

WDT 230

System Impact Study

December 22, 2006

Prepared by:

Eric Hester – Distribution Engineering
Roger Salas P.E. – Distribution Engineering



SOUTHERN CALIFORNIA
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Approved by:

A handwritten signature in black ink, appearing to read 'Randy R. Smith', with a stylized flourish at the end.

Randy R. Smith
Engineering Manager

EXECUTIVE SUMMARY

[REDACTED] applied to Southern California Edison ("SCE") Transmission and Distribution Business Units (TDBU) for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [REDACTED] will own and operate a 45.5 MW generating facility [REDACTED] to be interconnected at a new interconnection facilities to be constructed by SCE. [REDACTED] substation will be served by tapping the Etiwanda-Ameron-Pipe transmission line coming from Etiwanda 66KV switchrack. Distribution service pursuant to the WDAT is proposed to be from the [REDACTED] to the California Independent System Operator ("ISO") grid at SCE's 230 kV Etiwanda Substation. The proposed in-service date of the [REDACTED] is July 2, 2007.

The [REDACTED] is a generation system consisting of [REDACTED] 13.8 kV, 71.2 KVA LM6000 Gas Turbine with net generation export of 44.5 MW. The generation facility will utilize [REDACTED] 45 MVA, 13.8 kV/66 kV step-up transformer to interconnect the generator to the SCE's system. As requested by [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, 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, three-phase analysis and single-line-to-ground short circuit duty to determine whether the energy associated with the [REDACTED] can be transmitted through SCE's system to the ISO grid at Etiwanda Substation, without creating the need for modifications to SCE's system and/or the ISO grid. The study showed that, with the [REDACTED] Plant on-line:

- Thermal loadings on the SCE subtransmission facilities used to provide the requested WDAT service were all within criteria limits.
- [REDACTED] 66kV breakers will need to be replaced and [REDACTED] 230kV breaker needs to be upgraded due to the [REDACTED]
- Appendix B details study results for the ISO-controlled transmission grid.

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

Interconnection (Substation and 66kV interconnection tie line)	\$1.69M
Protection Upgrades	\$0.30 M
New IT Facilities	\$0.25 M
RTU installed at [REDACTED]	\$ 0.05M
Circuit breaker replacements (66 kV, 230 kV)	\$ 4.86M
35% ITCC Tax	\$ 2.50M
Total non-binding order of magnitude cost estimate	\$9.65M

Additional system studies (i.e., transient stability) will not be required unless requested by a third party. Refined cost estimates will be developed in a subsequent Facilities Study if requested GBU. Non-binding cost estimate does not include any GO 131D costs.

CONTENTS

	<u>PAGE</u>
1. INTRODUCTION	1
2. STUDY CONDITIONS AND METHODOLOGY	2
2.A Planning Criteria	2
2.B System Load Conditions	2
2.C Power Flow Study	2
2.D Short-Circuit Duty Study	2
3. DISCUSSION OF STUDY RESULTS	2
3.A Power Flow Study	2
3.B Short-Circuit Duty Study	3
4. NON-BINDING ORDER OF MAGNITUDE COST ESTIMATES	4
5. CONCLUSIONS	4

APPENDIX

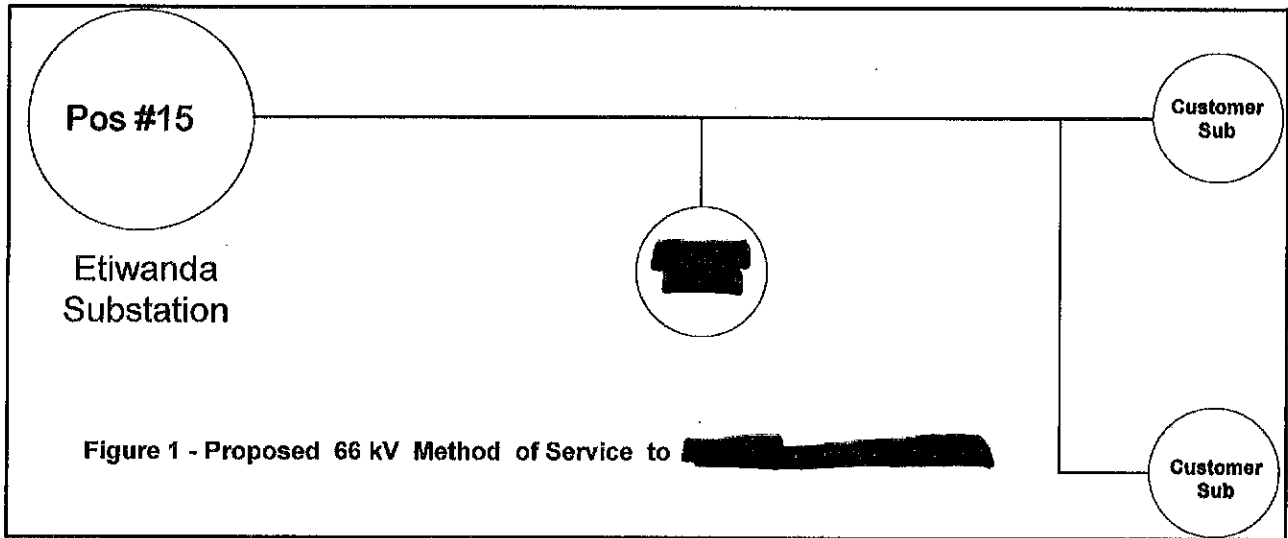
- A. Operational Summary
- B. Transmission Assessment

[REDACTED]

December 22, 2006

1. INTRODUCTION

[REDACTED] applied to Southern California Edison ("SCE") Transmission and Distribution Business Units (TDBU) for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [REDACTED] will own and operate a 45.5 MW generating facility [REDACTED] to be interconnected at a new interconnection facilities to be constructed by SCE. [REDACTED] will be served by tapping the Etiwanda-Ameron-Pipe transmission line coming from Etiwanda 66KV switchrack, as shown on Figure 1.



Distribution service pursuant to the WDAT is proposed to be from the [REDACTED] to the California Independent System Operator ("ISO") grid at SCE's 230 kV Etiwanda Substation. The proposed in-service date of the [REDACTED] is July 2, 2007.

The [REDACTED] is a generation system consisting of [REDACTED] 13.8 kV, 71.2 KVA LM6000 Gas Turbine with net generation export of 44.5 MW. The generation facility will utilize [REDACTED] 45 MVA, 13.8 kV/66 kV step-up transformer to interconnect the generator to the SCE's system. As requested by [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, 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, three-phase analysis and single-line-to-ground short circuit duty to determine whether the energy associated with the [REDACTED] can be transmitted through SCE's system to the ISO grid at Etiwanda Substation, without creating the need for modifications to SCE's 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 Etiwanda 66 kV subtransmission system. Appendix C 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 considered [REDACTED] system load conditions: peak loads and light loads. The peak load forecast was based on SCE's 2006-2015 Distribution Substation Plan. The light load forecast was assumed to be 65% of the peak load forecast.

C. Power Flow Study

This study evaluated the [REDACTED] 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] to determine if the addition of the [REDACTED] caused any violations of SCE's thermal loading criteria.

D. Short-Circuit Duty Study

This study evaluated the [REDACTED] impact on three-phase and phase-to-ground short-circuit duties seen by substation circuit breakers at the 66 kV level. [REDACTED] three-phase fault currents, X/R ratios and phase-to-ground short circuit duties were calculated both with and without the [REDACTED] to determine if the addition of the [REDACTED] 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]) as on-line. Substations where the [REDACTED] increased three-phase short-circuit or the single-line-to-ground 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].

3. DISCUSSION OF STUDY RESULTS

A. Power Flow Study

For both peak load and light load conditions, the addition of the [REDACTED] 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] 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] on symmetrical three-phase short-circuit and single-line-to-ground duties at various 66 kV buses on the SCE system. [REDACTED] buses were flagged where the [REDACTED] increased three-phase short-circuit or the single-line-to-ground duties by 0.1 kA or more. A review of circuit breaker interrupting capabilities at these locations determined that [REDACTED] 66 kV circuit breakers will need to be replaced as a result of the Grapeland Peaker Plant.

Table 1: Short-Circuit Duty Summary

Bus Names	Voltage (KV)	Short-Circuit Duty (kA)		3s airing element
		3-Phase SCD	Single-Line-to-Ground	
Alder	66)
Ameron	66)
Ameron(E)	66)
Archline	66)
Arbors	66)
Declez	66)
Etiwanda	66			6
Genamic	66)
Inland	66)
Linde	66)
Randall	66)
Wimbledon	66)

4. NON-BINDING ORDER OF MAGNITUDE COST ESTIMATES

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

Interconnection (Substation and 66kV interconnection tie line)	\$1.69M
Protection Upgrades	\$0.30 M
New IT Facilities	\$0.25 M
RTU installed at [REDACTED]	\$ 0.05M
Circuit breaker replacements (66 kV)	\$ 4.72M
35% ITCC Tax	\$ 2.45M
<hr/>	
Total non-binding order of magnitude cost estimate	\$9.50M

5. CONCLUSIONS

The results of this System Impact Study showed:

- Thermal loadings on the SCE subtransmission facilities used to provide the requested WDAT service were all within criteria limits.
- [REDACTED] 66kV breakers will need to be replaced and [REDACTED] 230kV breaker needs to be upgraded due to the [REDACTED]
- Appendix B details study results for the ISO-controlled transmission grid.

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

Interconnection (Substation and 66kV interconnection tie line)	\$1.69M
Protection Upgrades	\$0.30 M
New IT Facilities	\$0.25 M
RTU installed at [REDACTED]	\$ 0.05M
Circuit breaker replacements (66 kV, 230 kV)	\$ 4.86M
35% ITCC Tax	\$ 2.50M
<hr/>	
Total non-binding order of magnitude cost estimate	\$9.65M

Additional system studies (i.e., transient stability) will not be required unless requested by a third party. Refined cost estimates will be developed in a subsequent Facilities Study if requested by [REDACTED]. Non-Binding cost estimate does not include any GO 131D costs.

66kV System Operational Study Results

Appendix A

[REDACTED] applied to Southern California Edison ("SCE") Transmission and Distribution Business Units (TDBU) for distribution service under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [REDACTED] will own and operate a 45.5 MW generating facility [REDACTED] to be interconnected at a new interconnection facilities to be constructed by SCE. [REDACTED] will be served by tapping the Etiwanda-Ameron-Pipe transmission line coming from Etiwanda 66KV switchrack. Distribution service pursuant to the WDAT is proposed to be from the [REDACTED] to the California Independent System Operator ("ISO") grid at SCE's 230 kV Etiwanda Substation. The proposed in-service date of the [REDACTED] is July 2, 2007.

As requested by [REDACTED] SCE performed an Operational Study to identify the general electrical system impacts of the [REDACTED] and the required 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 Study Conditions and Methodology are similar to those in the System Impact Study except that the dataset used for the short-circuit study analysis represented all existing generation and all projects which are expected to be on line by July 2, 2007 (including the [REDACTED]). Substations where the [REDACTED] increased short-circuit duties (three phase or phase to ground) 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].

The Operational Study showed that, with the [REDACTED] plant on-line:

- [REDACTED] 66 kV circuit breakers will need to be replaced due to the [REDACTED]

Table 1: Short-Circuit Duty Summary

Bus Names	Voltage (KV)	3 Phase SC	Single-Line-to-
Alder	66		
Ameron	66		
Ameron(E)	66		
Archline	66		
Arbors	66		
Declez	66		
Etiwanda	66		
Genamic	66		
Inland	66		
Linde	66		
Randall	66		
Wimbledon	66		

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

Interconnection (Substation and 66kV interconnection tie line)	\$1.69M
Protection Upgrades	\$0.30 M
New IT Facilities	\$0.25 M
RTU installed at [REDACTED]	\$ 0.05M
Circuit breaker replacements (66 kV)	\$ 0.36M
35% ITCC Tax	\$ 0.92M
<hr/> Total non-binding order of magnitude cost estimate	<hr/> \$3.58M

Additional system studies (i.e., transient stability) will not be required unless requested by a third party. Refined cost estimates will be developed in a subsequent Facilities Study if requested [REDACTED] Non-binding cost estimate does not include any GO 131D costs.



SYSTEM IMPACT STUDY

December 18, 2006



SOUTHERN CALIFORNIA
EDISON[®]
An EDISON INTERNATIONAL[®] Company

Prepared by

Brandon Besch / David Franklin

Southern California Edison Company

Patricia C. Arons
Approved by Patricia Arons
for

EXECUTIVE SUMMARY

INTRODUCTION

[REDACTED] applied to Southern California Edison Transmission Distribution Business Unit (TDBU) for Interconnection pursuant to Wholesale Distribution Access Tariff (WDAT). [REDACTED] proposed to interconnect a new 44.55 MW generation project [REDACTED] to the 66kV bus at Etiwanda substation. The in-service date proposed by [REDACTED] is July 2, 2007. *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]*

Southern California Edison Company (SCE) has performed a System Impact Study (SIS) to determine the adequacy of SCE's transmission system to accommodate the [REDACTED]. The results of the SIS will be used as the basis to determine project cost allocation for facility upgrades in the Facilities Study. The study indicates that the system is adequate to accommodate the 44.55 MW of generation without transmission line modifications. However, Circuit Breaker replacements, for greater capacity, are required. A Facilities Study will be required for the [REDACTED].

RESULTS / CONCLUSION

POWER FLOW STUDY RESULTS

The power flow study results show that no overloading problems are found on the transmission lines for base-case, N-1 and N-2 contingencies. Specifically:

Base Case (spring and summer Conditions)

There were no base case overloads attributed to [REDACTED]

Single Contingencies (spring and summer Conditions)

There were no single contingency overloads attributed to [REDACTED]

Double Contingencies (spring and summer Conditions)

There were no double contingency overloads attributed to [REDACTED]

TRANSIENT STABILITY AND POST TRANSIENT STUDIES

SCE used study findings from earlier Interconnection Studies for large projects electrically close to this project and concluded that there are no negative transient stability and post – transient impacts to the SCE transmission system from this proposed project.

SHORT CIRCUIT DUTY STUDY RESULTS

3-PHASE FAULT DUTY

Evaluate the need for circuit breaker replacement at [REDACTED] – 500kV substation and [REDACTED] – 230kV substation.

SINGLE – LINE TO GROUND FAULT DUTY

Evaluate the need for circuit breaker replacement at [REDACTED] – 500kV substations and [REDACTED] – 230kV substations.

SCOPE OF WORK

No SCE Transmission System related components (Circuit Breakers and Transmission Lines) are triggered by the [REDACTED]. Distribution related components will be addressed by the Field Engineering SIS. The [REDACTED] is only exposed to Case B cost triggered by projects ahead of [REDACTED] in the queue.

Power Flow Study Conclusions

BASE CASE (spring and summer conditions)

There were no base case overloads attributed to [REDACTED]

SINGLE CONTINGENCIES (spring and summer conditions)

There were no single contingency overloads attributed to [REDACTED]

DOUBLE CONTINGENCIES (spring and summer conditions)

There were no double contingency overloads attributed to [REDACTED]

Transient Stability and Post Transient Studies

SCE used study findings from earlier Interconnection Studies for large projects electrically close to this project and concluded that there are no negative transient stability and post – transient impacts to the SCE transmission system from this proposed project.

Short Circuit Duty Study Conclusions

3-PHASE FAULT DUTY

Evaluate the need for circuit breaker replacement at [REDACTED] – 500kV substation and [REDACTED] – 230kV substation.

Bus Name	Bus KV	PRE CASE		POST CASE		DELTA KA
		V/D	KA	V/D	KA	
Serrano						
Alamitos West						
Chino						
Etiwanda						
Hinson						
Mira Loma East						
Mira Loma West						
San Bernardino						
Vincent						
Vista						

SINGLE - LINE TO GROUND FAULT DUTY

Evaluate the need for circuit breaker replacement at [redacted] - 500kV substations and [redacted] - 230kV substations.

Bus Name	Bus KV	PRE CASE		POST CASE		DELTA KA
		X/R	KA	X/R	KA	
Lugo	525	12.3	33.2	12.3	33.3	0.1
Etiwanda	230	15.3	36.7	15.3	37.1	0.4
Mira Loma B	230	13.1	57.1	13.1	57.4	0.3
San Bernardino	230	20.4	37.8	20.3	37.9	0.1
Serrano	230	19.6	54.8	19.6	54.9	0.1
Vista	230	13.8	38.9	13.8	39	0.1

COST OF UPGRADES

No overload problems were identified for [redacted]. This project did not increase any existing loading by 1% or more.

Engineering has evaluated the circuit breakers at all substations where the project contributed to the Short Circuit Duty results in an increase of 0.1kA or greater.

Circuit breaker replacements and upgrades to accommodate the generation interconnection on the SCE network are listed below. This study has not assumed overload mitigation requirements for projects ahead of the queue. The total cost of 37,111,000 was not triggered by the [redacted] and only shown as maximum exposure in case of changes in the queue.

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

CASE A - Triggered by [redacted] Etiwanda Project

STATION	SYSTEM	Replace	Upgrade	Sets of TRV's required	Cost of CB	Cost of TRV set of 3	Sub-Total CB	Sub-Total TRV	GRAND TOTAL
Chino	220kV		1	1		\$ 144,000	\$ -	\$ 144,000	\$ 144,000
		0	1				\$ -	\$ 144,000	\$ 144,000

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

STATION	SYSTEM	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	24			\$ 629,000		\$ 15,096,000	\$ -	\$ 15,096,000

Mesa *	220kV	23			\$ 629,000		\$ 14,467,000	\$ -	\$ 14,467,000
Mira Loma*	220kV	12			\$ 629,000		\$ 7,548,000	\$ -	\$ 7,548,000
		59	0				\$ 37,111,000	\$ -	\$ 37,111,000

*Additional costs of upgrading the Etiwanda, Mira Loma and Mesa 220kV Switchyards to 83kA is approximately \$15,000,000 at each location.

**Requires SCE's Field Engineering concurrence.

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. All cost estimates are rough order of magnitude, and are non-binding cost estimates.

CONTENTS

INTRODUCTION.....	2
STUDY CONDITIONS AND ASSUMPTIONS	3
POWER FLOW STUDY RESULTS	10
TRANSIENT STABILITY AND POST TRANSIENT STUDIES	10
SHORT CIRCUIT DUTY STUDY RESULTS.....	10
SCOPE OF WORK.....	11
Power Flow Study Conclusions.....	11
Transient Stability and Post Transient Studies Conclusion	11
Short Circuit Duty Study Conclusions.....	12
COST OF UPGRADES	12
APPENDIX A APPLICATION QUEUE	

[REDACTED]

SYSTEM IMPACT STUDY

December 18, 2006

INTRODUCTION

[REDACTED] applied to Southern California Edison Transmission Distribution Business Unit (TDBU) Interconnection pursuant to Wholesale Distribution Access Tariff (WDAT). [REDACTED] proposed to interconnect a new 44.55 MW generation project [REDACTED] to the 66kV bus at Etiwanda substation. The in-service date proposed by [REDACTED] is July 2, 2007.

Southern California Edison Company (SCE) 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 adequate to accommodate the 44.55 MW of generation without modifications. However, Circuit Breaker replacements, for greater capacity, are required. 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 [REDACTED].* Any changes from the attached data could void the study results.

The study was performed for two system conditions: (a) 2007 heavy summer load forecast (one-in-ten-year heat wave assumption) with maximum eastern area generation, high East-of-River/West-of-River (EOR/WOR) power flow, and high power flow into the Devers 500-kV substation, and (b) 2007 spring load forecast (65% of 2007 heavy summer peak load) with maximum eastern area generation, high EOR/WOR power flow, and high power flow into the Devers 500-kV substation. These conditions reflect the most critical expected loading condition for the transmission system in SCE's eastern area.

STUDY CONDITIONS AND ASSUMPTIONS

A. Planning Criteria

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

Power Flow Assessment

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

Assuming the largest unit (San Onofre Unit 2 or 3) initially off and then:

- Single Contingencies (loss of one line or one AA-Bank)

Assuming both San Onofre Units in service and then:

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

The following criteria are used:

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

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

Congestion Assessment

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

- Congestion management, as a means to mitigate base case overloads, can be used if it is determined to be manageable and the CAISO concurs with the implementation.
- Facility upgrades will be required if it is determined that the use of congestion management is unmanageable as defined in the congestion management section that follows.

- Special protection schemes (SPS), in lieu of facility upgrades, will be recommended if the scheme is effective, does not jeopardize system integrity, does not exceed the current CAISO single and double contingency tripping limitations, does not adversely effect existing or proposed special protection schemes in the area, and can be readily implemented.
- Facility upgrades will be required if use of protection schemes is determined to be ineffective, the amount of tripping exceeds the current CAISO single and double contingency tripping limitations, adverse impacts are identified on existing or currently proposed special protection schemes, or the scheme cannot be readily implemented.
- Congestion management in preparation for the next contingency will be required, with CAISO concurrence, if no facility upgrades or special protection schemes are implemented.

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

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

If the normal loading limits of facilities are exceeded in (a), the overload is identified as an existing overload that was triggered by a project in queue ahead of the [REDACTED]. 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).

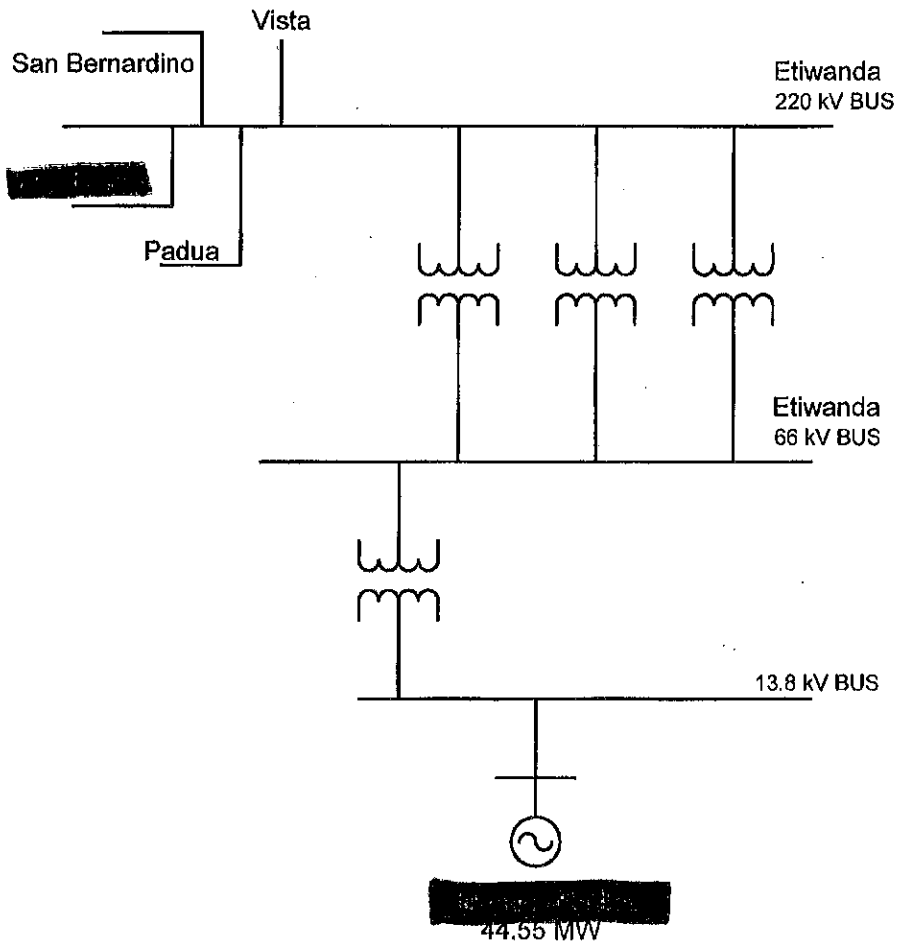
The results of these studies should identify:

- 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. Modeling the [REDACTED]

The proposed [REDACTED] is geographically located on the parcel of land in the Northwest corner of SCE's Etiwanda Substation property. The Project is proposed to connect to the 66kV bus at Etiwanda Substation with a loop or tap of the existing Ameron – Pipe 66kV distribution line. A one-line of the proposed interconnection is shown below in Figure 1.

GBU **[REDACTED]** FIGURE 1
SINGLE LINE DIAGRAM



C. System Conditions

To simulate the SCE transmission system for analysis, the study selected the databases that were used to conduct the CAISO Controlled Transmission 2005-2009 Assessment. Power flow studies considered the existing system arrangement and reflected other transmission projects that occupy a higher position on the application queue. For example:

- Palo Verde-Devers No. 2 500-kV line was modeled in service
- All four West of Devers 230-kV lines have been upgraded
- Rancho Vista 500/230-kV substation was modeled in service
- Devers-Mirage 115-kV system is split into separate, radial, Devers and Mirage 115-kV systems.
- Oak Valley 230/115-kV substation is modeled.
- Jurupa 230/66-kV substation is modeled in service.

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 vicinity. In addition, the study considered two system load conditions: 2007 heavy summer and 2007 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. For the Devers 115-kV system, the local A-bank peak forecast was modeled to simulate the worst case loading conditions.

The 2007 forecast was modified to reflect the inclusion of projects that would not be in service by 2007 but still occupy a higher position on the application queue than the [REDACTED]. The 2005-2014 spring load forecast assumed 65% of heavy summer load forecast for the bulk transmission system except for the Devers system, which assumed 50% to reflect the most stressed conditions in the Devers 115-kV system.

D. Power Flow Study

The Power Flow Study was conducted under 2007 heavy summer and 2007 spring load conditions with and without the [REDACTED] for a total of 4 cases. Further description of the case assumptions follows:

a) *2007 Spring:*

Case 1 **without** and Case 2 **with** the [REDACTED]

These [REDACTED] cases assumed 2007 spring load (65% of summer peak load for the total system) with maximum generation in SCE's eastern area, maximum EOR/WOR power flow, and high power flow into Devers 500-kV substation. 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]

b) *2007 Summer:*

Case 3 **without** and Case 4 **with** the [REDACTED]
 These [REDACTED] cases assumed 2007 heavy summer load with maximum generation in SCE's eastern area electrical system, maximum BOR/WOR power flow, and high power flow into Devers 500-kV substation. 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]

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

SCE AREA TOTAL GENERATION, IMPORT, LOAD AND LOSSES (MW)				
	2007 Spring		2007 Summer	
	Case 1 (without project)	Case 2 (with project)	Case 3 (without project)	Case 4 (with project)
Generation	11,301.4	11301.1	16,572	16,573
Import	5,004.1	5,002.9	8,604	8,604
Load	15,622.9	15,622.9	24,490	24,490
Losses	682.6	680.6	686	687

E. Post Transient Voltage Study

Those contingencies that show significant voltage deviations in the power flow analysis are selected for further analysis using governor power flow analysis. Typically, voltage deviations of 5% or more in the power flow analysis are flagged for the post transient voltage study. The voltage deviations are compared to the SCE guidelines of 7% for single contingency outages and 10% for double contingency outages.

F. Transient Stability Study

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

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

2. During the transient period, generator is required to remain in-service for the low voltage and frequency excursions specified in WECC Table W-1 (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
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

20 cycles at load buses, or exceed 25% at load buses or 30% at non-load buses at any time other than during the fault.

G. Short Circuit Duty Study

The data provided by the [REDACTED] was used to determine the impact on short circuit duty to determine the needs for circuit breaker upgrades.

POWER FLOW STUDY RESULTS

Spring and Summer Results

Base Case

There were no base case overloads attributed to [REDACTED]

Single Contingencies

There were no single contingency overloads attributed to [REDACTED]

Double Contingencies

There were no double contingency overloads attributed to [REDACTED]

TRANSIENT STABILITY AND POST TRANSIENT STUDIES

SCE used study findings from earlier Interconnection Studies for large projects electrically close to this project and concluded that there are no negative transient stability and post – transient impacts to the SCE transmission system from this proposed project.

SHORT CIRCUIT DUTY STUDY RESULTS

A. Short Circuit Duty Study Results

The following charts show the pre-project and post project 3-phase and single line to ground short circuit duties, as well as the incremental short circuit duty contribution of the [REDACTED]. These charts include buses at which the incremental short circuit duty contribution of the project is 0.1 kA or greater, and where the 3-phase short circuit duty is at 60% or greater of the rated interrupting current of the lowest rated component at the station.

Bus Name	Bus
Serrano	
Alamitos West	
Chino	
Etiwanda	
Hinson	
Mira Loma East	
Mira Loma West	

San Berna
Vincer
Vista

<u>Bus Name</u>
Lugo
Etiwanda
Mira Loma B
San Bernardino
Serrano
Vista

In the event that any Applicant presently placed ahead of the [REDACTED] in the Application Queue withdraws the Application, the Short Circuit Duties will be re-calculated and all circuit breakers will be re-evaluated. The new evaluation may conclude that the [REDACTED] would be responsible for some or all of the replacements and upgrades identified in the pre-project case.

SCOPE OF WORK

No SCE Transmission System related components (Circuit Breakers and Transmission Lines) are triggered by the [REDACTED]. Distribution related components will be addressed by the Field Engineering SIS. The [REDACTED] is only exposed to Case B cost triggered by projects ahead of Center in the queue.

Power Flow Study Conclusions

BASE CASE (spring and summer conditions)

There were no base case overloads attributed to [REDACTED]

SINGLE CONTINGENCIES (spring and summer conditions)

There were no single contingency overloads attributed to [REDACTED]

DOUBLE CONTINGENCIES (spring and summer conditions)

There were no double contingency overloads attributed to [REDACTED]

Transient Stability and Post Transient Studies Conclusion

SCE used study findings from earlier Interconnection Studies for large projects electrically close to this project and concluded that there are no negative transient stability and post – transient impacts to the SCE transmission system from this proposed project.

Short Circuit Duty Study Conclusions

3-PHASE FAULT DUTY

Evaluate the need for circuit breaker replacement at [REDACTED] - 500kV substation and [REDACTED] - 230kV substation.

Bus Name	Bi	PRE CASE	POST CASE
Serrano			
Alamitos West			
Chino			
Etiwanda			
Hinson			
Mira Loma East			
Mira Loma West			
San Bernardino			
Vincent			
Vista			

SINGLE - LINE TO GROUND FAULT DUTY

Evaluate the need for circuit breaker replacement at [REDACTED] - 500kV substations and [REDACTED] - 230kV substation.

Bus Name	Bus KV	ΔA
Lugo	525	0.1
Etiwanda	230	0.4
Mira Loma B	230	0.3
San Bernardino	230	0.1
Serrano	230	0.1
Vista	230	0.1

COST OF UPGRADES

No overload problems were identified for [REDACTED]. This project did not increase any existing loading by 1% or more.

Engineering has evaluated the circuit breakers at all substations where the project contributed to the Short Circuit Duty results in an increase of 0.1kA or greater.

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. The total cost of 37,111,000 was not triggered by the [REDACTED] and only shown as maximum exposure in case of changes in the queue.

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

CASE A - Triggered by [REDACTED] Etiwanda Project

STATION	SYSTEM	Replace	Upgrade	Sets of TRV's required	Cost of CB	Cost of TRV set of 3	Sub-Total CB	Sub-Total TRV	GRAND TOTAL
Chino	220kV		1	1		\$ 144,000	\$ -	\$ 144,000	\$ 144,000
		0	1				\$ -	\$ 144,000	\$ 144,000

CASE B - Triggered by earlier Projects ahead of [REDACTED] Etiwanda in Application Queue

STATION	SYSTEM	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	24			\$ 629,000		\$ 15,096,000	\$ -	\$ 15,096,000
Mesa *	220kV	23			\$ 629,000		\$ 14,467,000	\$ -	\$ 14,467,000
Mira Loma*	220kV	12			\$ 629,000		\$ 7,548,000	\$ -	\$ 7,548,000
		59	0				\$ 37,111,000	\$ -	\$ 37,111,000

*Additional costs of upgrading the Etiwanda, Mira Loma and Mesa 220kV Switchyards to 83kA is approximately \$15,000,000 at each location.

**Requires SCE's Field Engineering concurrence.

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. All cost estimates are rough order of magnitude, and are non-binding cost estimates.

APPENDIX A. Application Queue


Project Name	Project Size (MW)
TOT005	830
WDT011	9
WDT034	2.1
WDT016	11.57
TOT022	16.5
WDT028	2.5
TOT023	3.71
1114	2.8
TOT015	45
TOT004	1000
TOT010	450
TOT018	750
WDT044	49.9
WDT014	5.6
WDT038	110
WDT040	17.1
WDT041	34
WDT042	40
TOT019	44.4
TOT021	22.2
TOT051	22.44
TOT032	850
TOT040	110
TOT041	280
WDT054	16.5
WDT072	10.5

TOT048	45.3
TOT056	90.6
WDT073	80
WDT075	39.6
WDT082	19.8
WDT080	28.5
TOT005	20
7019	1.5
WDT086	8
WDT085	2.4
WDT053	42.6
TOT067	330
WDT092	66
7033	6
7030	6
7044	2.25
2495	1.28
2502	2.7
7045	7.3
7034	2
7042	1
7068	47
WDT109	4.2
WDT110	5.6
WDT111	3.93
7056	2.12
WDT098	40
7057	1.3
2530	1.21

7075	2
7071	1.13
7036	3.8
2535	1
2521	10.6
EAK049	134
2529	2.28
2522	1.06
7070	5.74
2538	14.66
2540	1.1
7088	8
WDT118	9
WDT112	16.54
7084	2.4
TOT095	185
WDT019	45.5
TOT100	63
7094	1.4
7010	3.3
7100	1.5
7101	1.77
WDT133	48.3
WDT129	2.56
WDT123	8.73
WDT123	3
WDT123	6.75
2531	2.4
2546	4.9

TOT096	50
WDT124	32
WDT082	1.2
2543	1.1
TOT079	520
TOT102	65
TOT108	300
WDT147	45.6
TOT109	72
TOT111	17
TOT112	82
WDT131	8.4
TOT113	201
TOT117	300
TOT116	10
WDT163	5.6
WDT164	80
TOT119	157
WDT165	325
TOT120	100.5
WDT177	96
TOT121	599
WDT176	6.5
TOT037	810
TOT127	65
TOT129	1650
WDT179	49.9
TOT135	500.5
WDT182	507

TOT138	424.8
TOT131	850
TOT132	500
WDT190	49.9
TOT148	250
WDT205	99
TOT146	51
TOT149	610
TOT150	60
WDT213	49
TOT151	400
TOT152	120
TOT155	33
TOT156	34
TOT166	613.5
TOT160	570
TOT153	51
TOT154	570
TOT161	220
TOT164	180
TOT162	550
TOT163	600
TOT165	160
TOT167	120
TOT149	304
WDT221	8.5
TOT159	635
TOT157	600
TOT158	1400

CSDLA Puente Hills Project A	8
TOT171	150
TOT169	50
TOT170	150
WDT223	49.9
TOT172	550
TOT173	500
TOT174	1200
WDT227	102
WDT228	63
TOT175	300
 - WDT230	44.55