] Project to determine if the addition of the [redacted] Project caused 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] Project) as on-line. Substations where the [redacted] Project increased three-phase short-circuit duties by 0.1 kA or more were flagged, and circuit breaker interrupting capabilities were reviewed at these substations to determine if any circuit breakers required replacement as a result of the [redacted] Plant.

3. DISCUSSION OF STUDY RESULTS

A. *Power Flow Study*

For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under base case conditions.

For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under N-1 conditions.

B. *Short-Circuit Duty Study*

Table 1 below summarizes the impact of the [redacted] Project on symmetrical three-phase short-circuit duties and X/R ratios at various 66 kV buses on the SCE system. [redacted] buses were flagged where the [redacted] Plant increased three-phase short-circuit duties by 0.1 kA or more: Terra Bella 66 kV, Wheatland 66 kV, Captive 66kV, Columbine 66 kV, Mariposa 66 kV, Quinn 66 kV, Browning 66 kV, Delano 66 kV, Earlimart 66 kV, Pandol 66 kV, Ultra 66 kV, Vestal "A" 66 kV, Captive 12 kV, Delano 12 kV, Vestal 12 kV, Mariposa 12 kV, and Pixley 12 kV. A review of circuit breaker interrupting capabilities at these locations determined that the incremental contribution to increased SCD did not trigger the need for circuit breaker upgrades. A short circuit study was also preformed on the 12 kV substations.

Table 1: Three-Phase Short-Circuit Duty Summary

System Bus	Pre-Project SCD (kA)	Pre-Project X/R Ratio	Post-Project SCD (kA)	Post-Project X/R Ratio	Delta SCD (kA)
Browning 66 kV					
Captive 66 kV					
Columbine 66 kV					
Delano 66 kV					
Earlimart 66 kV					
Mariposa 66 kV					
Pandol 66kV					
Quinn 66 kV					
Terra Bella 66 kV					
Ultra 66kV					
Vestal 66 kV					
Wheatland 66 kV					
Captive 12 kV					
Delano 12 kV					
Vestal 12 kV					
Mariposa 12 kV					
Pixley 12 kV					

4. NON-BINDING ORDER OF MAGNITUDE COST ESTIMATES

Non-binding order of magnitude cost estimates for the required interconnection facilities and 66 kV system upgrades are as follows:

[redacted] Project interconnection facility (66 kV line loop-in)	$2.90M
Protection Upgrades	$0.30M
RTU at [redacted] Project	$0.10M
66 kV system line upgrades	$0.04M
Total non-binding order of magnitude cost estimate	$3.34M

Note: The above costs do not include the 35% ITCC tax. The 66 kV system line upgrades do not include any 131D costs.

5. CONCLUSIONS

The results of this System Impact Study showed that, with the [redacted] Project on-line:

- For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under base case conditions.

- For both peak load and light load conditions, the addition of the [redacted] Project caused no violations of SCE's thermal loading criteria under N-1 conditions.

- The evaluation concluded that no CB replacements or upgrades are required for the [redacted] Project project.

Non-binding order of magnitude cost estimates for the required interconnection facilities and 66 kV system upgrades are as follows:

[redacted]roject interconnection facility (66 kV line loop-in)	$2.90M
Protection Upgrades	$0.30M
RTU at [redacted] Project	$0.10M
66 kV system line upgrades	$0.04M
Total non-binding order of magnitude cost estimate	$3.34M

Note: The above costs do not include the 35% ITCC tax. The 66 kV system line upgrades do not include any 131D costs.

APPENDIX A

TRANSMISSION ASSESSMENT

[redacted]

WHOLESALE DISTRIBUTION ACCESS TARIFF

SYSTEM IMPACT STUDY
TRANSMISSION ASSESSMENT

March 6, 2006

SOUTHERN CALIFORNIA
EDISON®
An *EDISON INTERNATIONAL®* Company

Prepared by
Meng Shen

Southern California Edison Company

for Patricia L Arons

[redacted]

SYSTEM IMPACT STUDY - TRANSMISSION ASSESSMENT

EXECUTIVE SUMMARY

[redacted] applied to Southern California Edison ("SCE") for Distribution Service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). Wellhead proposes to connect a single GE LM6000 simple cycle gas turbine at [redacted] generating facility in Delano, California ("Project"), with a maximum operating rating of 49.9 MW. [redacted] proposes to connect the Project to SCE's Delano-Mariposa-Captive 66 kV line for the delivery of energy to the ISO Grid at SCE's Vestal Substation. The in-service date proposed by [redacted]s June 1, 2006.

SCE has performed a System Impact Study to determine the adequacy of SCE's transmission system to accommodate the Project. The study indicated that the system is not adequate to accommodate the 49.9 MW of generation without modifications. The study did not identify any problems under Peak Load conditions except for certain N-2 contingencies. The study identified N-0, N-1 and N-2 overload problems under Off-Peak Load conditions. All the N-1 and N-2 overload problems are mitigated by the existing Big Creek RAS and Pastoria SPS. Congestion Management has been proposed to mitigate the various N-0, N-1 and N-2 overloads. The implementation of congestion management is subject to approval from the California Independent System Operator ("CAISO"). An operating study and a facilities study will be required for the Project.

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*** [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.

STUDY RESULTS

The study results show that the existing system is not adequate to accommodate the Project without upgrades.

A. Power Flow Study Conclusions

Base case
Under Peak Load conditions, there was no base case overload identified.

Under Off Peak Load conditions, one pre-project base case overload was exacerbated by the addition of the Project. The power flow on the Pardee leg of Pardee-Pastoria-Warne 230 kV increases from 1251 Amps (101%) to 1276 Amps (103%). The Total Project is subject to curtailment.

Single Contingencies

Under Peak Load conditions, there was no N-1 overload identified.

Under Off Peak Load conditions, there were [redacted] transmission lines with N-1 overloads. With the addition of the Project, the post-contingency loadings range from 102% to 138%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

Double Contingencies

Under Peak Load conditions, there were [redacted] transmission lines with N-2 overloads. With the addition of the Project, the post-contingency loadings range from 115% to 162%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

Under Off Peak Load conditions, there were six transmission lines with N-2 overloads. With the addition of the Project, the post-contingency loadings range from 115% to 212%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

B. Post-Transient Voltage Stability Study Conclusions

There were no problems identified on post-transient voltage stability with implementation of the existing Big Creek RAS and PEF SPS.

C. Transient Stability Study Conclusions

There were no problems identified on transient stability response to system contingencies with implementation of the existing Big Creek RAS and PEF SPS.

D. Short Circuit Study Conclusions

The data provided by [redacted] as impacted [redacted] 230 kV substations with increases in the short circuit duty at or above 0.1 kA. Engineering concluded that no CB replacements or upgrades are required for the Project on the Bulk Power System.

SCOPE OF WORK FOR FACILITIES STUDY

The scope of work for facilities study includes the following:

1. Develop cost to interconnect the Project in Vestal 66 kV system.
2. Develop congestion management procedure for the [redacted]. The procedure is subject to approval from CAISO.

The scope of upgrades identified in the previous System Impact Studies to accommodate the projects in queue ahead of the Project will include the following. These costs are not allocated to the [redacted]

1. Antelope-Vincent-Rio Hondo-Mesa 230 kV T/L upgrades:
    a. Tear down both existing Antelope-Mesa 230 kV and Antelope-Vincent 230 kV T/Ls.
    b. Construct second new Antelope-Vincent 500 kV T/L initially energized at 230 kV (2B-2156 ACSR conductor).
    c. Construct new Rio Hondo-Mesa 230 kV T/L initially energized at 230 kV (2B-1033 ACSR conductor).

    Cost Estimate: $65,000,000

2. Antelope-Cottonwind upgrades:
    a. New 230 kV Cottonwind station to be located approximately 20 miles northwest of the Antelope 230 kV substation adjacent to existing Antelope-Magunden No.2 230 kV transmission line.
    b. Tear-down approximately 20-mile portion of the existing Antelope-Magunden No.2 230 kV between Antelope and new Cottonwind substation and construct with new double-circuit 230 kV stringing both sides and connecting to new substation.
    c. Connect the remaining section of the existing Antelope-Magunden No.2 230 kV transmission line to the new substation.

    Cost Estimate: $58,000,000

3. Transmission upgrades between Pastoria and Pardee. The scope of work has not been determined for this upgrade.
    Cost Estimate: Unknown at this time.

Note:

a. The above cost estimates are order of magnitude estimates subject to change based on results of the Facilities Study.
b. 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.

TABLE OF CONTENTS

[redacted]

WHOLESALE DISTRIBUTION ACCESS TARIFF

SYSTEM IMPACT STUDY
TRANSMISSION ASSESSMENT

I. INTRODUCTION

[redacted] pplied to Southern California Edison ("SCE") for Distribution Service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] propose to connect a single GE LM6000 simple cycle gas turbine at [redacted] generating facility in Delano, California ("Project"), with a maximum operating rating at 49.9 MW. [redacted] proposes to connect the Project to SCE's Delano-Mariposa-Captive 66 kV line for the delivery of energy to the ISO Grid at SCE's Vista Substation. The in-service date proposed b [redacted] s June 1, 2006.

SCE has performed a System Impact Study to determine the adequacy of SCE's transmission system to accommodate the Project. The study indicated that the system is not adequate to accommodate the 49.9 MW of generation without modifications. An operating study and a facilities study will be required for the Project.

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*** [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) 2006 Peak Load with very high internal northern area generation and Midway – Vincent (Path 26) flow at its maximum rating of 4000 MW, and (b) 2007 Off-Peak load with very high internal northern area generation and Midway – Vincent (Path 26) flow at its maximum rating of 4000 MW. These conditions reflected the most critical expected loading conditions for the transmission system in SCE's northern area.

II. 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 Planning Criteria

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 and contingency 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.

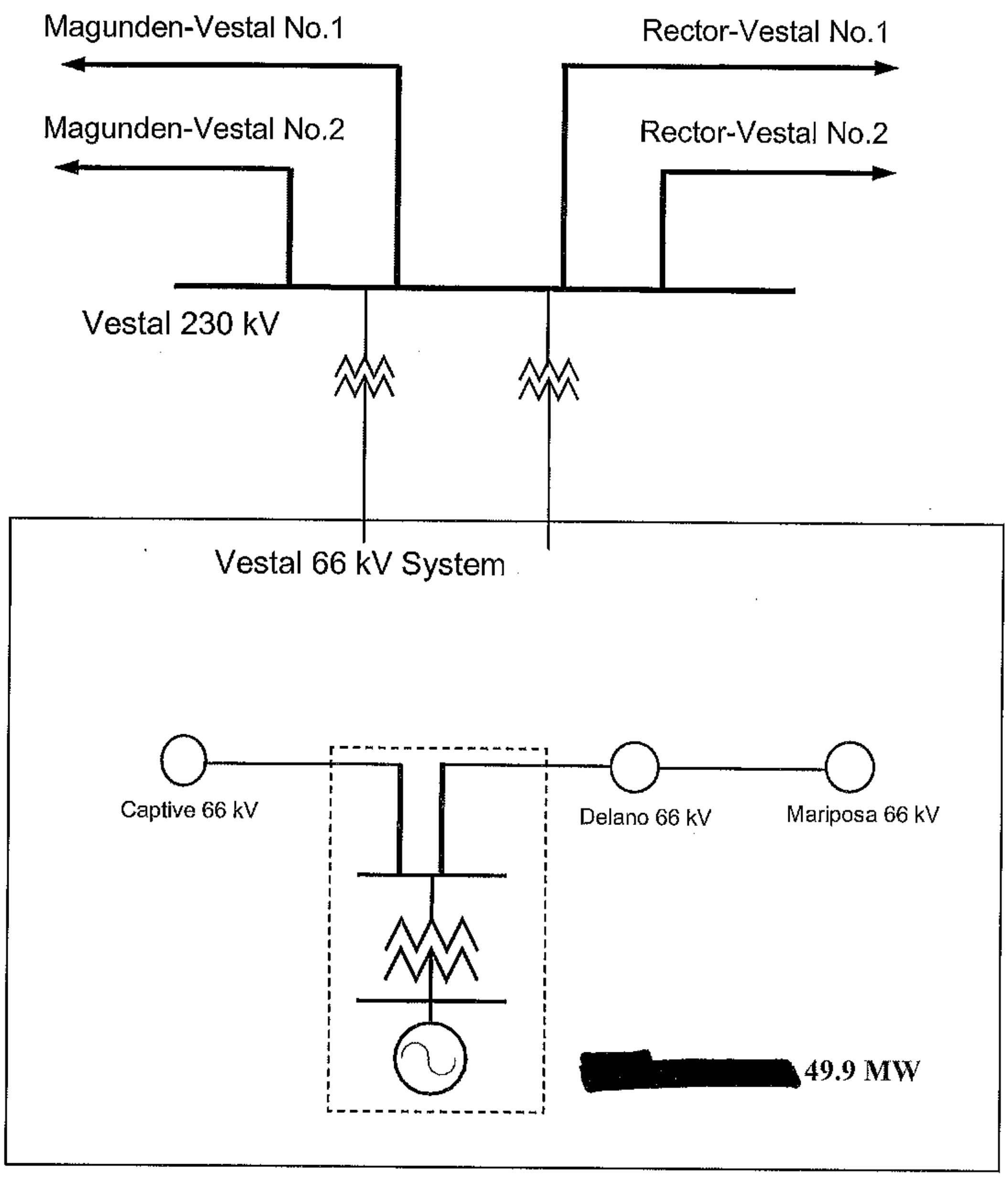
B. [redacted]

[redacted] proposes to connect the Project to SCE's Delano-Mariposa-Captive 66 kV line for the delivery of 49.9 MW of energy to the ISO Grid at SCE's Vestal Substation. The in-service date proposed by [redacted] is June 1, 2006. Figure 1 displays the equivalent one line diagram that Transmission & Interconnection Planning use to model the new generation.

FIGURE 1

[redacted]

SCHEMATIC 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 SCE Annual CAISO Controlled Transmission Assessment. In order to identify the facilities upgrades triggered by the Project, System Impact studies considered the existing system arrangement with the addition of all planned transmission projects and the proposed transmission upgrades to accommodate higher-queued projects in SCE Big Creek Corridor. All transmission projects and special protection schemes are listed below.

1. The following are planned transmission projects in SCE Big Creek Corridor:
   - South of Pastoria Infrastructure Replacement Project which increases the normal line rating of Pastoria – Bailey, Bailey – Pardee and Pastoria – Pardee 230 kV lines from 885 amps to 1500 amps.

   - Segment 1 of Antelope Transmission Project – a new Antelope – Pardee 500 kV transmission line (bundled 2156 ACSR) initially energized at 230 kV.

   - Segment 2 of Antelope Transmission Project – a new Antelope – Vincent 500 kV transmission line (bundled 2156 ACSR) initially energized at 230 kV.

   - Segment 3 of Antelope Transmission Project:
     - A new radial 500 kV transmission line (bundled 2156 ACSR) initially energized at 230 kV from the Antelope substation to the potential location of a conceptual substation hub refer to the Tehachapi Substation #1 near Cal Cement.
     - A new 230 kV transmission line (bundled 1590 ACSR) from the location of the Tehachapi Substation #1 to the location of a second conceptual substation referred to as Tehachapi Substation #2 near Monolith.
     - A new substation near Monolith with two line positions (one for line to Antelope and one for line to the Barren Ridge I Wind Project which then continues to the Barren Ridge II wind Project) referred to as Tehachapi Substation #2.

2. The following are proposed transmission projects to accommodate higher-queued projects in SCE Big Creek Corridor:
   - Antelope-Vincent-Rio Hondo-Mesa 230 kV T/L upgrades:
     - Tear down both existing Antelope-Mesa 230 kV and Antelope-Vincent 230 kV T/Ls.
     - Construct second new Antelope-Vincent 500 kV T/L initially energized at 230 kV (2B-2156 ACSR conductor).
     - Construct new Rio Hondo-Mesa 230 kV T/L initially energized at 230 kV (2B-1033 ACSR conductor).
   - Antelope-Cottonwind upgrades:
     - New 230 kV switching station to be located approximately 20 miles northwest of the Antelope 230 kV substation adjacent to existing Antelope-Magunden No.2 230 kV transmission line
     - Tear-down approximately 20-mile portion of the existing Antelope-Magunden No.2 230 kV between Antelope and new substation and construct with new double-circuit 230 kV stringing both sides and connecting to new substation.
     - Connect the remaining section of the existing Antelope-Magunden No.2 230 kV transmission line to the new substation.

- Modify the existing Pastoria Energy Facility Special Protection Scheme to accommodate one higher-queued project.

The bulk power study considered scenarios that evaluated maximum Midway – Vincent (Path 26) imports and maximum generation from Big Creek hydro units, Tehachapi Wind generation, market generation and Qualified Facilities in the Northern area. These conditions were evaluated to identify critical case scenarios that would stress the SCE 500-kV transmission system network and the 230 kV Big Creek corridor. In addition, the study considered two system load conditions: 2006 Peak Load Conditions and 2007 Off Peak Load Conditions.

rvice.

E. Pastoria Energy Facility Special Protection System

The initial Pastoria Energy Facility 750 MW project was interconnected with minimal transmission upgrades but required implementation of a Special Protection System (PEF SPS) for loss of one or two transmission facilities. This SPS is in service and has operated several times as designed. The following outlines the existing outages that can result in the potential operation of the PEF SPS:

Single Outages

Maintenance Outages

Under maintenance conditions, the proposed PEF SPS will arm the entire Pastoria Energy Facility (750 MW) to trip for the next outage condition.

For loss of two transmission lines, the entire PEF project is tripped thereby requiring only one arming point. An additional arming point is utilized to handle maintenance outages and overlapping outages.

The existing PEF SPS needs to be modified to include the tripping of one higher-queued project for the loss of two transmission lines.

F. Power Flow Study

Power flow studies were conducted under 2006 Peak Load Conditions and 2007 Off Peak 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) 2006 Peak Load Conditions: Case 1 **without** the Project and Case 2 **with** the Project. All currently planned transmission upgrades, higher-queued generation projects and transmission upgrades to accommodate higher-queued generation projects in the Big Creek corridor are modeled.

b) 2007 Off Peak Load Conditions: Case 3 **without** the Project and Case 4 **with** the Project. All currently planned transmission upgrades, higher-queued generation projects and transmission upgrades to accommodate higher-queued generation projects in the Big Creek corridor are modeled.

With the addition of the Project, SCE's area total generation, imports, loads, and losses for each case are summarized in Table 2.2 below:

Table 2.2 Power Flow Cases

SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW)		
	2006 Peak Load Conditions	2007 Off Peak Load Conditions

G. Post Transient Voltage Stability 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.

H. Transient Stability Study

For transient stability evaluation, three-phase faults with normal clearing are studied for single contingencies; single-line-to-ground faults with delayed clearing are studied for double contingencies according to NERC/WECC planning criteria.

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 (provided below) 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 (in addition to NERC requirements)
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	Not Applicable	Nothing in Addition to NERC		
B	≥ 0.33	Not to exceed **25%** at load buses or **30%** at non-load buses. Not to exceed **20% for more than 20 cycles** at load buses.	Not below **59.6 Hz** for 6 cycles or more at a load bus	Not to exceed **5%** at any bus
C	0.033 – 0.33	Not to exceed 30% at any bus. Not to exceed **20% for more than 40 cycles** at load buses.	Not below **59.0 Hz** for 6 cycles or more at a load bus	Not to exceed **10%** at any bus
D	< 0.033	Nothing in Addition to NERC		

Note 2: As an example in applying the WECC Disturbance-Performance Table, Category B disturbance in one system shall not cause a transient voltage dip in another system that is greater than 20% for more than [redacted] cycles at load buses, or exceed 25% at load buses or 30% at non-load buses at any time other than during the fault.

I. Short Circuit Duty

The data provided by [redacted] s used to evaluate short circuit duty impact on bulk power substations with duty increase at or above 0.1 kA.

III. POWER FLOW STUDY RESULTS

A. 2006 Peak Load Results

Base Case

There are no base case overloads triggered by the addition of the Project.

Single Contingencies (N-1)

There are no N-1 overloads triggered by the addition of the Project.

Double Contingencies (N-2)

With the addition of the Project, the power flow study identified four transmission lines with N-2 overloads under peak load conditions. The worst overloads for each overloaded line are shown in the Table 3-1 below. Refer to Table B-1 in Appendix B for detailed results.

Sensitivity Studies showed that all the N-2 overloads would be mitigated by PEF SPS and Big Creek RAS.

Table 3-1. Worst N-2 overloads (2006 Peak Load Results)

B. 2007 Off Peak Load Results

Base Case

With the addition of the Project, the power flow study identified the loading on the Pardee leg of Pardee-Pastoria-Warne 230 kV increased from 1251 Amps (101%) to 1276 Amps (103%).

Single Contingencies (N-1)

With the addition of the Project, the power flow study identified four transmission lines with N-1 overloads under off peak load conditions. The worst overloads for each overloaded line are shown in the Table 3-2 below. Refer to Table B-2 in Appendix B for all the overloads.

Sensitivity Studies showed that all the N-1 overloads would be mitigated by PEF SPS and Big Creek RAS.

Table 3-2. Worst N-1 overloads (2007 Off Peak Load Results)

Double Contingencies (N-2)

With the addition of the Project, the power flow study identifie[redacted]transmission lines with N-2 overloads under spring conditions. The worst overloads for each overloaded line are shown in the Table 3-4 below. Refer to Table B-2 for in Appendix B for all the overloads.

Sensitivity Studies showed that all the N-2 overloads would be mitigated by PEF SPS and Big Creek RAS.

Table 3-4. Worst N-2 overloads (2007 Spring Results)

Overloaded Transmission Facilities	Transmission Outage	Normal Rating	Emergency Rating	Pre Project		Post Project		Project Impact	
		Amps	Amps	Amps	Percent	Amps	Percent	Amps	Percent

IV. POST TRANSIENT VOLTAGE STUDY RESULTS

With implementation of the existing Big Creek RAS and PEF SPS, there were no additional identified post transient voltage criteria violations due to the addition of the Project. Refer to Appendix C for a list of contingencies performed and Appendix D for the results of post-transient runs.

V. TRANSIENT STABILITY STUDY RESULTS

A. GE PSLF Version 15.1 Models

GE PSLF Version 15.1 supports the generator dynamic models proposed b[redacted]for the Project.

<u>GENROU</u>

This model is used to represent the machine dynamics for the generators.

<u>REXS</u>

This model is used to represent the exciter dynamics for the generators.

<u>GGOV1</u>

This model is used to represent the turbine/governor dynamics for the generators.

<u>PSS2A</u>

This model is used to represent the power system stabilizer dynamics for the generators.

The parameter values for each of the 4 models were provided by [redacted]

B. Transient Stability Study Results

With implementation of the existing Big Creek RAS and PEF SPS, transient stability studies determined that the system remained stable under both single and double contingency outage conditions with the addition of the Project. Transient stability studies shared the same list of contingencies as in Appendix C.

Transient stability plots including the Project were provided in Appendix E and F.

Appendix E illustrated Peak Load condition system response plots after contingencies for Pre-project case and Post-Project case.

Appendix F illustrated Off-Peak Load condition system response plots after contingencies for Pre-project case and Post-Project case.

VI. 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 Project has increased the short circuit duty at the substation facilities listed below. Engineering evaluation concluded that no CB replacements or upgrades are required for the Project.

Table 4-1 Three Phase (3PH) Short Circuit Duty Study Results

VII. CONCLUSIONS

A. Power Flow Study Conclusions

Base case

Under Peak Load conditions, there was no base case overload identified.

Under Off Peak Load conditions, one pre-project base case overload was exacerbated by the addition of the Project. The power flow on the Pardee leg of Pardee-Pastoria-Warne 230 kV increases from 1251 Amps (101%) to 1276 Amps (103%). The Total Project is subject to curtailment.

Single Contingencies

Under Peak Load conditions, there was no N-1 overload identified.

Under Off Peak Load conditions, there were four transmission lines with N-1 overloads. With the addition of the Project, the post-contingency loadings range from 102% to 138%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

Double Contingencies

Under Peak Load conditions, there were four transmission lines with N-2 overloads. With the addition of the Project, the post-contingency loadings range from 115% to 162%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

Under Off Peak Load conditions, there were six transmission lines with N-2 overloads. With the addition of the Project, the post-contingency loadings range from 115% to 212%. The overloads are mitigated by the existing Big Creek RAS and PEF SPS. The Total Project is subject to curtailment.

B. Post Transient Voltage Stability Study Conclusions

There were no problems identified on post-transient voltage stability by the addition of the Project with implementation of the existing Big Creek RAS and PEF SPS.

C. Transient Stability Study Conclusions

There were no problems identified on transient stability response to system contingencies with implementation of the existing Big Creek RAS and PEF SPS.

D. Short Circuit Duty Study Conclusions

The data provided by [redacted] has impacted two 230 kV substations with increases in the short circuit duty at or above 0.1 kA. Engineering concluded that no CB replacements or upgrades are required for the Project on the Bulk Power System.

VIII. SCOPE OF WORK FOR FACILITIES STUDY

The scope of work for facilities study includes the following:

1. Develop cost to interconnect the Project in Vestal 66 kV system.
2. Develop congestion management procedure for the [redacted]. The procedure is subject to approval from CAISO.

The scope of upgrades identified in the previous System Impact Studies to accommodate the projects in queue ahead of the Project will include the following. These costs are not allocated to the [redacted]

1. Antelope-Vincent-Rio Hondo-Mesa 230 kV T/L upgrades:
   a. Tear down both existing Antelope-Mesa 230 kV and Antelope-Vincent 230 kV T/Ls.
   b. Construct second new Antelope-Vincent 500 kV T/L initially energized at 230 kV (2B-2156 ACSR conductor).
   c. Construct new Rio Hondo-Mesa 230 kV T/L initially energized at 230 kV (2B-1033 ACSR conductor).
2. Antelope-Cottonwind upgrades:
   a. New 230 kV Cottonwind station to be located approximately 20 miles northwest of the Antelope 230 kV substation adjacent to existing Antelope-Magunden No.2 230 kV transmission line

b. Tear-down approximately 20-mile portion of the existing Antelope-Magunden No.2 230 kV between Antelope and new Cottonwind substation and construct with new double-circuit 230 kV stringing both sides and connecting to new substation.
c. Connect the remaining section of the existing Antelope-Magunden No.2 230 kV transmission line to the new substation.

3. Transmission upgrades between Pastoria and Pardee. The scope of work has not been determined for this upgrade.

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.

APPENDIX A. Power Flow Diagrams

2006 Peak Load Case Power Flow Diagram (Pre Project)

2006 Peak Load Case Power Flow Diagram (Post Project)

2007 Off-Peak Load Case Power Flow Diagram (Pre Project)

2007 Off-Peak Load Case Power Flow Diagram (Post Project)

PAGES OMITTED FOR
CEII REGULATIONS