[redacted]

SYSTEM IMPACT STUDY
RESTUDY

February 7, 2008

SOUTHERN CALIFORNIA
EDISON
An *EDISON INTERNATIONAL*℠ Company

Prepared by
Ying He

Southern California Edison Company

Steven E. Mavis
Manager, Generation
Interconnection Planning

EXECUTIVE SUMMARY

[redacted] applied to the Southern California Edison Company ("SCE") for Interconnection Service and Distribution Service of the proposed 49 megawatt (MW) [redacted] Such application was under the terms of SCE's Wholesale Distribution Access Tariff ("WDAT"). [redacted] proposed to interconnect the [redacted] to the existing Garnet-Banning-Maraschino-Windfarm 115-kV line between SCE's Garnet 115 kV Substation and the Renwind 115 kV Substation. The method of service required to interconnect the [redacted] Project involves looping the existing Garnet-Banning-Maraschino-Windfarm 115 kV line in-and-out of a new substation (referred to in this study as [redacted][1]) to be permitted by [redacted] and constructed within the [redacted] site.

A System Impact Study (SIS) was initially performed and delivered to [redacted] on August 7, 2006. Because of queued ahead project withdrawals, a restudy of the SIS was undertaken to update the original study results. In addition, the restudy included an update to the proposed in-service date for the [redacted] from November 30, 2008 to October 1, 2009 with a corresponding commercial operating date of March 1, 2010. This revised System Impact Study Report provides the updated study results for the [redacted] consistent with the interconnection queue as of November 16, 2007.

Results of this revised System Impact Study will be used as the basis to determine the appropriate project cost allocation for facility upgrades in a revised Facilities Study to be conducted. ***The study accuracy and results for the assessment of the system adequacy are contingent on the accuracy of the technical data provided by*** [redacted] Any changes from the data provided could void the study results. The study report provides detailed study assumptions and conditions of the system in which the study was conducted.

Please be aware that further restudy may be required to reflect the system configuration if higher queued generation or transmission project(s) that were modeled in the system impact re-study withdraw or are modified in accordance with applicable tariff allowances.

The following key transmission projects were included in the revised SIS power flow base cases:

1. The Dever-Palo Verde 500 kV #2 Project (The DPV2 Project)
2. The Devers-Mirage 115 kV System Split Project (Dever-Mirage Split)
3. The West-of-Devers Upgrade Project which involves upgrading the following 230 kV transmission lines to bundled (2B)1590 ACSR conductor:
    a. Devers-Vista #1 230 kV
    b. Devers-Vista #2 230 kV
    c. Devers-San Bernardino #1 230 kV
    d. Devers-San Bernardino #2 230 kV

[1] The final name of the substation is subject to change once SCE finalizes the substation name evaluation efforts.

4. The new Oak Valley 230 kV Substation (now referred to as "El Casco") including the looping in-and-out of the Devers-San Bernardino #2 230 kV transmission line
5. The new Jurupa Substation (now referred to as "Wildlife") including the looping in-and-out of the Mira Loma-Vista #1 230 kV transmission line

CONCLUSION

Based on the study results, the existing SCE transmission facilities with the minimum set of facility upgrades required to interconnect the [redacted] are not adequate to accommodate the [redacted] without additional reliability facility upgrades.

Power Flow

The power flow study results identified several thermal overload problems under base-case and single outage conditions. Specifically:

Double Outages (N-2 Contingencies)

Double outages were studied. No thermal overloads were identified. All loadings were below the line emergency ratings listed in the current CAISO Register Data.

Under-Voltage Ride-Through Requirements

The original transient stability study results indicated that the [redacted] will be required to install under voltage ride-through capability of at least 0.15 per-unit as measured at the generator step-up transformer or conversely improve the terminal voltage profiles during fault conditions by adding external dynamic reactive resources, such as STATCOM or D-VAR devices, within the wind farm. The study results showed that with 0.15 per-unit ride-through capability, the wind generator may still trip for a 3-phase fault at the Devers 230-kV bus, Devers 115-kV bus, or Garnet 115-kV bus.

The use of the Mitsubishi MWT-1000A WTG would require the installation of dynamic reactive resources to satisfy the under voltage ride-through requirements as mandated by WECC and FERC Order 661, as appropriate. The additional dynamic reactive resources, such as SVC or D-VAR devices, will provide for the dynamic voltage support required by injecting reactive current during system faults in order to maintain adequate voltage levels at the turbine terminal so that the windpark can maintain connected. The project developer has anticipated the need for a DVAR system to satisfy the LVRT requirements and included such a system on the simplified one-line diagram provided in the original application. However, because these systems are tailored to each specific project, the electrical parameters will not be readily available until the Project preliminary engineering is completed. Such work is done by the project developer and is usually completed after completion of the Facilities Studies. As a result, SCE will need to coordinate with [redacted] to validate that the DVAR system provides for the LVRT performance required prior to energizing the Project.

Stability Analysis

There were no stability data changes to be provided to this SIS Re-Study. Therefore, the original stability study results, conclusions, and recommendations will remain the same.

Short Circuit Duty Study

Under a three-phase-to-ground short-circuit duty study, a total of [redacted] 230 kV and [redacted] 115 kV existing substation locations were identified to require detailed engineering review. Under a single-phase-to-ground short-circuit duty study, a total of [redacted] 230 kV and [redacted] 115 kV existing substation locations were identified to require detailed engineering review. The results of the detailed engineering review identified that [redacted] 230 kV circuit breaker replacement and [redacted] 230 kV circuit breaker upgrades are required. Of these, all [redacted] circuit breaker replacements and one of the [redacted] circuit breaker upgrades are triggered by projects in queued ahead of the [redacted] The remaining [redacted] circuit breaker upgrades are triggered by the addition of the [redacted]

Cost Estimates

The *Nonbinding* Cost Estimate for the interconnection facilities and reliability network upgrades triggered by the [redacted] is $1.1 million and **nonbinding** non-network cost estimates for the facilities (distribution and direct assign) needed to interconnect the project is estimated at $2.5 million. The *Nonbinding* Cost Estimate for [redacted] maximum exposure for network upgrades triggered by queued ahead projects is $20.1 million which excludes approximately $200 million associated with SCE's West-of-Devers Transmission Upgrades. These estimates have been developed without detailed cost engineering and will be refined in the revised Facilities Study.

DELIVERABILITY ASSESSMENT

Separate studies entitled "Deliverability Assessments" will be performed by the CAISO[2] which will determine whether or not the project is deemed as 100% deliverable to the Grid for the Resource Adequacy (RA) purpose. If the project is found to be less than 100% deliverable, the study will recommend conceptual mitigation measures to make it 100% deliverable. The following is the website link to the CAISO's Deliverability Baseline Studies:

http://www.caiso.com/ 1c44/1c4

FACILITY STUDY

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A Facilities Study will be requi ilities Study will include detailed cost estimates f es required to interconnect t [redacted]

1. Update the cost and schedu [redacted] g: o

2. Develop the cost estimate and schedule for the new upgrades ... this restudy and required to mitigate the identified base case overload problems triggered by the ... ahead pro

3. Refine the cost estimate and schedule for the circuit breaker replacements and upgrades identified

[2] The deliverability study results for the [redacted] are anticipated to be available by the end of 2007.

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I. INTRODUCTION

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II. 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:

[3] The final name of the substation is subject to change once SCE finalizes the substation name evaluation efforts.

Power Flow Analysis

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

The following criteria are used:

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

System upgrades for transmission lines are generally recommended for all reliability criteria violations. Special Protection Systems (SPS) may be allowed for single contingency and credible or "likely" double contingency reliability criteria violation in place of system upgrades, provided that the SPS complies with the CAISO Planning Standards' New Generator SPS Guidelines.

Congestion Assessment

The following principles were used in determining whether congestion management, SPS, or facility upgrades are required to mitigate base case, single contingency, and/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 Operations concurs with the implementation. Congestion management to mitigate criteria violations may include curtailment of the proposed generation project in real time as needed.

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

- SPS will be recommended if it effectively mitigates system problems, does not jeopardize system integrity, does not exceed the current CAISO single and double contingency tripping limitations, does not adversely impact existing or proposed SPS in the area, and conforms to existing CAISO SPS Guidelines.

- Facility upgrades will be required if the use of an SPS is determined to be ineffective, system integrity is jeopardized, the amount of generation tripping exceeds the current CAISO single and double contingency tripping limitations, adverse impacts are identified to existing or proposed SPS in the area, or the SPS does not conform with the existing SPS Guidelines.

- Congestion management, discussed in the congestion management section that follows, in preparation for the next contingency will be required, with concurrence from CAISO Operations, if no facility upgrades or SPS 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). Included in the study are CAISO-approved transmission projects queued ahead of the generation interconnection request.

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

If the normal loading limits of facilities are exceeded in (a), the overload is identified as an existing overload that was triggered by a project in queue ahead of the [redacted] Project. If the normal loading limits of facilities are exceeded in (b) and were not exceeded in (a), the overload is identified as triggered by the addition of the [redacted], 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 SPS 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.

Congestion Management

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

- Implementation of the CAISO Market Redesign and Technology Upgrade (MRTU), currently scheduled for March 31, 2008, which will allow for forward scheduling thus ensuring feasible schedules are implemented
    - Day ahead congestion management
    - Hour ahead congestion management (T-75)

It should be noted that the existence of intermittent resources in specific areas may result in day-ahead and hour-ahead schedules that do not or will not necessarily track with real-time operations. The CAISO has recognized this fact and developed the Participating Intermittent Resource Program (PIRP) that minimizes financial penalties associated with scheduling versus real-time imbalances on dealing with them on a monthly basis. This program effectively guarantees full delivery of the intermittent resources' actual production regardless of whether or not it exceeds the submitted schedules. Under this program, the CAISO provides the intermittent resource a schedule at T-105 which is then submitted back to the CAISO by the scheduling coordinator at T-75. Because imbalances are accounted for on a monthly basis and no mechanisms are currently in place to allow for DECing. In addition, areas where changes to generation dispatch conditions and system topology conditions that are outside of the CAISO control and thus not readily known to the CAISO can adversely limit the ability to develop proper estimated feasible schedules thus making MRTU unworkable. Under both of these cases, real-time congestion management may still be required to reliably operate the electric grid. In order for real-time congestion management to be a feasible alternative to system facilities, the following factor needs to be satisfied:

- Time requirements should be established 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 appropriate congestion management 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, SPS, 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 thus potentially resulting in congestion management

c. if overloads 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 SPS 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.

The range of base case congestion for the [redacted] will be determined by reducing market generation projects in the Devers area including the [redacted] For single and double element outage conditions, the same methodology will be used to identify how much generation tripping is required in order to determine if use of an SPS is appropriate. Use of SPS will be deemed inappropriate if the total amount of generation reduction is found to exceed 1,150 MW under loss of one transmission element and 1,400 MW under loss of two transmission elements. These limits are established by the CAISO utilizing the current Spinning Reserve Criteria.

B. Generation and Load Assumptions

To simulate the SCE transmission system for analysis, the study used databases that were developed to conduct SCE's Annual CAISO Controlled Facilities Expansion Program. The databases were modified to include several SCE transmission projects that have been identified through the expansion program. These transmission projects include the following:

1. The Dever-Palo Verde 500 kV #2 Project (The DPV2 Project)
2. The Devers-Mirage 115 kV System Split Project (Dever-Mirage Split)
3. The West-of-Devers Upgrade Project which involves upgrading the following 230 kV transmission lines to bundled (2B)1590 ACSR conductor:
   a. Devers-Vista #1 230 kV
   b. Devers-Vista #2 230 kV
   c. Devers-San Bernardino #1 230 kV
   d. Devers-San Bernardino #2 230 kV
4. The new Oak Valley 230 kV Substation (now referred to as "El Casco") including the looping in-and-out of the Devers-San Bernardino #2 230 kV transmission line
5. The new Jurupa Substation (now referred to as "Wildlife") including the looping in-and-out of the Mira Loma-Vista #1 230 kV transmission line

Two system load conditions were considered for this study: 2011 heavy summer and a 2011 light spring case which assumed 65% of heavy summer except for the local Devers-Mirage 115 kV subtransmission system. For this subtransmission system, the study assumed 50% of heavy summer to simulate the worst case loading conditions. In addition, the bulk power flow study evaluated conditions with dispatch of generation outside of the SCE service territory and electrical system in a manner that maximized SCE imports on the West-of-River (Path 46) and included all pertinent queued ahead generation projects in the electrical vicinity of the [redacted]. This was done in order to develop loading scenarios that would stress the transmission system in the area where the [redacted] is interconnecting (SCE's eastern area vicinity). Generation assumptions are provided below in Table 1-1. Heavy summer and light load study assumptions are provided below in Tables 1-2 and Table 1-3 respectively

Table 1-1
Active Queued Generation Projects Modeled in the Study

CAISO Queue	Project Number and Point of Interconnection	Project Size (MW)	Requested Operating Date
SCE WDAT	WDAT 011 - Garnet Substation	9.0	06/11/07
SCE WDAT	WDAT 034 - Garnet Substation	2.1	06/23/99
SCE WDAT	WDAT 016 - Garnet Substation	11.6	12/31/07
1	TOT 022 - Devers-Garnet 115 kV line	16.5	12/31/07
Amend 39	TOT 023 - Devers-Garnet 115 kV line	3.7	13/31/03
Amend 39	TOT 015 - Devers-Garnet 115 kV line	45	10/01/07
Amend 39	TOT 004 - San Bernardino Substation	1,000	In Service
SCE WDAT	WDAT 042 - Devers Substation	40	08/01/01
Amend 39	TOT 019 - Devers-Farrel-Windland 115 kV line	44.4	03/22/01
Amend 39	TOT 021 - Devers-Farrel-Windland 115 kV line	22.2	09/15/01
Amend 39	TOT 051 - Devers-Farrel-Windland 115 kV line	22.4	10/01/03
3	TOT 032 - Devers Substation	850	07/01/07
SCE WDAT	WDAT 054 - Venwind 115 kV Substation	16.5	06/01/05
Amend 39	TOT 048 - Devers-Garnett 115 kV line	45.3	07/25/01
Amend 39	TOT 056 - Devers-Garnett 115 kV line	90.6	07/25/01
SCE WDAT	WDAT 073 - Colton 66 kV Substation	80	12/01/03
SCE WDAT	WDAT 075 - Valley 115 kV Substation	39.6	01/01/01
SCE WDAT	WDAT 080 - Colton 66 kV Substation	28.5	07/04/01
SCE WDAT	WDAT 053 - Garnet-Banning-Maraschini-WindFarm 115kV line	42.6	06/16/02
SCE WDAT	WDAT 092 - Devers-Sanwind 115kV Line	66	08/22/02
SCE WDAT	WDAT 098 - Vista 66 kV	40	06/05/02
Amend 39	TOT 095 - IID Interconnection Request	185	04/01/05
SCE WDAT	WDAT 019 - Colton 66 kV	No Export	
SCE WDAT	WDAT 123 - Garnet Substation	8.7	08/01/04
SCE WDAT	WDAT 123 - Garnet Substation	3	08/01/04
SCE WDAT	WDAT 123 - Garnet Substation	6.8	07/01/04
17	TOT 079 - Blythe Substation	520	06/01/11
23	TOT 109 - San Bernardino	72	10/01/05
SCE WDAT	WDAT 165 - Vista 115 kV Substation	325	01/01/08
49	TOT 120 - Devers Substation	100.5	10/01/10
SCE WDAT	WDT 177 - New Jurupa Substation	96	08/01/05
SCE WDAT	WDT 176 - Garnet Substation	6.5	06/30/06
50	TOT 037 - Valley Substation	810	12/01/06
SCE WDAT	WDT 179 - Vista 66kV	49.9	06/01/09
SCE WDAT	WDT 182 - Valley 115 kV	508	08/01/09
72	TOT132 - Serrano-Valley 500 kV Line	500	09/01/07

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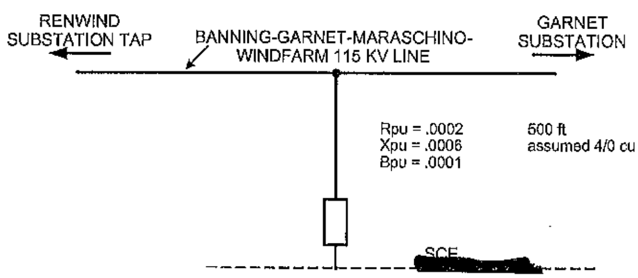
C[redacted]

The proposed [redacted] is geographically located in the San Gorgonio Pass approximately one mile southwest of SCE's Garnet 115 kV Substation. Specifically, the project will be in Riverside County in Township 3S, Range 4E, Sections 22, 27 and 28. As part of the [redacted], the developer proposes to utilize 49 individual Mitsubishi MWT-1000A wind turbine generators (WTG) connected by several 34.5 kV distribution feeders (electrical parameters have not yet been provided by developer). Each Mitsubishi MWT-1000A is rated at 1 MW for a net project output of 49 MW. [redacted] has proposed interconnect the project to the existing Garnet-Banning-Maraschino-Windfarm 115-kV line between the Garnet Substation and the Renwind Substation. A one-line of the proposed interconnection is shown below in Figure 1-1.

FIGURE 1-1

[redacted]

SINGLE LINE DIAGRAM



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D. Power Flow Study

The [redacted] System Impact Study considered two power flow study scenarios. Each case was derived from the most current CAISO Expansion Study base cases. Further description of the case assumptions follows:

a) SCE System with a 2011 Heavy Summer load forecast and all generation projects in queue ahead of the [redacted] and associated upgrades if known, Case 1

The study considered heavy load conditions with generation patterns and Path 46 imports maximized to identify the extent of potential congestion and fully stress the SCE system in the area where the [redacted] is interconnecting. Generation included: Regulatory must-take, all existing generation in the SCE Eastern area, and all other proposed generation projects in queue ahead of the [redacted]

b) SCE System with a 2011 Heavy Summer load forecast and all generation projects in queue ahead of the [redacted] and associated upgrades if known, and the inclusion of the [redacted] Case 2

Case 1 modified to include the [redacted] with a net generation of 49 MW.

c) SCE System with a 2011 Light Spring load forecast and all generation projects in queue ahead of the [redacted] and associated upgrades if known, Case 3

The study considered light load conditions with generation patterns and Path 46 imports maximized to identify the extent of potential congestion and fully stress the SCE system in the area where the [redacted] is interconnecting. Generation included: Regulatory must-take, all existing generation in the SCE Eastern area, and all other proposed generation projects in queue ahead of the [redacted]

d) SCE System with a 2011 Light Spring load forecast and all generation projects in queue ahead of the [redacted] and associated upgrades if known, and the inclusion of the [redacted], Case 4

Case 3 modified to include the [redacted] with a net generation of 49 MW

With the addition of the [redacted] SCE area total generation, imports, loads, and losses [redacted] cases 1-4 are summarized below in the Table 1-8. For each of the four cases, power flow simulations of the bulk power system were conducted for the base case, single contingencies and double contingencies of 500kV, 230 kV, and 115 kV transmission lines as well as 500/230-kV and 230/115 kV transformer banks to determine impacts to the SCE system. All single and double contingencies were simulated without implementation of any applicable existing SPS.

Table 1-8
Summary of Base Cases (MW)

SCE Load and Resource (MW)				
	2011 Heavy Summer (On-Peak)		2011 Light Spring (Off-Peak)	
	Case 1 (Pre-Project)	Case 2 (Post-Project)	Case 3 (Pre-Project)	Case 4 (Post-Project)
Generation	18,312	18,321	9,294	9,317
Import	9,611	9,611	9,223	9,223
Load	27,377	27,377	17,628	17,628
Losses	546	555	475	478

E. 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. Because the original SIS did not identify widespread system instability, the re-evaluation was limited to determining if the Mitsubishi MWT-1000A WTG meets the FERC under-voltage ride-through requirement. To make such determination, transient stability studies were limited to evaluating three-phase-to-ground faulted conditions at the closest network substation which is the Garnet 115 kV Substation with normal fault clearing. Study results were evaluated utilizing the applicable Planning Criteria as summarized in Table 1-9.

Table 1-9
WECC DISTURBANCE-PERFORMANCE TABLE
OF ALLOWABLE EFFECTS ON OTHER SYSTEMS
(in addition to NERC requirements)

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.

F. Post-Transient Voltage Study

The power flow study voltage results were used as a screen to identify those contingencies that may require additional post-transient voltage studies. Single and double contingencies identified in the power flow to have a voltage drop in excess of 5% were selected for post-transient voltage analysis. The Post-transient voltage studies compare voltage deviations to the NERC/WECC/CAISO reliability requirements including the SCE guidelines of 7% for single contingency outages and 10% for double contingency outages and identify those outages which result in a criteria violation. Mitigation measures will be recommended for any criteria violation identified.

G. Short Circuit Duty Study

To determine the impact on short-circuit duty, within SCE's electrical system, after inclusion of the [redacted] the study calculated the maximum [redacted] three-phase-to-ground short-circuit duties. Generation and transformer data represented in the generator and transformer data sheets provided by the customer were utilized. Bus locations where short-circuit duty is increased with the proposed [redacted] by at least 0.1 kA and the duty is in excess of 60% of the minimum breaker nameplate rating are flagged for further review. Upon completion of the detailed circuit breaker review, circuit breakers exposed to fault currents in excess of 100 percent of their interrupting capacities will need to be replaced or upgraded, whichever is appropriate. It should be noted that other WECC entities may request specific information within the WECC process to evaluate potential impact within their respective systems of this project addition.

H. Deliverability Assessment

In accordance with LGIP sections 3.3.2 and 3.3.3 of the LGIP, Deliverability Assessment will be performed to determine the qualified capacity of the project from a Resource Adequacy perspective. The study focuses on the ability of the system to accommodate output of the project to the aggregate of load under the conditions when resources are needed the most such as during summer peak conditions when resource shortage is likely to happen. For more details of Deliverability Assessment including methodology and modeling requirements for deliverability base case, please refer to http://www.caiso.com/181c/181c902120c80.html.

As required by LGIP tariff language, deliverability results need to provide the following information of this project regarding deliverability:

- The amount of capacity that can be deemed deliverable without additional upgrade(s)
- The upgrade(s) needed for this project to be deemed fully deliverable

Please note that upgrades identified through this deliverability assessment (delivery upgrades) are discretional upgrades implemented only for those customers who desire a higher level of service. Generation projects may proceed to interconnect to the CAISO control grid without delivery upgrades provided that all the required reliability upgrades have been implemented. However, a developer's decision to interconnect without the identified delivery upgrade(s) could result in the project losing its eligibility to receive capacity payments, as allowed under the CPUC Resource Adequacy program.

I. Cost Estimates

Non-binding cost estimates will be derived for the facility upgrades identified as needed to reliably interconnect the [redacted]

J. Scope of Facilities

The scope of the facility upgrades identified in this study was developed without the benefit of:

- Detailed substation site review,
- Detailed right-of-way review,
- Detailed telecommunication facility review,
- Detailed system protection review,
- Detailed weather studies,
- Detailed environmental assessments, and
- Preliminary engineering

Such detailed studies are typically undertaken upon execution of the LGIA. It is possible that these detailed studies needed to support the actual project design and any permitting could affect the scope of facilities.

K. Timelines for Implementing Facility Upgrades

Timelines ***(non-binding)*** for the completion of facility upgrades to accommodate new projects are based on a number of factors. For the most part, the driving factors include the following:

- Time requirements to prepare the Proponents Environmental Assessment (PEA) in support of an application for a Certificate of Public Convenience and Necessity (CPCN) or Permit to Construct (PTC)
- CPCN or PTC Application review and approval process (State and Federal Agencies)
- Estimated material acquisition lead times
- Construction of facilities
- Other factors

III. GENERATOR ELECTRIC GRID FAULT RIDE-THROUGH CAPABILITY CRITERIA AND POWER FACTOR CRITERIA (FERC ORDER 661)

FERC adopted a Generator Electrical Grid Fault Ride-Through Capability Criteria (FERC Order 661). In addition, WECC has also implemented a Low Voltage Ride-Through requirement. The purpose of this Low Voltage Ride-Through Capability and Power Factor Criteria is to ensure continued reliable service. The criteria were used in this System Impact Study for evaluating generator performance and are summarized as follows:

A. Low-Voltage Ride Through Requirements

1. Wind generating plants are required to remain in-service during system faults (three phase faults with normal clearing and single-line-to-ground with delayed clearing) and subsequent post-fault voltage recovery to pre-fault voltage unless clearing the fault effectively disconnects the generator(s) from the system.

2. The maximum clearing time the wind plant shall be required to withstand a three-phase fault shall be 150 milliseconds (9 cycles), after which, if the fault remains following the location-specific normal clearing time for three-phase faults, the wind generating plant may disconnect from the transmission system.

3. A wind generating plant shall remain interconnected during such a fault on the transmission system for a voltage level as low as zero volts as measured at the high side of the wind generating plant step-up transformer.

B. Power Factor Design Criteria

1. A wind generating plant shall maintain a power factor within the range of 0.95 leading to 0.95 lagging as measured at the Point of Interconnection, if the Transmission Provider's System Impact Study shows that such a requirement is necessary to ensure safety or reliability.

2. The Power Factor standard can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors if agreed to by the Transmission Provider, or a combination of the two.

3. Wind plants shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the System Impact Study shows this to be a required for system safety or reliability

IV. STUDY RESULTS

A. LOAD FLOW RESULTS

Base Case

Power Factor Correction

As required by FERC Order 661, studies were performed to determine if power factor correction is required. To properly evaluate and determine if power factor correction is needed, initial studies were performed without the inclusion of any power factor correction beyond that which is inherently supplied by the induction wind generators. Under these initial studies, system voltages were found to be within acceptable limits. However, the reactive power requirements were found to be supplied from the source station thereby resulting in additional thermal loading on the 115 kV lines serving the system. Loadings under light load conditions without power factor correction beyond that which is inherently supplied by the induction wind generators at any of the wind generation projects requesting interconnection are provided below in Table 1-1.

Table 1-1
Base Case Loadings without Power Factor Correction at all new Windparks

	ject
Devers Nc	ɔ
Devers Nc	ɔ
Devers Nc	ɔ
Devers leg	ɔ
Garnet leg	ɔ
Devers leg	ɔ

With the addition of power factor correction at all of the wind generation projects requesting interconnection reduced the loading of the above facilities. Such finding illustrates that the installation of power factor correction at all new wind generation facilities is essential in ensuring facilities are utilized in the most efficient manner thus ensure reliability is maintained. Table 1-2 provides the resulting loadings with the inclusion of power factor correction at all new wind generation projects, including the [redacted]

Table 1-2
Base Case Loadings with Power Factor Correction at all new Windparks

	ɔject
Devers Nc	o
Devers Nc	o
Devers Nc	o
Devers leg	ɔ
Garnet leg	ɔ
Devers leg	

[redacted]

[redacted]

Generation (MW) Subject to Base Case Congestion

In order to quantify the amount of generation potentially subjected to base case congestion management, several sensitivity studies were performed which reduced the generation output of project in reverse queue order until the overloads were eliminated. Based on this methodology, the amount of base case congestion identified to mitigate the thermal overload on the existing Devers-Garnet-Venwind 115 kV line was found to be approximately 56 MW while the amount required to mitigate thermal overload on the Devers 230/115 kV transformer banks was found to be approximately 52 MW.

Operational Issues with Implementing Base Congestion Management in this Area

Given that a significant amount of generation resources in this area, including the Mountain View IV Project, are intermittent in nature (wind generation), it is likely that the schedules for these projects may not track with real-time dispatch. The CAISO recognized that the special operating characteristics of intermittent energy resources could act as a barrier to those resources participating in the CAISO energy market. In the CAISO's request for modification to its Open Access Transmission Tariff (OATT) filed under Amendment No. 42 on January 31, 2002, the CAISO stated that "wind generators and other intermittent resources generally are unable to adjust their generation output to ISO Dispatch instruction" and that "as-available Energy from intermittent resources is difficult to forecast accurately for more than one or two hours into the future due to the significant variability of the fuel source (e.g., wind and sunlight)".

Because schedules for intermittent resources generally do not track with real-time operations the CAISO developed the Participating Intermittent Resource Program (PIRP) that minimizes financial penalties associated with imbalances between schedules and actual production. Such program manages the penalties by dealing with the imbalance on a monthly basis rather than an hourly basis. This program effectively guarantees full delivery of the intermittent resources' actual production regardless of whether or not it exceeds the submitted schedules. Under this program, the CAISO provides the intermittent resource a schedule at T-105 which is then submitted back to the CAISO by the scheduling coordinator at T-75. Because imbalances are accounted for on a monthly basis and no mechanisms are currently in place to allow for DECing, reliance on MRTU may not be sufficient to mitigate the thermal overload problems identified under base case conditions with all facilities in service. Consequently, interconnection of the [redacted] in advance of facility upgrades ("temporary interconnection"), except for those required to interconnect (new 115 kV substation and corresponding telecommunication facilities), will require detailed review from the CAISO Operations group and the possible installation of a base case special protection system to alleviate the operational complexities that could lead to reliability problems. Such base case SPS would:

- monitor amp loadings on 115 kV lines and transformer banks which were identified to overload
- provide estimated value of available capacity, if feasible, to the [redacted]
- signal an alarm requesting generation run-back and initiate time delay counter
- trip the [redacted] if loading on the facilities identified to overload are not reduced to allowable limits within an allocated time period

Because the use of a special protection system should only be implemented to mitigate thermal overloads under emergency conditions (i.e., outage conditions), such temporary interconnection should be considered as an interim solution until the proper facility upgrades (reliability upgrades) as discussed above are constructed. The CAISO will need to address if such temporary interconnection can be accommodated while maintaining system reliability (i.e., can the system be operated).

Single Outages (N-1 Contingencies)

[redacted]

[redacted]

B. POST-TRANSIENT VOLTAGE STABILITY

The power flow study did not identify any critical contingencies that result in bus voltages which require further post-transient voltage review. Consequently, there was no need to perform a post-transient voltage evaluation.

C. TRANSIENT STABILITY

As previously identified, the [redacted] did not result in any transient stability problems.

D. UNDER VOLTAGE RIDE-THROUGH AND POWER FACTOR CORRECTION

The study identified that the [redacted] will be required to install reactive support necessary to meet a 0.95 power factor boost at the point of interconnection. Without additional reactive support, th[redacted] would create a net reactive load of approximately 20 MVAr on the system. This reactive demand results in degraded system voltages, especially under outage conditions as more and more wind generation is installed on the system. Because the San Gorgonio Pass is one of California's wind energy zones, it is anticipated that additional wind generation will be installed in this area. Consequently, the [redacted] will be required to provide up to 0.95 boost power factor correction as metered at the point of interconnection. To meet the 0.95 power factor boost required, the [redacted] will need to install up to 36 MVAr of reactive support within their windpark.

As far as under voltage ride-through (LVRT), the use of the Mitsubishi MWT-1000A WTG would require the installation of dynamic reactive resources to satisfy the under voltage ride-through requirements as mandated by WECC and FERC Order 661, as appropriate. The additional dynamic reactive resources, such as SVC or D-VAR devices, will provide for the dynamic voltage support required by injecting reactive current during system faults in order to maintain adequate voltage levels at the turbine terminal so that the windpark can maintain connected. The project developer has anticipated the need for the DVAR system to satisfy the LVRT requirements and included such a system on the simplified one-line diagram provided in the original application. However, because these systems are tailored to each specific project, the electrical parameters will not be readily available until the Project preliminary engineering is completed. Such work is done by the project developer and usually completed after completion of the Facilities Studies. As a result, SCE will need to coordinate with [redacted] to validate that the DVAR system provides for the LVRT performance required prior to energizing the Project. To perform this review, [redacted] will need to provide the electrical parameters of the DVAR system once such parameters are established.

E. SHORT-CIRCUIT DUTY RESULTS

The short-circuit duty study was performed based on the customer provided data and included all the necessary transmission upgrades to interconnect all projects in queue up to an including the [redacted] As shown below in Table 2-3, the three-phase-to-ground short-circuit duty study identified [redacted] existing 230 kV and eleven existing 115 kV substation locations that required specific breaker evaluation for replacement. Shown below in Table 2-4, the single-phase-to-ground short-circuit duty study identified one existing 230 kV and [redacted] existing 115 kV substation locations that required specific breaker evaluation for replacement. These locations were flagged based on the review criteria of the project increasing short-circuit duty by more than 0.1 kA at locations where duty is in excess of 60% of the minimum circuit breaker rating.

Table 2-3
Three-3 Phase Short Circuit Duty Results

D	
M	
A	
B	
D	
F	
G	
N	
F	
S	
S	
[illegible]	
[illegible]	

Table 2-4
Single-Line-To-Ground Short Circuit Duty Results

Bus Name	Bus KV	PRE CASE		POST CASE		DELTA KA
		X/R	KA	X/R	KA	
DEVERS	[illegible]					0.5

Detailed review of these locations identified a total of 21 circuit breaker replacement and [redacted] circuit breaker upgrade requirements. All [redacted] circuit breaker replacements and [redacted] of the circuit breaker upgrades were found to be triggered by a queued ahead project and will therefore be categorized as Case B. The remaining [redacted] circuit breaker upgrades were found to be triggered by the [redacted] will therefore be the cost responsibility of the [redacted]. A summary of the CB evaluation results are provided below in Table 2-5.

Table 2-5
Results of Circuit Breaker Evaluation

Location	Case A Triggered by [redacted]		Case B Triggered by Queued Ahead Project	
	Replacements	Upgrades	Replacements	Upgrades
Devers 230 kV	0	7	7	1
Devers 115 kV	0	0	14	0

In the event of project withdrawals or modifications consistent with the LGIP allowances, the [redacted] may be responsible for Case B upgrades as determined in a technical reevaluation.

F. DELIVERABILITY ASSESSMENT

CAISO is in the process of performing the 2007Q3 Generation Deliverability Assessment, which will evaluate the deliverability of proposed generation projects including th[redacted]. Currently, the study results are anticipated to be available by the end of 2007. The study assumptions and the original study schedules can be found in the 2007Q3 Generation Deliverability Study Plan at http://www.caiso.com/1c44/1c44b5c31cce0.html.

In case additional network facilities are required for the Project to be deemed fully deliverable, the CAISO will communicate such needs to SCE and the network facilities will be evaluated in the Facilities Study.

V. COST ESTIMATES

The cost estimates of facility upgrades that have been identified to mitigate planning criteria violations triggered by queued ahead projects or by the addition of th[redacted]re provided below in Table 2-6. ***All cost estimates are rough, order of magnitude estimates and are non-binding.***

Table 2-6
Cost Estimates Provided in Millions
(2010 Dollars)

Facility Upgrade	Triggered by Queued Ahead Project[6]	Triggered by the Mountain View IV Project
Replace [redacted] 115 kV circuit breakers at Devers	$4.0	
Replace [redacted] and Upgrade [redacted] 230 kV circuit breakers at Devers	$4.1	
Upgrade 7 230 kV circuit breakers at Devers	-	$1.1
Substation required to interconnect [redacted] including telecomm and subtransmission work	-	$2.5
Upgrade Devers leg of the existing Devers-Garnet-Venwind 115 kV line	$2.0	
Install [redacted] Devers 230/115 kV Transformer Bank and split 115 kV bus	$10.0	
SCE West-of-Devers Transmission Project	$200*	-
Total	$220.1	$3.6

* Cost estimates for these projects are provided for information only. These costs are not expected to be the responsibility of any generator since these projects are needed for system reasons.

VI. ESTIMATED PROJECT TIMELINES

The original timelines provided in the initial Facilities Study will be updated to reflect the revised facility scope.

VII. CONCLUSION

Based on the study results, the existing SCE transmission facilities with the minimum set of facility upgrades required to interconnect th[redacted] are not adequate to accommodate the [redacted] without additional reliability facility upgrades.

Power Flow

The power flow study results identified several thermal overload problems under base-case and single outage conditions. Specifically:

[6] Cost of such additional facilities may later be assigned to the [redacted] if modifications to queued ahead projects (consistent with LGIP) or project withdrawals result in the [redacted] triggering the need for the upgrade (as determined by a restudy).

Base Case

The study identified that the installation of power factor correction at all new wind generation facilities, including th[redacted] is essential in ensuring facilities are utilized in the most efficient manner thus ensuring reliability is maintained.

Under Base Case off-peak conditions, [redacted]

the line emergency ratings listed in the current CAISO Register Data.

Under-Voltage Ride-Through Requirements

The original transient stability study results indicated that the [redacted] will be required to install under voltage ride-through capability of at least 0.15 per-unit as measured at the generator step-up transformer or conversely improve the terminal voltage profiles during fault conditions by adding external dynamic reactive resources, such as STATCOM or D-VAR devices, within the wind farm. The study results showed that with 0.15 per-unit ride-through capability, the wind generator may still trip for a 3-phase fault at the Devers 230-kV bus, Devers 115-kV bus, or Garnet 115-kV bus.

The use of the Mitsubishi MWT-1000A WTG would require the installation of dynamic reactive resources to satisfy the under voltage ride-through requirements as mandated by WECC and FERC Order 661 as appropriate. The additional dynamic reactive resources, such as SVC or D-VAR devices, will provide for the dynamic voltage support required by injecting reactive current during system faults in order to maintain adequate voltage levels at the turbine terminal so that the windpark can maintain connected. The project developer has anticipated the need for a DVAR system to satisfy the LVRT requirements and included such a system on the simplified one-line diagram provided in the original application. However, because these systems are tailored to each specific project, the electrical parameters will not be readily available until the Project preliminary engineering is completed. Such work is done by the project developer and is usually completed after completion of the Facilities Studies. As a result, SCE will need to coordinate with [redacted] to validate that the DVAR system provides for the LVRT performance required prior to energizing the Project.

Transient Stability Analysis

There were no stability data changes to be provided to this SIS Re-Study. Therefore, the original stability study results, conclusions, and recommendations will remain the same.

Short Circuit Duty Study

Under a three-phase-to-ground short-circuit duty study, a total of [redacted] 230 kV and eleven 115 kV existing substation locations were identified to require detailed engineering review. Under a single-phase-to-ground short-circuit duty study, a total of [redacted] 230 kV and [redacted] 115 kV existing substation locations were identified to require detailed engineering review. The results of the detailed engineering review identified that [redacted] 230 kV circuit breaker replacement and eight 230 kV circuit breaker upgrades are required. Of these, all [redacted] circuit breaker replacements and [redacted] of the [redacted] circuit breaker upgrades are triggered by projects in queued ahead of the [redacted] The remaining seven circuit breaker upgrades are triggered by the addition of the [redacted]

Cost Estimates

The ***Nonbinding*** Cost Estimate for the interconnection facilities and reliability network upgrades triggered by the [redacted] Project is $1.1 million and **nonbinding** non-network cost estimates for the facilities (distribution and direct assign) needed to interconnect the project is estimated at $2.5 million. The ***Nonbinding*** Cost Estimate for [redacted]s maximum exposure for network upgrades triggered by queued ahead projects is $20.1 million which excludes approximately $200 million associated with SCE's West-of-Devers Transmission Project. These estimates have been developed without detailed cost engineering and will be refined in the Facilities Study.

DELIVERABILITY ASSESSMENT

Separate studies entitled "Deliverability Assessments" will be performed by the CAISO[7] which will determine whether or not the project is deemed as 100% deliverable to the Grid for the Resource Adequacy (RA) purpose. If the project is found to be less than 100% deliverable, the study will recommend conceptual mitigation measures to make it 100% deliverable. The following is the website link to the CAISO's Deliverability Baseline Studies:

http://www.caiso.com/ 1c44/1c44b5c31cce0.html

FACILITY STUDY

A Facilities Study will be required for the [redacted] The Facilities Study will include detailed cost estimates for SCE upgrades and direct assignment facilities required to interconnect the [redacted] and should:

1. Update the cost and schedule for the facilities required to interconnect the [redacted] as identified in the original Facilities Study. Such facilities include the following:
    - SCE work associated with the 115kV Interconnection Facility with loop service to interconnect the [redacted]
    - 115kV Line Loop
2. Develop the cost estimate and schedule for the new upgrades identified in this restudy and required to mitigate the identified base case overload problems triggered by the queued ahead projects. These upgrades include the following:
    - Facility upgrades to mitigate thermal overload on the existing Devers-Garnet-Venwind 115 kV line
    - Installation of a fourth Devers 230/115 kV transformer bank
3. Refine the cost estimate and schedule for the circuit breaker replacements and upgrades identified

[7] The deliverability study results for the [redacted] are anticipated to be available by the end of 2007.