California ISO
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California Independent
System Operator Corporation

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July 28, 2009

Ross Metersky
Director, Business Development
Watson Cogeneration Company
22850 South Wilmington Avenue
Carson, California 90749

Subject: Watson Cogeneration Project Transition Cluster Phase I Interconnection Study

Dear Ross Metersky:

Attached is the Transition Cluster Phase I Interconnection Study Report for the interconnection of the proposed Watson Cogeneration Project (Project) to the CAISO Controlled Grid. The CAISO and SCE performed the Phase I Interconnection Study in accordance with the CAISO's LGIP tariff.

Results of the Phase I Interconnection Study establish the maximum cost responsibility for Network Upgrades assigned to the Project in accordance with the CAISO's LGIP tariff. The cost for Network Upgrades assigned to the Project is $2,540,000. In addition, the study report provides a non-binding cost estimate of the Interconnection Facilities to interconnect the Project to the CAISO Controlled Grid.

Please review the report and prepare comments and questions for the Results Meeting. The Phase I Interconnection Study Results Meeting will be coordinated and scheduled within 60 calendar days following receipt of this Phase I Interconnection Study report.

Sincerely,

Judy Brown

Judy Brown
Project Manager

Attachment

via e-mail:

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Transition Cluster Phase I Interconnection Study

Generation Interconnection

Watson Cogeneration Company

Watson Cogeneration Project

Final Report

California ISO
Your Link to Power

July 24, 2009

This study has been completed in coordination with Southern California Edison per the Large Generator Interconnection Procedure

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Executive Summary

Watson Cogeneration Company (Watson) applied to the California Independent System Operator (CAISO) for interconnection of a new 85 MW natural gas project (Watson Cogeneration Project). The Watson Cogeneration Project consists of a new single natural gas generator to be installed adjacent to six existing units. Watson Cogeneration Company requested and paid for Interconnection Studies in accordance with Section 3.5.1 of Appendix Y of the CAISO LGIP Tariff. The CAISO issued Queue Position 383 for the Project.

SCE performed an assessment to identify Interconnection Facilities required to connect the Watson Cogeneration Project to SCE's system by two existing Arcogen-Hinson 220 kV transmission lines per the customer's original requested Point of Interconnection (POI). The assessment concluded the original POI request is viable.

CAISO Tariff, Section 6.2 of Appendix Y, requires SCE provide a *good faith* estimate on costs pertaining to the Project. Additionally, the Tariff states Network Upgrades are presented as the estimated Maximum Cost Exposure listed in the Phase I Study. Based on Watson's requirements, SCE estimated the Project as follows:

Component	**Estimated Costs**
SCE Interconnection Facilities	200,000
Facility Distribution Upgrades	-0-
Reliability Network Upgrades	2,540,000
Delivery Network Upgrades	-0-
TOTAL ESTIMATED COST	**$2,740,000**

Cost ($)

1. Introduction

In accordance with CAISO Tariff Appendix Y, Section 6.1, the CAISO may study an Interconnection Request, in coordination with the applicable Participating Transmission Owner (PTO), individually, or in a Group Study, for the purpose of conducting one or more of the analyses forming the Interconnection Studies.

As the Interconnection Customer, Watson's Interconnection Request proposed a POI from the Project to the SCE grid that is within the Metro Area System. The Metro Area System constitutes a branch group whereby generation located within this area electrically affects other Interconnection Customer (IC) projects and SCE's transmission system with respect to the analysis being performed. Consequently, while independent analysis was conducted on the Project, group network analysis was conducted jointly with other similar situated generation projects interconnecting to the Metro Area System.

Details of this CAISO LGIP Transition Cluster Phase I Interconnection Study – Watson Cogeneration Project (Phase I Study) that relate uniquely to Watson's individual Interconnection Request, including POI and Interconnection Facilities requirements, are presented in this CAISO LGIP Transition Cluster Phase I Interconnection Study Report – Watson Cogeneration Project (Phase I Report). Details related specifically to the Group Network Analysis for the Metro Area System are also provided in this Phase I Report.

1.1 Grouping Interconnection Requests

SCE's electrical system can be described as having one network system and three electrical radial systems. The one network system is comprised of the Metro Area (sometimes referred to as the Los Angeles Basin area). Generation interconnection applications requesting interconnections to facilities within the Metro Area are to be studied on a group basis if they electrically affect one another; otherwise they are to be studied on an individual basis (i.e. serial project). The three electrical radial systems consist of the Northern Bulk System, Eastern Bulk System, and the East of Lugo Bulk System. Generation interconnection applications requesting interconnections to facilities within one of the three electrical radial systems are to be studied on a group basis. However, these generalized groups are primarily used for organizational purposes and management of work load among the various ISO and SCE engineers performing the studies. For cost allocation purposes the Groups are determined by the study results. For example, for Delivery Network Upgrades the Groups are determined by the Deliverability Assessment Methodologies http://www.caiso.com/1c44/1c44b5c3cce0.html.

1.2 Group Study Designation

Individually or in mutual agreement with the CAISO and SCE, Watson indicated that the Watson Generation Project is to be connected to the SCE portion of the CAISO Controlled Grid at SCE's Hinson 220 kV Substation which is located in the Metro Area. The customer is currently connected to the SCE Hinson system via the existing customer owned ArcoGen 220 kV Substation. Since its POI is located in the Metro Area System and, the impacts of the Watson Generation Project do not impact other Transition Cluster projects (with the possible exception of Short Circuit Duty), the Watson Cogeneration Project was be studied on an individual basis (i.e. group of one). All details related specifically to the network analysis for the Metro Area System are provided in this report.

2. Project Description

2.1 Point of Interconnection

The Watson Cogeneration Project involved the addition of a new 85 MW Natural Gas generator to an existing six units located at the customer owned ArcoGen 220 kV Substation. Watson identified that the substation will consist of a new single 69/13.8 kV GSU transformer providing a step directly from the generator. Existing 230/69 kV transformers will be used to connect to the existing 220 kV Arcogen Substation which is connected through two existing 220 kV lines to the existing SCE 220 kV Hinson Substation.

The Watson Generation Project one line diagram is shown in Figure 2.1 and illustrates the proposed facility arrangement and POI into the existing SCE system. Figure 2.2 provides the geographical location of the Project relative to the existing Arcogen and Hinson Substations.

Figure 2.1
Watson Cogeneration Project One Line Diagram

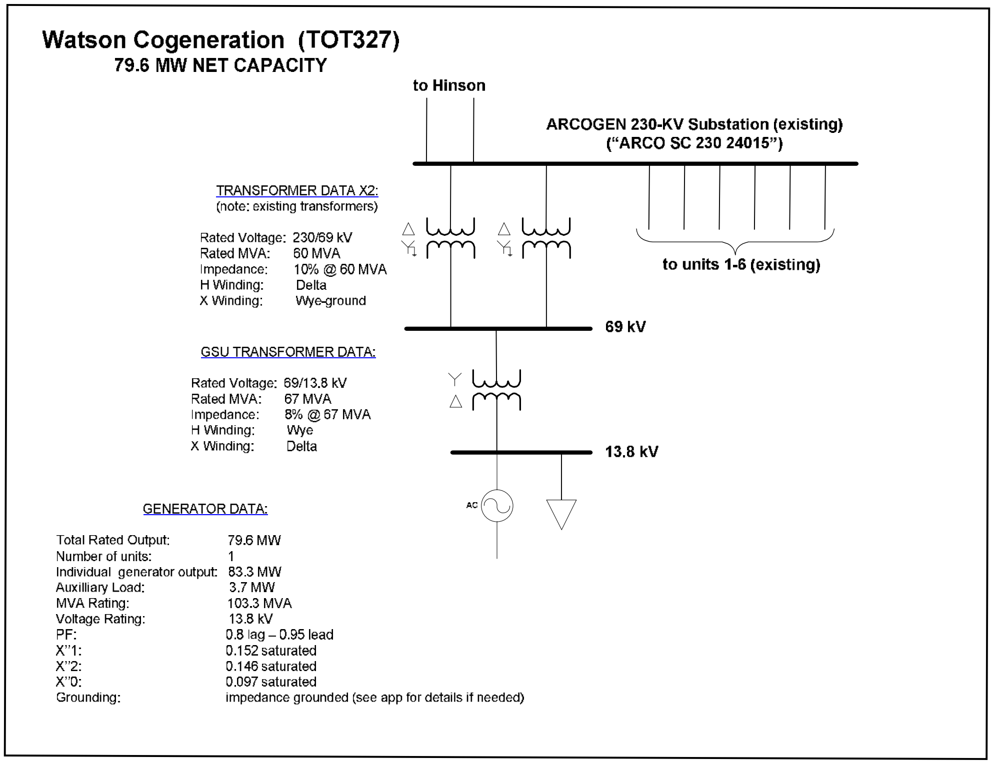


Figure 2.2
Watson Cogeneration Project Area Map

2.2 Generation Requests within Metro Area Bulk System

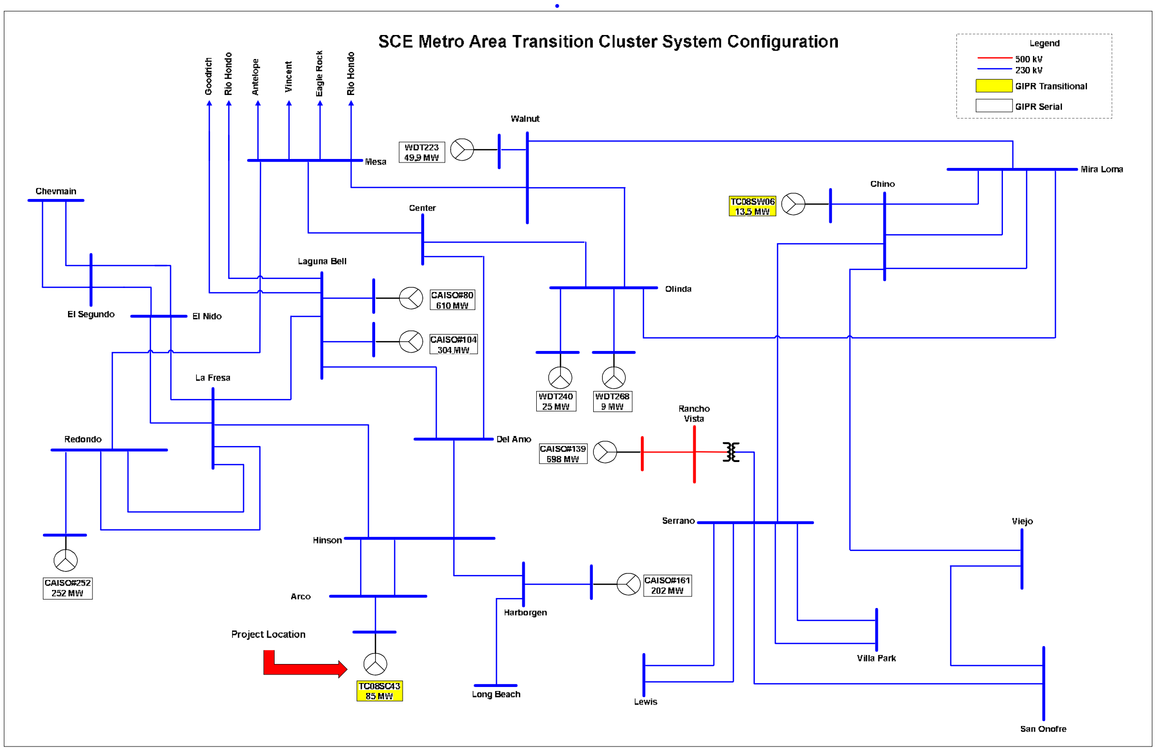
Details of the Metro Area Transition Cluster projects are shown in Table 2.1 below. Note that there are two projects identified in Table 2.1, the Watson Generation Project (CAISO Queue #383) and an active Transition Cluster project in the SCE WDAT interconnection queue (SCE WDAT #310). These projects do not impact each other from a power flow or stability perspective, and for purposes of the Transition Cluster study, the Watson Generation Project is being studied as a "group of 1" for purposes of the Transition Cluster Phase I study.

Table 2.1
Transition Cluster Generation In
Metro Area System Study Group

CAISO Queue Position	Resource Type	Size (MW)
CAISO Queue #383	Natural Gas	85
SCE WDAT #310	Natural Gas	13.5
Total Metro Area Cluster		98.5

A single-line diagram showing existing serial and Transition Cluster queued generation projects is provided in Figure 2.3 below.

Figure 2.3
Transition Cluster Generation In
Metro Area System Study Group



2.3 Watson Generation Project Facility

The Watson Generation Project is a proposed expansion of a steam and electrical generating (cogeneration) facility that is located in the City of Carson in Southern California[1]. The Project will complete the original design of Watson Cogeneration Facility that has been in continuous operation for more than 20 years. The Project will add a nominal 85 MW combustion turbine generator (CTG) with a single-pressure heat recovery steam generator (HRSG) to provide additional process steam to the BP Carson refinery. The original plant design allocated plot space and included provisions to accommodate a new unit at a later date. The additional unit is sized and designed to provide reliable base load operations with supplemental duct firing in the HRSG.

The Project includes one General Electric (GE) 7EA CTG, with an inlet fogging system, one duct fired HRSG, two redundant natural gas compressors (2x100 percent), one boiler feedwater (BFW) pump, one circulating water pump, two new cells added to an existing cooling tower, electrical distribution system, instrumentation and controls, and all necessary auxiliary equipment as described herein. The Project's primary objective is to provide additional process steam in response to the refinery's process steam demand.

The Project complements the existing cogeneration facility located within the confines of the refinery. The existing facility has four GE 7EA CTGs, four HRSGs and two steam turbine generators (STG). In operation

[1] Description of the Project Facility was obtained from the Application for Certification (AFC) filed at the California Energy Commission (CEC) and available at http://www.energy.ca.gov/sitingcases/watson/.

since 1988, the existing cogeneration facility is owned by Watson and operated by BP West Coast Products, LLC – BP Carson Refinery. Watson is a joint partnership between subsidiaries of BP America and Edison Mission Energy. Since the Project consists of adding a fifth CTG/HRSG to the existing configuration, it is also referred to as the "fifth train."

Dynamics data used to represent the generator in the GE PSLF Dynamic Software, as provided by the project developer, are shown below in Table 2.2 (generator), Table 2.3 (excitation system), Table 2.4 (governor) and Table 2.5 (power system stabilizer).

Table 2.2
Generator Model (GENROU)

Variable	Value	Description
Tpdo	6.10	D-axis transient rotor time constant
Tppdo	0.03	D-axis sub-transient rotor time constant
Tpqo	1.30	Q-axis transient rotor time constant
Tppqo	0.05	Q-axis sub-transient rotor time constant
H	6.8	Inertia constant, sec
D	0.0	Damping Factor, p.u.
Ld	1.89	D-axis synchronous reactance
Lq	1.85	Q-axis synchronous reactance
Lpd	0.249	D-axis transient reactance
Lpq	0.39	Q-axis transient reactance
Lppd	0.195	D-axis transient reactance
L1	0.165	Stator Leakage Reactance, p.u.
S1	0.13	Saturation factor at 1 p.u. flux
S12	0.34	Saturation factor at 1.2 p.u. flux
Ra	0.0024	Stator resistance, p.u.
Rcomp	0.0	Compounding reactance for voltage control, p.u.
Xcomp	0.0	Compounding resistance for voltage control, p.u.

Table 2.3
Ieee Type St4b Excitation System Model (EXST4B)

Variable	Value	Description
Tr	0.02	Filter time constant, sec
Kpr	3.6	Proportional Gain, pu
Kir	3.6	Integral Gain, pu
Ta	0.02	Time constant, sec
Vrmax	1.0	Maximum control element output, pu
Vrmin	-0.87	Minimum control element output, pu
Kpm	1.0	Prop. Gain of field voltage regulator, pu
Kim	0.0	Integral Gain of field voltage regulator, pu
Vmmax	1.0	Maximum field voltage regulator output, pu
Vmmin	-0.87	Minimum field voltage regulator output, pu
Kg	0.0	Excitation limiter gain, pu
Kp	5.55	Potential source gain, pu
Ang p	0.0	Phase angle of potential source, degree
Ki	0.0	Current source gain, pu
Kc	0.08	Exciter regulation factor, pu
Xl	0.0	P-bar leakage reactance, pu
Vbmax	6.94	Maximum excitation voltage

Table 2.4
Governor Model (GGOV1)

Variable	Value	Description
r	0.05	Permanent of droop, per-unit
rselect	1.0	Feedback signal for droop
Tpelec	1.0	Electrical power transducer time constant, sec
maxerr	0.05	Maximum value for speed error signal
minerr	-0.05	Minimum value for speed error signal
Kpgov	10	Governor proportional gain
Kigov	2	Governor integral gain
Kdgov	0.0	Governor derivative gain
Tdgov	1.0	Governor derivative controller time constant
vmax	1.0	Maximum valve position limit
Vmin	0.15	Minimum valve position limit
Tact	0.5	Actuator time constant
Kturb	1.5	Turbine gain
Wfnl	0.2	No load fuel flow, per-unit
Tb	300	Turbine lag time constant
Tc	195	Turbine lead time constant
Flag	1.0	Switch for fuel source characteristic
Teng	0.0	Transport lag time constant for diesel engine
Tfload	3.0	Load limiter time constant
Kpload	2.0	Load limiter proportional gain for PI controller
Kiload	0.67	Load limiter integral gain for PI controller
Ldref	1.0	Load limiter reference value, per-unit
Dm	-2.0	Speed sensitivity coefficient, per-unit
ropen	0.1	Maximum valve opening rate, per-unit / second
rclose	-0.1	Minimum valve opening rate, per-unit / second
Kimw	0.002	Power controller (reset) gain
Pmwset	15	Power controller setpoint, MW
aset	0.01	Acceleration limiter setpoint, per-unit / second
Ka	5.0	Acceleration limiter gain
Ta	0.1	Acceleration limiter time constant, second
db	0.00025	Speed governor dead band
Tsa	4.0	Temperature detection lead time constant, second
Tsb	5.0	Temperature detection lag time constant, second
rup	99.0	Maximum rate of load limit increase
rdown	-99.0	Minimum rate of load limit increase

Table 2.5
Power System Stabilizer Model (PSS2A)

Variable	Value	Description
J1	1	Input signal #1 code
K1	0	Input signal #1 remote bus number
J2	3	Input signal #2 code
K2	0	Input signal #2 remote bus number
Tw1	2	First washout on signal #1, sec.
Tw2	2	Second washout on signal #1, sec.
Tw3	2	First washout on signal #2, sec.
Tw4	0	Second washout on signal #2, sec.
T6	0	Time constant on signal #1, sec.
T7	2	Time constant on signal #2, sec.
Ks2	0.147	Gain on signal #2
Ks3	1	Gain on signal #2
Ks4	1	Gain on signal #2
T8	0.5	Lead of ramp tracking filter
T9	0.1	Lag of ramp tracking filter
n	1	Order of ramp tracking filter
m	5	Order of ramp tracking filter
Ks1	8	Stabilizer gain
T1	0.25	Lead/lag time constant, sec.
T2	0.03	Lead/lag time constant, sec.
T3	0.15	Lead/lag time constant, sec.
T4	0.015	Lead/lag time constant, sec.
Vstmax	0.1	Stabilizer output max limit, p.u.
Vstmin	-0.1	Stabilizer output min limit, p.u.

3. Point of Interconnection Assessment

The project location and POI is existing, therefore, an assessment of potential alternative POI's for the Watson Generation Project was not required. The requested POI for the Watson Generation Project is viable.

4. Network Study Analysis

The following is a summary of the results of the Network Study analysis study used to identify Network Upgrades to mitigate impacts on the CAISO Controlled Grid caused by the Watson Generation Project.

4.1 Study Scope and Purpose

In accordance with Section 6.2 of the CAISO LGIP Tariff, this analysis is to follow the scope and purpose as stated below.

> *"The Phase I Interconnection Study shall (i) evaluate the impact of all Interconnection Requests received during the Queue Cluster Window on the CAISO Controlled Grid, (ii) preliminarily identify all Network Upgrades needed to address the impacts on the CAISO Controlled Grid of the Interconnection Requests, (iii) preliminarily identify for each Interconnection Request required Interconnection Facilities, (iv) assess the Point of Interconnection selected by each Interconnection Customer and potential alternatives to evaluate potential efficiencies in overall transmission upgrades costs, (v) establish the maximum cost responsibility for Network Upgrades assigned to each Interconnection Request in accordance with LGIP Section 6.3, and (vi) provide a good faith estimate of the cost of Interconnection Facilities for each Interconnection Request.*

The Phase I Interconnection Study will consist of a short circuit analysis, a stability analysis to the extent the CAISO and applicable Participating TO(s) reasonably expect transient or voltage stability concerns, a power flow analysis, including off-peak analysis, and an On-Peak and Off-Peak Deliverability Assessment(s), as applicable, in accordance with LGIP Section 6.3.2. The Phase I Interconnection Study will state for each Group Study or Interconnection Request studied individually (i) the assumptions upon which it is based, (ii) the results of the analyses, and (iii) the requirements or potential impediments to providing the requested Interconnection Service to all Interconnection Requests in a Group Study or to the Interconnection Request studied individually. The Phase I Interconnection Study will provide, without regard to the requested Commercial Operation Dates of the Interconnection Requests, a list of Network Upgrades to the CAISO Controlled Grid that are preliminarily identified as required as a result of the Interconnection Requests in a Group Study or as a result of any Interconnection Request studied individually and Participating TO's Interconnection Facilities associated with each Interconnection Request, and an estimate of any other financial impacts (i.e., on Local Furnishing Bonds)."

4.2 Cost Allocation if Network Upgrades

In accordance with Section 6.3 of the CAISO LGIP Tariff, the method for allocating costs of Network Upgrades to specific Interconnection Customers in the Phase I Study is stated below.

"The CAISO, in coordination with the applicable Participating TO(s), will perform short circuit and stability analyses for each Interconnection Request either individually or as part of a Group Study to preliminarily identify the Reliability Network Upgrades needed to interconnect the Large Generating Facilities to the CAISO Controlled Grid. The CAISO, in coordination with the applicable Participating TO(s), shall also perform power flow analyses, under a variety of system conditions, for each Interconnection Request either individually or as part of a Group Study to identify Reliability Criteria violations, including applicable thermal overloads, that must be mitigated by Reliability Network Upgrades.

The cost of all Reliability Network Upgrades identified in the Phase I Interconnection Study shall be estimated in accordance with LGIP Section 6.4. The estimated costs of Reliability Network Upgrades identified as a result of an Interconnection Request studied separately shall be assigned solely to that Interconnection Request. The estimated costs of Reliability Network Upgrades identified through a Group Study shall be assigned to all Interconnection Requests in that Group Study pro rata on the basis of the maximum megawatt electrical output of each proposed new Large Generating Facility or the amount of megawatt increase in the generating capacity of each existing Generating Facility as listed by the Interconnection Customer in its Interconnection Request."

Also, in accordance with Section 6.4 of the CAISO LGIP Tariff, unit costs were developed and provided the basis for preparing cost estimates for Network Upgrades as stated below.

"Prior to the commencement of the initial Queue Cluster Window for each calendar year, each Participating TO, under the direction of the CAISO, shall publish per unit costs for facilities generally required to interconnect Generation to their respective systems. These per unit costs shall reflect the anticipated cost of procuring and installing such facilities during the current Interconnection Study Cycle, and may vary among Participating TOs and within a PTO Service Territory based on geographic and other cost input differences, and should include an annual adjustment for the following ten (10) years to account for the anticipated timing of procurement to accommodate a potential range of Commercial Operation Dates of

Interconnection Requests in the Interconnection Study Cycle. The per unit costs will be used to develop the cost of Reliability Network Upgrades, Delivery Network Upgrades and Participating TO's Interconnection Facilities under this LGIP Section 6."

4.3 Study Procedures

In accordance with Section 6.6 of the CAISO LGIP Tariff, Phase I Interconnection studies were conducted following the procedures stated below.

"The CAISO shall coordinate the Phase I Interconnection Study with applicable Participating TO(s) pursuant to LGIP Section 3.2 and any Affected System that is affected by the Interconnection Request pursuant to LGIP Section 3.7. Existing studies shall be used to the extent practicable when conducting the Phase I Interconnection Study. The CAISO will coordinate Base Case development with the applicable Participating TOs to ensure the Base Cases are accurately developed. The CAISO shall use Reasonable Efforts to complete and publish to Interconnection Customers the Phase I Interconnection Study report at a maximum within two hundred seventy (270) calendar days after the close of the Queue Cluster Window and approximately one hundred eighty calendar days after the final Scoping Meeting held for the Interconnection Study Cycle; however, each individual study or Group Studies may be completed prior to this maximum time where practicable based on factors, including, but not limited to, the number of Interconnection Requests in the Queue Cluster Window, study complexity, and reasonable availability of subcontractors as provided under LGIP Section 13.2. The CAISO will share applicable study results with the applicable Participating TO(s) for review and comment and will incorporate comments into the study report. The CAISO will issue a final Phase I Interconnection Study report to the Interconnection Customer. At the time of completion of the Phase I Interconnection Study, the CAISO may, at the Interconnection Customer's request, determine whether the provisions of LGIP Section 7.6 apply.

At any time the CAISO determines that it will not meet the required time frame for completing the Phase I Interconnection Study due to the large number of Interconnection Requests in the Queue Cluster Window, study complexity, or unavailability of subcontractors on a reasonable basis to perform the study in the required time frame, the CAISO shall notify the Interconnection Customers as to the schedule status of the Phase I Interconnection Study and provide an estimated completion date with an explanation of the reasons why additional time is required.

Upon request, the CAISO shall provide the Interconnection Customer all supporting documentation, workpapers and relevant pre-Interconnection Request and post-Interconnection Request power flow, short circuit and stability databases for the Phase I Interconnection Study, subject to confidentiality arrangements consistent with LGIP Section 13.1."

4.4 Classification of Network Upgrades as Reliability or Deliverability

In the performance of power flow, post-transient, or stability studies, if network upgrades are found to be needed, the following are the CAISO guidelines used for classifying reliability and delivery network upgrades.

1. **Reliability Network Upgrades** are transmission facilities at or beyond the POI "***necessary to interconnect***" the generation in order to remedy short circuit or stability problems, or thermal overloads. However, they shall only be deemed necessary for thermal overloads, occurring under any system condition, where such thermal overloads cannot be adequately mitigated through

Congestion Management, Operating Procedures, or Special Protection Systems (SPS) based on the characteristics of the Large Generating Facilities included in the Interconnection Studies, limitations on market models, systems, or information, or other factors specifically identified in the Interconnection Studies. Reliability Network Upgrades also include, consistent with WECC practice, the facilities necessary to mitigate any adverse impact the Large Generating Facility's interconnection may have on a path's WECC rating. [Tariff Definition]

2. **Delivery Network Upgrades** are transmission facilities at or beyond the POI, other than Reliability Network Upgrades, identified in the Interconnection Studies ***to relieve Constraints on the CAISO Controlled Grid***. [Tariff Definition]

3. Network upgrades necessary to interconnect the generation and inject a particular generation project's full output into the grid under favorable system dispatch conditions are Reliability Network Upgrades. Favorable system dispatch conditions can include counterflows and reasonable displacement of other local generation.

4. Network upgrades necessary to deliver the projects output under system dispatch conditions consistent with the CAISO's Deliverability Assessment Methodologies are Delivery Network Upgrades.

5. Low cost (e.g., less than $1 million) network upgrades identified under system dispatch conditions more stressed than the CAISO's Deliverability Assessment Methodologies are Reliability Network Upgrades. This is because overburdening the CAISO's congestion management system can increase processing time to a point that could create reliability concerns.

6. Network upgrades necessary to mitigate stability problems caused by delivering generation under system dispatch conditions consistent with the CAISO's Deliverability Assessment Methodologies, and are not Reliability Network Upgrades identified in item 3 above, are Delivery Network Upgrades.

4.5 Study Conditions and Assumptions

Master and Study Level Power Flow Cases

Two master power flow base cases (Master Cases) representing on-peak and off-peak conditions were developed as the starting point for the Transition Cluster Phase I Interconnection Study based on the 5-year base case developed for the 2009 SCE Transmission Reliability Assessment and Compliance Plan. These two Master Cases included all load, generation, transmission and critical path flow assumptions to reflect accurately the entire SCE grid under in the year and season of interest. From these two Master Cases, study level power flow base cases (Study Cases) for each Individual and Group Study area were developed in accordance with Interconnection Requests that entered the Transition Cluster Window. Generation entering in the Transition Cluster through the CAISO LGIP Tariff process and the SCE Wholesale Distribution Access Tariff (WDAT) Clustering Large Generation Interconnection Procedures (CLGIP) process were modeled. Refinements were made to the Master Case to create each Study Case to more accurately evaluate the individual generator or group of generators within their respective local or regional electrical area.

However, generation and transmission projects with lead times longer than 5 years were included in the base cases. Further refinements were made to the Master Cases to create study cases to more accurately evaluate the individual generator or group of generators within their respective study group area and sub area. Full Deliverability and Energy-Only generation units were modeled on line at full rated nameplate MW capacity. The aggregate generation MW output within a study group area and sub area were dispatched to other areas including PG&E, SCE, and SDG&E. Though a target dispatch to PG&E, SCE, and SDG&E was on a traditional planning assumption split of 50%, 43%, and 7%, respectively, not all base cases were able to achieve these target levels. The bulk power study considered two load conditions: 2013 heavy summer and 2013 Light Spring load conditions.

Heavy summer and localized light load study assumptions are provided below in Table 3.1 and Table 3.2 respectively.

Table 3.1
Heavy Summer Load (MW) Assumptions

SUBSTATION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alamitos 220/66	194	191	191	191	192	192	190	191	192	192
Alberhill 500/115	0	0	0	251	259	264	280	289	300	310
Antelope 220/66	693	709	726	741	759	777	794	812	829	852
Auld 500/115	0	0	0	0	0	0	0	0	596	608
Bailey 220/66	143	153	164	175	187	199	211	223	234	249
Barre 220/66	796	797	793	796	801	812	815	822	828	839
Big Creek 220/220	11	11	11	11	11	11	11	11	11	11
Blythe (Walc) 161/33	60	60	61	62	62	63	64	65	66	67
Camino 220/66	2	2	2	2	2	2	2	2	2	2
Center 220/66	491	488	490	494	499	502	506	509	514	517
Chevmain 220/66	167	167	167	167	167	167	167	167	167	167
Chino 220/66	732	848	869	886	903	921	927	932	944	958
Cima 220/66	3	3	3	3	3	3	3	3	3	3
Del Amo 220/66	486	480	481	480	485	488	496	501	503	505
Devers 220/115	716	341	350	358	368	378	387	401	411	422
Eagle Mountain 220/66	2	2	2	2	2	2	2	2	2	2
Eagle Rock 220/66	218	222	226	230	236	246	253	257	260	266
El Casco 220/115	0	208	215	219	233	241	249	257	265	274
El Dorado 220/115	13	13	13	13	13	13	13	13	13	13
El Nido 220/66	423	427	436	436	439	437	439	442	443	446
Ellis 220/66	686	689	712	717	727	729	736	744	749	757
Etiwanda 'Ameron' 220/66	18	18	18	18	18	18	18	18	18	18
Etiwanda 220/66	743	751	757	788	809	829	845	873	887	908
Goleta 220/66	299	297	296	296	297	298	299	301	302	303
Goodrich 220/33 (City of Pasadena)	309	307	306	306	308	309	312	314	315	316
Gould 220/66	139	139	142	145	147	150	152	154	156	159
Hinson 220/66	481	476	473	472	472	474	474	476	477	479
Inyokern 220/115	30	31	32	37	38	39	40	41	42	44
Johanna 220/66	473	489	512	529	581	584	586	592	597	615
Kramer 220/115	191	194	197	200	204	207	209	212	215	219
La Cienega 220/66	521	522	525	526	529	533	535	538	541	545
La Fresa 220/66	711	703	699	698	699	705	706	709	713	713
Laguna Bell 220/66	479	477	478	481	485	490	494	500	505	509
Lewis 220/66 (City of Anaheim)	565	564	565	571	588	597	606	619	628	636
Lighthipe 220/66	492	489	489	489	491	494	496	498	501	502
Mesa 220/66	648	654	650	651	658	657	663	669	675	678
Mira Loma 220/66	699	604	614	625	638	647	666	687	703	718
Mirage 220/115	0	488	496	505	516	527	538	544	555	565
Moorpark 220/66	854	866	872	879	885	895	903	914	920	930
Olinda 220/66	388	387	389	394	396	401	407	416	424	430
Padua 220/66	690	686	684	683	686	696	704	713	720	724
Rector 220/66	770	785	793	810	836	849	482	494	505	515
Rio Hondo 220/66	739	738	738	739	742	748	750	757	762	765
San Bernardino 220/66	662	666	672	684	689	696	712	724	705	712
San Joaquin 220/66	0	0	0	0	0	0	424	435	444	453
Santa Clara 220/66	608	617	626	636	646	655	662	672	681	693
Santiago 220/66	796	851	876	897	920	945	963	685	695	703
Saugus 220/66	827	843	990	1011	1037	1057	1076	1099	1122	1142
Springville 220/66	299	298	307	307	308	323	328	334	339	345
Valley 500/115	1820	1864	1912	1712	1758	1806	1839	1886	1331	1360
Vestal 220/66	180	181	182	183	183	185	186	188	190	192
Victor 220/115	493	500	504	513	524	535	545	556	567	577
Viejo 220/66	382	388	390	393	397	402	406	672	679	685
Villa Park 220/66	763	768	763	766	728	734	736	735	739	739
Vista 220/115	362	248	260	252	256	264	267	271	278	282
Vista 220/66	728	732	736	538	549	562	574	587	630	648
Walnut 220/66	723	712	706	709	710	712	715	720	725	726
Wilderness 220/66 (City of Riverside)	0	0	0	296	296	298	298	300	301	301
TOTALS	**24718**	**25144**	**25560**	**25974**	**26372**	**26768**	**27160**	**27545**	**27921**	**28308**

Table 3.2
Localized Light Load (MW) Assumptions

SUBSTATION	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alamitos 220/66	119	117	117	117	118	118	116	117	118	118
Alberhill 500/115	0	0	0	154	159	162	172	177	184	190
Antelope 220/66	425	434	445	454	465	476	487	498	508	522
Auld 500/115	0	0	0	0	0	0	0	0	365	373
Bailey 220/66	88	94	100	107	115	122	129	136	144	153
Barre 220/66	488	489	486	488	491	498	499	504	507	514
Big Creek 220/220	7	7	7	7	7	7	7	7	7	7
Blythe (Walc) 161/33	37	37	37	38	38	39	39	40	41	41
Camino 220/66	1	1	1	1	1	1	1	1	1	1
Center 220/66	301	299	300	303	306	308	310	312	315	317
Chevmain 220/66	109	109	109	109	109	109	109	109	109	109
Chino 220/66	448	519	532	543	554	564	568	571	579	587
Cima 220/66	2	2	2	2	2	2	2	2	2	2
Del Amo 220/66	298	295	295	294	297	299	304	307	308	309
Devers 220/115	439	209	214	220	225	231	237	246	252	258
Eagle Mountain 220/66	1	1	1	1	1	1	1	1	1	1
Eagle Rock 220/66	133	136	138	141	144	151	155	157	159	163
El Casco 220/115	0	128	132	134	143	148	153	158	162	168
El Dorado 220/115	8	8	8	8	8	8	8	8	8	8
El Nido 220/66	259	262	267	268	269	268	269	271	272	274
Ellis 220/66	420	422	437	440	446	447	451	456	459	464
Etiwanda 'Ameron' 220/66	12	12	12	12	12	12	12	12	12	12
Etiwanda 220/66	456	460	464	483	496	508	518	535	544	557
Goleta 220/66	183	182	181	182	182	183	183	185	185	186
Goodrich 220/33 (City of Pasadena)	189	188	187	188	188	190	191	192	193	194
Gould 220/66	85	85	87	89	90	92	93	95	96	97
Hinson 220/66	295	292	290	289	289	291	291	292	293	294
Inyokern 220/115	19	19	19	23	23	24	25	25	26	27
Johanna 220/66	290	300	314	324	356	358	359	363	366	377
Kramer 220/115	117	119	121	123	125	127	128	130	132	134
La Cienega 220/66	320	320	322	323	324	326	328	330	332	334
La Fresa 220/66	436	431	429	428	429	432	433	435	437	437
Laguna Bell 220/66	293	292	293	295	297	300	303	306	309	312
Lewis 220/66 (City of Anaheim)	346	345	346	350	360	366	371	379	385	390
Lighthipe 220/66	301	300	299	300	301	303	304	305	307	308
Mesa 220/66	397	401	398	399	403	402	406	410	413	416
Mira Loma 220/66	429	370	376	383	391	397	408	421	431	440
Mirage 220/115	0	299	304	310	316	323	330	334	340	346
Moorpark 220/66	524	531	535	539	543	549	553	560	564	570
Olinda 220/66	238	237	239	241	243	246	250	255	260	263
Padua 220/66	423	420	419	419	420	427	431	437	441	444
Rector 220/66	472	481	486	497	512	520	296	303	310	316
Rio Hondo 220/66	453	452	452	453	455	458	460	464	467	469
San Bernardino 220/66	406	408	412	419	422	427	436	444	432	436
San Joaquin 220/66	0	0	0	0	0	0	260	266	272	278
Santa Clara 220/66	0	0	0	0	0	0	0	0	0	0
Santiago 220/66	373	378	384	390	396	401	406	412	418	425
Saugus 220/66	488	522	537	550	564	579	590	420	426	431
Springville 220/66	507	516	607	620	636	648	660	673	688	700
Valley 500/115	183	182	188	188	189	198	201	204	208	211
Vestal 220/66	1116	1143	1172	1049	1078	1107	1127	1156	816	833
Victor 220/115	110	111	111	112	112	113	114	115	116	117
Viejo 220/66	302	306	309	315	321	328	334	341	347	354
Villa Park 220/66	234	238	239	241	244	247	249	412	416	420
Vista 220/115	468	471	468	470	446	450	451	450	453	453
Vista 220/66	222	152	159	155	157	162	164	166	170	173
Walnut 220/66	446	449	451	330	337	345	352	360	386	397
Wilderness 220/66 (City of Riverside)	443	437	433	434	435	436	438	441	444	445
TOTALS	**15157**	**15419**	**15673**	**15746**	**15990**	**16232**	**16472**	**16707**	**16937**	**17174**

The active serial queued generation projects modeled in the study are shown in Table 3.3.

Table 3.3
Metro Area Active Serial Queued Projects

Los Angeles Basin (Metro) Area Interconnection Projects		
Project ID	**Area of Interconnection**	**Project Size (MW)**
CAISO Queue #7	El Segundo 230	630
CAISO Queue #66	Walnut 230	500.5
CAISO Queue #80	Laguna Bell 230	610
CAISO Queue #104	Laguna Bell 230	304
CAISO Queue #161	Harborgen 230	202
CAISO Queue #252	Redondo 230	12.7
SCE WDAT #086	Sanitreat 66kV	8
SCE WDAT #223	Walnut 66kV	49.9
SCE WDAT #229	Center 66kV	47.1
SCE WDAT #236	Barre 66kV	47.9
SCE WDAT #240	Olinda 66kV	25

Area and Path Flow Assumptions

The following table shows SCE Area assumptions and relevant path flows and area import totals in the pre-Transition Cluster base cases.

Table 3.4
Base Case Power Flow Study Assumptions (MW)

	2013 Heavy Summer		2013 Light Spring	
Area Assumptions	Case 1 Pre-Project	Case 2 Post-Project	Case 3 Pre-Project	Case 4 Post-Project
Generation	17,049	17,048	11,379	11,388
Import	9,664	9,664	5,003	5,003
Load	26,270	26,274	16,179	16,182
Losses	443	438	203	208
Path Flows and Area Imports				
West-of-River (Path 46)	6,781	6,781	4,139	4,138
Midway-Vincent (Path 26)	3,997	3,998	1,436	1,439
South of Lugo	3,177	3,159	1,684	1,667
So. of SONGS (Path 43)	1,158	1,159	1,478	1,479
So. California Import Transfer	12,974	12,947	7,879	7,879

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4.4 Study Methodology

The power flow base cases(s) and dynamic stability data were developed in General Electric PSLF 16.3_02 format. For all areas outside California, the network topology and loads reflect information provided to WECC by each respective owner area. This Phase I Interconnection Study was conducted by applying the SCE and CAISO Planning Standards. More specifically, the main criteria applicable to this study are as follows:

Power Flow Study Principles

The following principles were used in determining whether congestion management, SPS, 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
- SPS, in lieu of facility upgrades, will be recommended if the system is simple and 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 SPS in the area, and can be readily implemented
- Facility upgrades will be required if implementation of a special protection system is determined to be complex, ineffective, or the amount of tripping exceeds the current CAISO single and double contingency tripping limitations
- Facility upgrades will also be required if adverse impacts are identified on existing or currently proposed SPS
- Congestion management in preparation for the next contingency will be required, with CAISO concurrence, if no facility upgrades or SPS are implemented

Power Flow Analysis Criteria and Contingency List

Power flow studies will be performed under normal, and single and double contingency conditions to ensure the Planning Standards are met.

A. Under normal conditions, bus voltages must be maintained to within system operating bulletin normal limits, unless location-specific operating voltage requirements also exist. All line and transformer loadings must be below normal continuous ratings.

B. SCE guidelines for VAR flow interchange with adjacent utilities would be ideally kept at a fixed, constant value. However, because a power system is dynamic, VAR flow can be controlled only within reasonable limits and may actually exceed the limits from time to time.

C. Study Criteria during Contingency Conditions

   - No transmission element will be loaded above its emergency rating as stated in the CAISO transmission register and indicated below.

<table>
<tr><td rowspan="3">Transmission Lines</td><td>Base Case</td><td>Limiting Component Normal Rating</td></tr>
<tr><td>N-1</td><td>Limiting Component A-Rating</td></tr>
<tr><td>N-2</td><td>Limiting Component B-Rating</td></tr>
<tr><td rowspan="2">500/220 kV Transformer Banks</td><td>Base Case</td><td>Normal Loading Limit</td></tr>
<tr><td>Long-Term &
Short-Term</td><td>As defined by SCE Operating Bulletin No.33</td></tr>
</table>

- Equipment emergency voltage limits (high or low) will not be exceeded.
- Bus voltage deviations from the base case voltage shall not exceed established planning limits.
- No loss of load for single contingencies.

D. The base cases will be used to simulate the impact of the Transition Cluster queued generation projects during normal operating conditions, as well as single and selected multiple (CAISO Categories "B" and "C") outages. Both conditions immediately following contingencies and post-transient conditions will be studied. The outage list is available from CAISO.

Short Circuit Duty Study Principles

To determine the impact on short-circuit duty within the SCE electrical system after inclusion of the Transition Cluster generation Projects, the study calculated the maximum symmetrical three-phase-to-ground and single-line-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 Transition Cluster generation projects, 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.

Transient Stability Analysis Criteria

Transient stability studies will be performed to the extent that CAISO and SCE reasonably expect transient or voltage stability concerns for the electrical area under study.

a. All machines in the system shall remain in synchronism as demonstrated by their relative rotor angles.
b. System stability is evaluated based on the damping of the relative rotor angles and the damping of the voltage magnitude swings.
c. The transient voltage dip should be maintained above 0.80 p.u. at Adelanto and Sylmar.
d. Other transient voltage dips and duration requirements must meet the criteria of the WECC/NERC Planning Standards as indicated below.

Table 3.5
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.

5. POWER FLOW STUDY FINDINGS

Base Case Results

The study did not identify any Base Case overload due to the addition of the Watson Generation project. Power flow plots illustrating heavy summer and spring base case conditions with and without the Watson Generation Project are shown below in Figure 3.1 through Figure 3.4.

Figure 3.1
Heavy Summer Power Flow Plot
Pre-Project with All Upgrades for Queued Ahead Projects Modeled

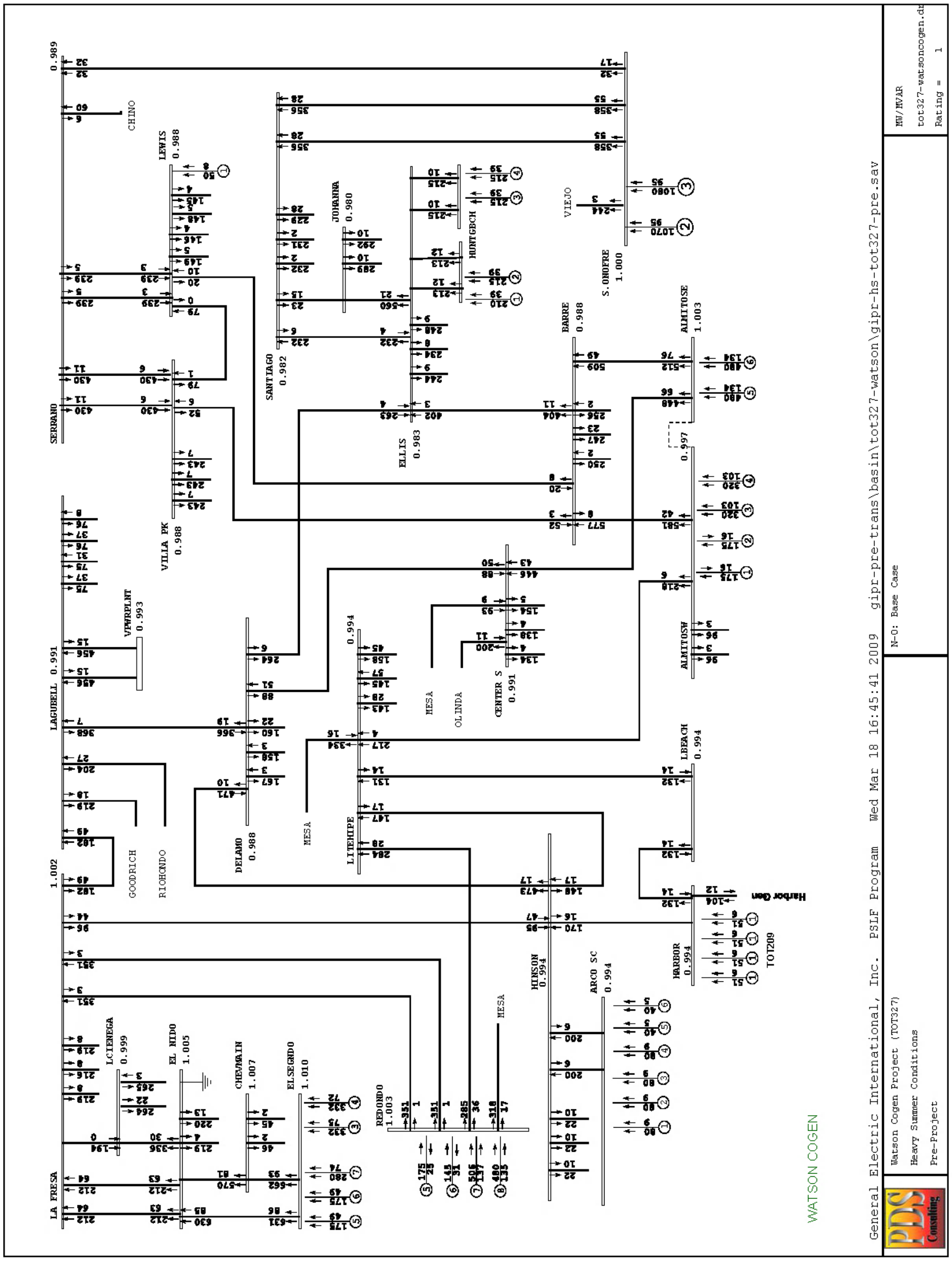


Figure 3.2
Heavy Summer Power Flow Plot
Post-Project with All Upgrades for Queued Ahead Projects Modeled

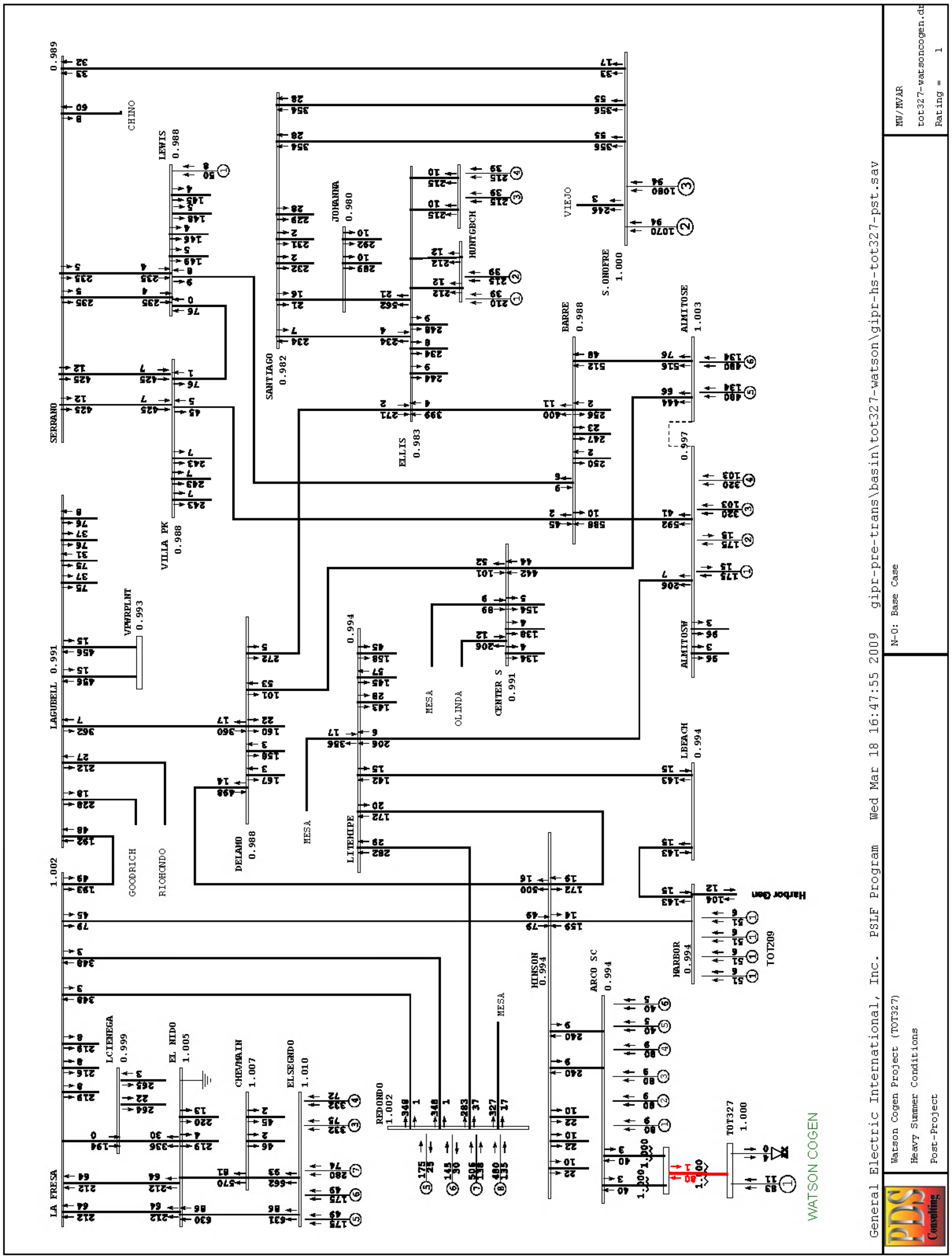


Figure 3.3
Spring Power Flow Plot
Pre-Project with All Upgrades for Queued Ahead Projects Modeled

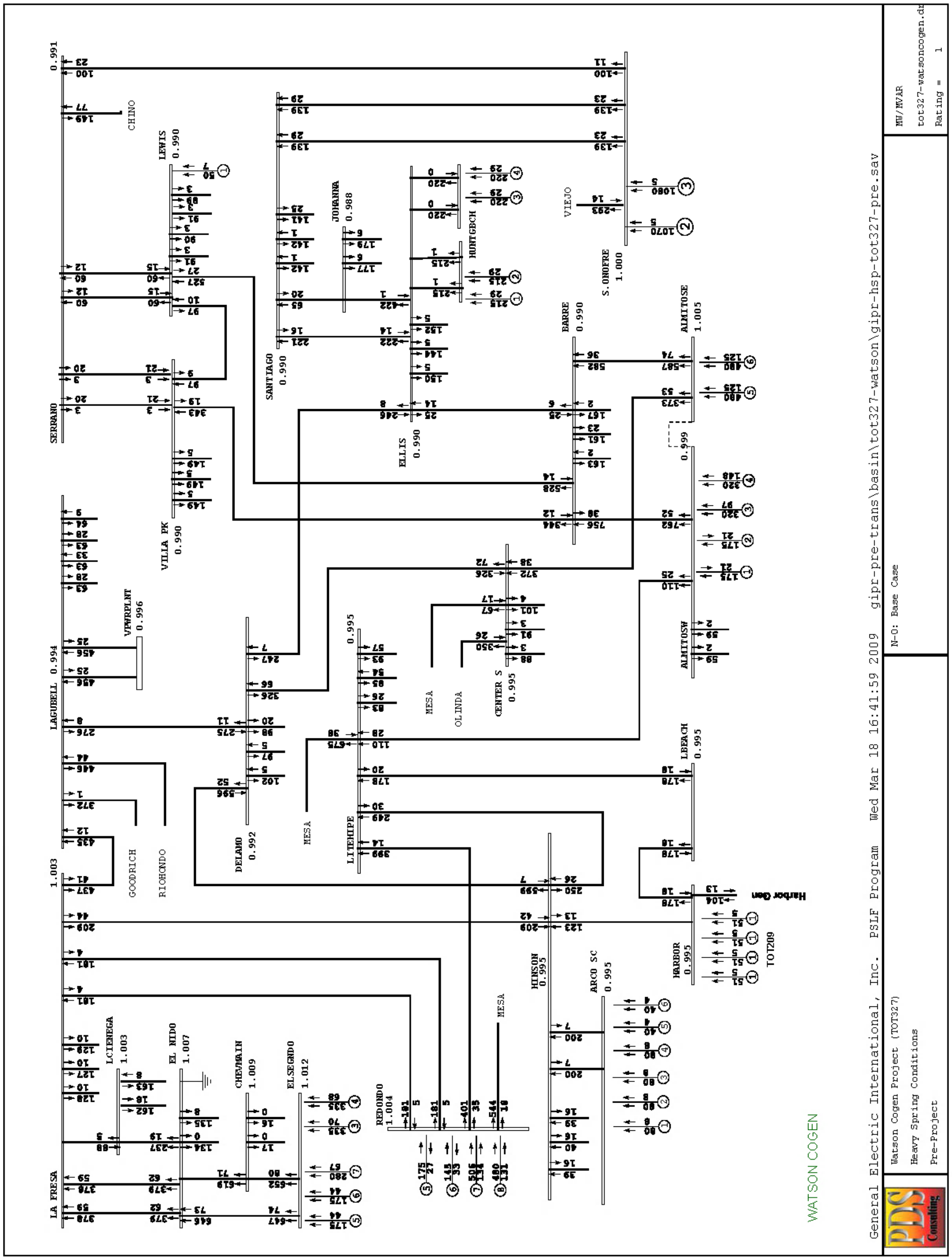
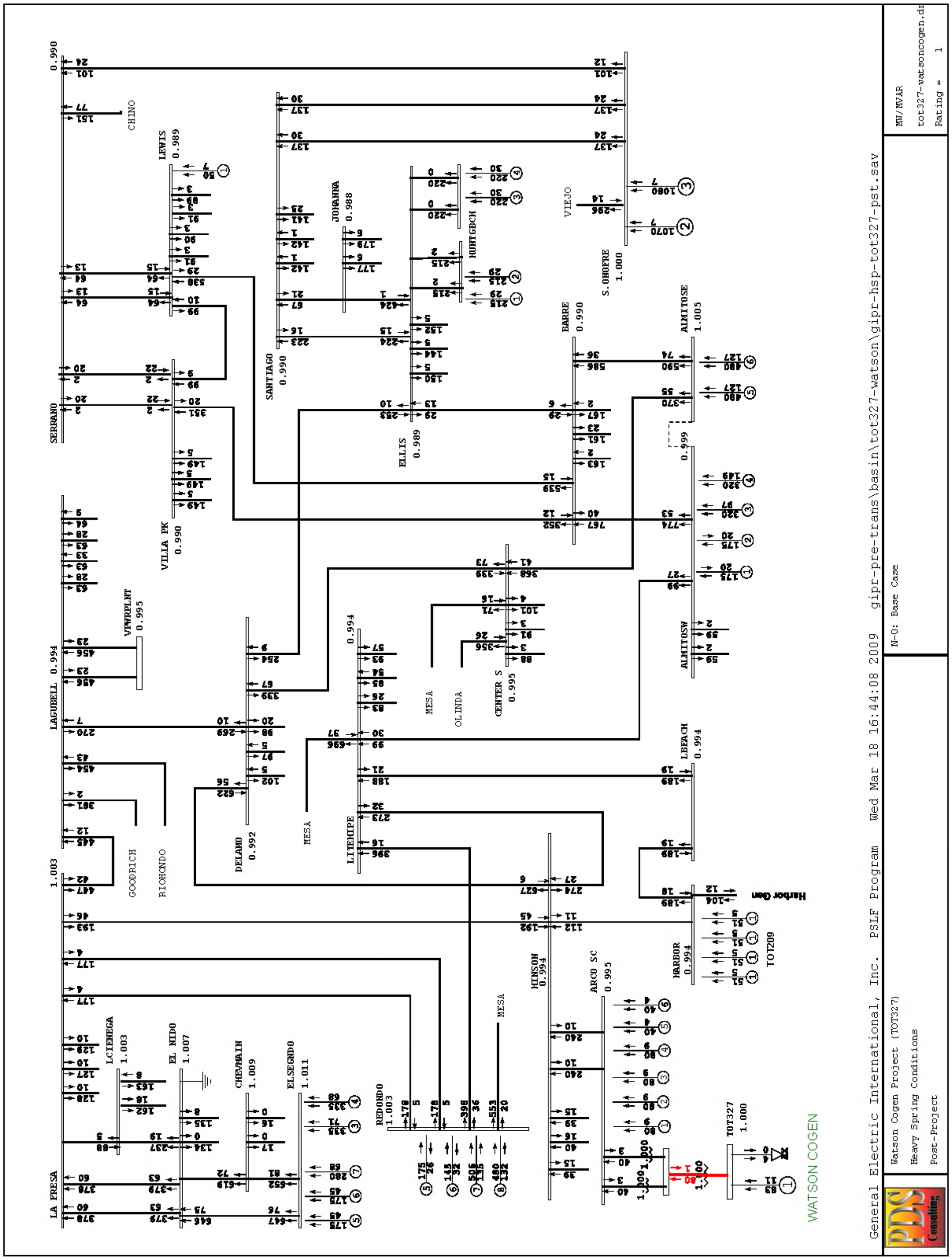


Figure 3.4
Spring Power Flow Plot
Post-Project with All Upgrades for Queued Ahead Projects Modeled



Contingency (N-1 and N-2) Results

The study identified one transmission facility overloaded under one N-1 contingency. The overloaded facility is the Lighthipe-Mesa 220 kV line, upon loss of the Alamitos-Barre No. 2-220 kV line during spring conditions. See the table 3.6 below.

Table 3.6
Single Contingency (N-1) Power Flow Results

Overloaded Facility	Rating	Heavy Summer		Heavy Spring	
		Pre	Post	Pre	Post
Lighthipe – Mesa 220 kV T/L (Loss of Alamitos-Barre No. 2 220 kV)	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	105.8% 100.0%	108.7% 102.7%

Assumed upgrades for serial queued generation projects (i.e. upgrade of Mesa wavetrap to 3000 A) will mitigate this overload and will accommodate the Watson Generation Project.

The study identified several transmission facility overloads under N-2 contingencies. The overloaded lines are Del Amo-Hinson 220 kV, Lighthipe-Long Beach 220 kV, Hinson-Lighthipe 220 kV, Lighthipe-Mesa 220 kV, and Mesa-Redondo 220 kV. See the table 3.7 below.

Table 3.7
Double Contingency (N-2) Power Flow Results

Overloaded Facility	Rating	Heavy Summer		Heavy Spring	
		Pre	Post	Pre	Post
Del Amo-Hinson 220 kV line Loss of Lighthipe-Mesa 220 kV T/L and Loss of Mesa-Redondo 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	112.9% 106.6%	117.1% 110.6%
Del Amo-Hinson 220 kV line Loss of La Fresa-Laguna Bell 220 kV T/L and Loss of Lighthipe-Mesa 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	112.5% 106.3%	116.9% 110.4%
Del Amo-Hinson 220 kV line Loss of La Fresa-Laguna Bell 220 kV T/L and Loss of Mesa-Redondo 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	103.1% 97.4%	106.9% 101.0%
Long Beach-Lighthipe 220 kV line Loss of Hinson-Delamo 220 kV T/L and Loss of Hinson-Lighthipe 220 kV T/L	1150 Amps (N) 1185 Amps (E)	No Overload	No Overload	129.5% 125.6%	137.7% 133.6%
Hinson-Lighthipe 220 kV line Loss of Hinson-Delamo 220 kV T/L and Loss of Long Beach-Lighthipe 220 kV T/L	1185 Amps (N) 1600 Amps (E)	No Overload	No Overload	157.4% 116.6%	167.9% 124.3%
Lighthipe-Mesa 220 kV line Loss of La Fresa-Laguna Bell 220 kV T/L and Loss of Mesa-Redondo 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	119.2% 112.6%	122.5% 115.7%
Lighthipe-Mesa 220 kV line Loss of Alamitos-Barre No.2 220 kV T/L and Loss of Delamo-Ellis 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	112.2% 106.0%	115.2% 108.8%
Lighthipe-Mesa 220 kV line Loss of Laguna Bell-Rio Hondo 220 kV T/L and Loss of Mesa-Redondo 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	112.0% 105.8%	115.0% 108.6%
Lighthipe-Mesa 220 kV line Loss of Alamitos-Barre No.1 220 kV T/L and Loss of Alamitos-Barre No.2 220 kV T/L	2400 Amps (N) 2540 Amps (E)	No Overload	No Overload	107.2% 101.3%	110.1% 104.0%

Mesa-Redondo 220 kV line Loss of La Fresa-Laguna Bell 220 kV T/L and Loss of Lighthipe-Mesa 220 kV T/L	2000 Amps (N) 2200 Amps (E)	No Overload	No Overload	115.3% 104.8%	117.9% 107.2%
Mesa-Redondo 220 kV line Loss of La Fresa-Laguna Bell 220 kV T/L and Loss of Lighthipe-Redondo 220 kV T/L	2000 Amps (N) 2200 Amps (E)	No Overload	No Overload	109.0% 99.1%	110.6% 100.5%

Upgrades assumed for serial queued projects (i.e. upgrade of two Mesa wavetrap to 3000 A and upgrade of Hinson wavetrap to 3000 A) will mitigate all N-2 overloads on the Del Amo-Hinson 220-kV, Lighthipe-Mesa 220 kV and Mesa-Redondo 220-kV lines.

Mitigation of the impacts of the Watson Generation Project on the remaining overloads (Lighthipe-Long Beach 220 kV and Lighthipe-Hinson 220 kV) could be mitigated by system upgrades such as adding the Watson Cogeneration Project to an existing planned SPS. The SPS will trip the Watson Generation Project under two N-2 contingency conditions (simultaneous outage of the Del Amo-Hinson 220 kV and either the Hinson-Lighthipe 220 kV or the Lighthipe-Long Beach 220 kV). The CAISO has determined however, that mitigation of these remaining N-2 overloads could also be effectively implemented by use of congestion management, i.e. generation disputably in lieu of system upgrades. Based on this determination, no cost for network upgrades to mitigate the remaining N-2 overloads will be allocated to the Watson Generation Project as part of the Phase I study.

POST-TRANSIENT STABILITY FINDINGS

There were no post-transient criteria violations identified with the addition of the Watson Generation Project.

TRANSIENT STABILITY FINDINGS

There were no transient stability criteria violations identified with the addition of the Watson Generation Project.

SHORT CIRCUIT DUTY STUDY FINDINGS

The starting point for developing the SCD base case for transition cluster studies was the existing SCE transmission network and all associated generation. The short circuit model extends beyond SCE's area to include projects that have a significant impact on the short circuit duties at SCE busses. Equivalents are used to model the system beyond these areas. The existing Serial Group projects and associated transmission upgrades identified in each interconnection system impact study were then added to this model to form the pre-Transition Cluster base case model.

Short circuit duties at each SCE bus were then determined after adding the Transition Cluster generation and associated transmission upgrades to the pre-Transition Cluster base case model to form the Transition Cluster base case model. These short circuit duty results were evaluated to identify over stressed circuit breakers.

Results of the short-circuit duty studies are shown below in tables 3.8 and 3.9.

Table 3.8
Three Phase (3PH)
Short Circuit Duty Study Results

Bus Name	Bus KV	Pre-Project		Post-Project		DELTA kA
		X/R	kA	X/R	kA	
MIRA LOMA	500	25.5	41.9	25.7	53.4	11.5
REDONDO	220	24.2	47.6	24.4	48.4	0.8

Table 3.9
Single Line to Ground (SLG)
Short Circuit Duty Study Results

Bus Name	Bus KV	Pre-Project		Post-Project		DELTA kA
		X/R	kA	X/R	kA	
MIRA LOMA	500	10.2	37.2	9.7	45.8	8.6
REDONDO	220	30.6	42.4	30.9	42.8	0.4

Discussion of SCD Study Results at Mira Loma and Serrano Substations

The significant number of requests to interconnect generating facilities to the SCE grid has proved challenging with regard to Short Circuit Duty. The Phase I studies depict several areas of the SCE system with extremely high Short Circuit Duty, and various methods of mitigation are being evaluated. However, at this time SCE does not have a proposed recommendation to alleviate this issue at two separate locations.

Specifically, SCE's Mira Loma Substation shows a post project three-phase Short Circuit Duty of 75.5 kA at the 220 kV bus. Given the high X/R ratio and close proximity of the calculated short circuit duties to the next higher circuit breaker rating (80 kA), SCE would likely need to upgrade the 220 kV bus to 100 kA. The 100 kA Short Duty Requirement presents a number of technical issues (i.e., circuit breaker availability, substation design, and personal grounding) that would need to be worked out before a reasonably accurate cost estimate could be developed. As an example, SCE's current personal grounding technology is limited to 70 kA. A new grounding technology would need to be developed to meet the expected short circuit duty requirements. Therefore, cost estimates have not been provided for this element of work. Additionally, SCE's Serrano Substation is shown with a post project three-phase Short Circuit Duty of 63.9 kA at the 220 kV bus, however, existing SCE equipment is rated at 63 kA. The Serrano Substation is critical to the operation of the SCE System, and it is physically located in a congested metropolitan area. Acceptable and viable methods of mitigation will require solving very complex engineering challenges with potentially long lead times.

Detailed engineering analysis is required to propose feasible solutions at these substations. The Phase I Study process does not allow time to address these types of complex planning and engineering challenges. SCE will further evaluate the impacts of the Short Circuit Duty at these stations, and investigate mitigations during the Phase II Study

6. Study Related to Interconnection Facilities

6.1 Participating Transmission Owner Interconnection Facilities

SCE performed an assessment to identify PTO Interconnection Facilities required to connect the Watson Generation Project to the existing system. Based on information provided by Watson in their Interconnection Request and known information about the geographic area surrounding the POI, SCE has identified the following Interconnection Facilities that need to be installed between the Point of Change of Ownership and the CAISO Controlled Grid. Section 4.2 identifies assumptions included and excluded from this Phase I Study Report.

6.2 Phase I Facilities Study Assumptions

Assumptions Included in Phase I Study	
1.	SCE will install the additional telecommunications path from the Generating Facility to SCE as noted in the deliverability network upgrades section below.
2.	SCE will install the required revenue metering cabinet and retail load meters at the Generating Facility.
3.	SCE will install the required remote terminal unit (RTU) at the Generating Facility.
4.	Existing protection at the Arcogen Substation and Hinson Substation will be used to protect the Arcogen-Hinson No. 1 and No. 2 220 kV lines.

Assumptions NOT Included in Phase I Study	
1	The Project must provide <u>one of the two</u> telecommunication paths that would be required for the line protection and SPS.
2	All required CAISO metering equipment at the Generating Facility will be provided by the generator.
3	All required revenue metering equipment to meter the Generating Facility retail load will be specified by SCE and installed by the generator on their facilities.

6.3 Phase I Facilities Installed by SCE

Metering Services Organization

SCE will install a revenue metering cabinet and revenue meters required to meter the Retail load at the Generating Facility. The generator will provide the required metering equipment (voltage and current transformers).

Power System Control

SCE will install one RTU at the Generating Facility to monitor the typical generation elements such as MW, MVAR, terminal voltage and circuit breaker status at each generating unit and the plant auxiliary load and transmit this information to the SCE Grid Control Center.

7. Study Related to Network Upgrades

SCE identified Network Upgrades to mitigate impacts on the SCE's portion of the CAISO Controlled Grid caused by the Project.

STUDY RESULTS RELATED TO DELIVERABILITY NETWORK UPGRADES

Based on CAISO determination that congestion management will be effective mitigation for power flow overloads identified in the Phase I Study, there are delivery network upgrades identified as part of the Phase I study.

STUDY RESULTS RELATED TO RELIABILITY NETWORK UPGRADES

Install new CB's or upgrade existing CB's as follows:

Mira Loma 500 kV Substation:
Install four (4) new 63kA circuit breakers and upgrade six (6) existing circuit breakers to 63kA. This installation will require eleven (11) sets of transient recovery capacitors.

Redondo 220 kV Substation:
Upgrade four (4) existing circuit breakers to 63kA which require the installation of five (5) sets of transient recovery capacitors.

8. Study Related to Distribution Upgrades

There were no distribution upgrades identified as part of the Phase I study.

9. Facilities Requirements and Cost Responsibility

The following facilities requirements and associated costs have been determined to be the responsibility of Watson.

9.1 Participating Transmission Owner (PTO) Interconnection Facilities

This Phase I Study identified the following Interconnection Facilities located between the Point of Change of Ownership and the CAISO Controlled Grid. For a description of the facilities, please refer to Section 5 above. For cost information please refer to *Table 8.1*, *Summary of Cost Estimates* located below.

9.2 Distribution Upgrades

This Phase I Study has identified no Distribution Upgrades required to mitigate impacts on SCE's distribution system caused by the connection of and power deliveries from the Watson Cogeneration Project to the CAISO Controlled Grid.

9.3 Reliability Network Upgrades

This Phase I Study has identified Reliability Network Upgrades required to mitigate impacts on SCE's transmission system caused by the connection of and power deliveries from the Watson Cogeneration Project to the CAISO Controlled Grid. For a description of the facilities, please refer to Section 6 above. For cost information please refer to *Table 8.1*, *Summary of Cost Estimates* located below.

9.4 Delivery Network Upgrades

This Phase I Study has identified Delivery Network Upgrades required to mitigate impacts on SCE's transmission system caused by the connection of and power deliveries from the Watson Cogeneration Project to the CAISO Controlled Grid. For a description of the facilities, please refer to Section 6 above. For cost information please refer to *Table 8.1*, *Summary of Cost Estimates* located below.

Table 9.1
Summary of Cost Estimates

Watson Co-generation - T383

Interconnection Facilities Cost Estimate Summary (2009 Dollars)

Scope: Install all Interconnection Facilities to interconnect 85MW of Generation to the SCE Grid at the Hinson Substation 220kV Bus via the existing Arcogen Transmission Lines.

ELEMENT	INTERCONNECTION FACILITIES (Subject to ITCC) (A)	DISTRIBUTION UPGRADES (Subject to ITCC) (B)	RELIABILITY UPGRADES * (Not Subject to ITCC) (C)	ITCC ** (35%) (D=A*35%+B*35%)	ONE-TIME PAYMENT (F=A+B+C+D)
Metering Services					
Retail Metering Equipment at the Generation Facility	$ 12,000	$ -	$ -	$ 4,200	$ 16,200
Power System Control					
RTU at Generation Facility	$ 91,000	$ -	$ -	$ 31,850	$ 122,850
General Contractor					
Project Management	$ 11,000	$ -	$ -	$ 3,850	$ 14,850
Totals	**$ 114,000**	**$ -**	**$ -**	**$ 39,900**	**$ 153,900**
					$ 200,000

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* Pursuant to FERC Order 2003A, ITCC is not collected on Reliability Upgrades.

** ITCC cost (calculated at 35% based on Customer Operating Date after 2009) may be satisfied with a letter of credit in accordance with the tax provisions of the LGIA.

10. Estimated Construction Schedule

The estimated time to construct the required PTO's Interconnection Facilities, any Distribution Upgrades, Reliability Network Upgrades, and Delivery Network Upgrades will be provided in the Phase II Study. Given the magnitude of the Network Upgrades required to interconnect the generation, as requested in the Transition Cluster, the non-binding estimated date the PTO's interconnection facilities, network upgrades, and distribution upgrades will be completed as identified in the Phase I Study could take up to 24 months from execution of an LGIA to engineer, license, permit, and construct.

11. Other Study Assumptions and Responsibilities

11.1 Conceptual Plan of Service

The results provided in this Phase I study are based on conceptual engineering and a preliminary plan of service and are not sufficient for permitting of facilities. The Plan of Service is subject to change as part of the Phase II Interconnection Study.

11.2 Customer's Technical Data

Additional technical data related to the Interconnection Customer's project may be required as part of the Phase II study. The study accuracy and results for the Phase I Study are contingent upon the accuracy of the technical data provided by the Interconnection Customer. Any changes from the data provided could void the study results.

11.3 Study Impacts on Neighboring Utilities

Results or consequences of this Phase I Study and/or to-be-performed Phase II Interconnection Study may require additional studies, facility additions, and/or operating procedures to address impacts to neighboring utilities and/or regional forums. For example, impacts may include but are not limited to WECC Path Ratings, short circuit duties outside of the CAISO Controlled Grid, and sub-synchronous resonance (SSR).

11.4 Use of SCE Facilities

The Interconnection Customer is responsible for acquiring all property rights necessary for the Interconnection Customer's Interconnection Facilities, including those required to cross SCE facilities and property. This Interconnection Study does not include the method or estimated cost to the Interconnection Customer of SCE mitigation measures that may be required to accommodate any proposed crossing of SCE facilities with Interconnection Customer's Interconnection Facilities. The use of SCE property rights shall only be permitted upon written agreement between SCE and the Interconnection Customer. Any proposed use of SCE property rights may require a separate study and/or evaluation, at the Interconnection Customer's expense, to determine whether such use may be accommodated.

11.5 SCE Interconnection Handbook

The Interconnection Customer shall be required to adhere to all applicable requirements in the SCE Interconnection Handbook. These include, but are not limited to, all applicable protection, voltage regulation, VAR correction, harmonics, switching and tagging, and metering requirements.

11.6 Western Electricity Coordinating Council (WECC) Policies

The Interconnection Customer shall be required to adhere to all applicable WECC policies including, but not limited to, the WECC Generating Unit Model Validation Policy.

11.7 System Protection Coordination

Adequate Protection coordination will be required between SCE-owned protection and Interconnection Customer-owned protection. If adequate protection coordination cannot be achieved, then modifications to the Interconnection Customer-owned facilities (i.e., Generation-tie or Substation modifications) may be required to allow for ample protection coordination.