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Locke Lord LLP

Attorneys & Counselors

500 Capitol Mall, Suite 1800
Sacramento, CA 95814
Telephone: 916-930-2500
Fax: 916-930-2501
www.lockelord.com

John A. McKinsey
Direct Telephone: 916-930-2527
Direct Fax: 916-720-0443
jmckinsey@lockelord.com

September 19, 2014

VIA E-FILING

Carlsbad Energy Center Project (07-AFC-06C)
Mike Monasmith, Project Manager
Paul Kramer, Hearing Officer
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814-5512

Re: Carlsbad Energy Center Project Petition to Amend (07-AFC-06C)
Project Owner's Supplemental Responses to Data Requests in Set One (Nos. 28 - 30)

Dear Mr. Monasmith:

California Energy Commission staff filed Data Request Set 1 (TN 202715) (the "**Data Requests**") on July 16, 2014, regarding the Carlsbad Energy Center LLC's ("**Project Owner**") Petition to Amend the Carlsbad Energy Center Project (07-AFC-06C). On August 5, 2014, Project Owner requested additional time until September 19, 2014 to respond to Data Request Numbers 28 through 30. Accordingly, Project Owner hereby submits the enclosed responses to those Data Requests.

Please contact me or my colleague Allison Harris if there are questions.

Locke Lord LLP

By: _____
John A. McKinsey
Attorneys for Carlsbad Energy Center LLC

JAM:awph

Enclosures

Carlsbad Energy Center Project
Petition to Amend

(07-AFC-06C)

Data Response Set 1 Supplement

(Supplemental Responses to Data Requests 28 to 30)

Submitted to

California Energy Commission

Prepared by

Carlsbad Energy Center LLC

With Assistance from

CH2MHILL®

6 Hutton Centre Drive Suite 700
Santa Ana, CA 92707

September 19, 2014

Contents

Figures

Attachment

Introduction

Attached are Carlsbad Energy Center LLC's (Project Owner) supplemental responses to the California Energy Commission (CEC) Data Request Set 1 , Numbers 28 through 30, regarding the Carlsbad Energy Center Project (CECP) (07-AFC-06C) Petition to Amend (PTA). CEC staff granted Project Owner additional time until September 19, 2014, to respond to these Data Requests, and accordingly, Project Owner hereby submits those responses. Any capitalized term not defined in this Supplemental Data Response Set 1 shall have the meaning given to it in the PTA.

The responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as the CEC presented them and are keyed to the Data Request numbers.

New or revised graphics or tables are numbered in reference to the respective Data Request number to which they correspond. For example, the first table used in response to Data Request 1 would be numbered Table DR1-1. The first figure used in response to Data Request 1 would be Figure DR1-1, and so on. Figures or tables from the CECP PTA that have been revised have "R1" following the original number, indicating revision 1.

Additional tables, figures, or documents submitted in response to a data request (for example, supporting data, stand-alone documents such as plans, folding graphics, etc.) are found at the end of each discipline-specific section and are not sequentially page-numbered consistently with the remainder of the document, though they may have their own internal page numbering system.

Transmission System Engineering (28–30)

DATA REQUEST

BACKGROUND: ELECTRICAL ONE-LINE DIAGRAMS

The PTA does not include pre and post-project electrical one-line diagrams and physical layout drawings of the SDG&E EPS 230 kV and 138 kV switchyards (PTA, Sections 3.2.3 and 3.2.4).

DATA REQUEST

28. Submit pre and post-project electrical one-line diagrams of the existing SDG&E EPS 138 kV and 230 kV switchyards showing configuration of switchyard buses and switching bays (with SB nos.) with breakers and associated disconnect switches with their respective sizes and/or ratings in amperes along with all transmission outlets showing the modifications in the switchyard for interconnection of the overhead 138 kV and the UG 230 kV gen tie lines. In addition, provide post-project electrical one-line diagrams of the SDG&E 138 kV and 230 kV switchyards after the decommissioning of the Encina Power Station (EPS), and disconnection of the existing EPS Units as scheduled in 2017. Fully describe and detail any and all measures proposed to insure transmission infrastructure integrity and the during the EPS demolition activities sought by the in the PTA. Moreover, describe any and all transmission measures and details planned for the seamless and timely transition from EPS Unit electrical generation to that of the Amended CECP.

Response: Project Owner provided electrical one line drawings of the existing SDG&E EPS 138 kV and 230 kV switchyards in Project Owner's August 15, 2014 responses to CEC staff's Data Response Set 1. Project Owner has since received electrical one-line drawings of (a) the post-Commercial Operation Date configurations of the 138kV and 238kV SDG&E switchyards, which are enclosed as Figures DR28-3 and DR28-4, respectively; and (b) of the ultimate arrangements of these switchyards, which are enclosed as Figures DR28-5 and DR28-6, respectively.

As Project Owner previously explained, to ensure a seamless and timely transition from EPS electrical generation to CECP electrical generation in the Encina Switchyard, EPS Unit 1 will cease operation before the 138kV commissioning of CECP. EPS Unit 1 will be disconnected from Bay Position 2, and SDG&E will move an outgoing line from Bay Position 1 to Bay Position 2, thereby opening up Bay Position 1 for the new CECP 138kV connection. Similarly to the Licensed CECP, this is the only position that requires these procedural steps. In the 230kV portion of the Encina Switchyard, SDG&E will take necessary actions to ensure that a breaker position is available for the new 230kV line from the Amended CECP, thereby preventing interference with existing EPS unit connections.

DATA REQUEST

29. Provide pre and post-project physical layout drawings of the SDG&E EPS 230 kV and 138 kV switchyards, with all transmission outlets.

Response: A drawing of the post-Commercial Operation Date, general physical layout of the SDG&E 230kV and 138kV switchyards are enclosed as Figure DR29-2. The general final arrangement drawing for the 138/230kV switchyards are enclosed as Figure DR29-3.

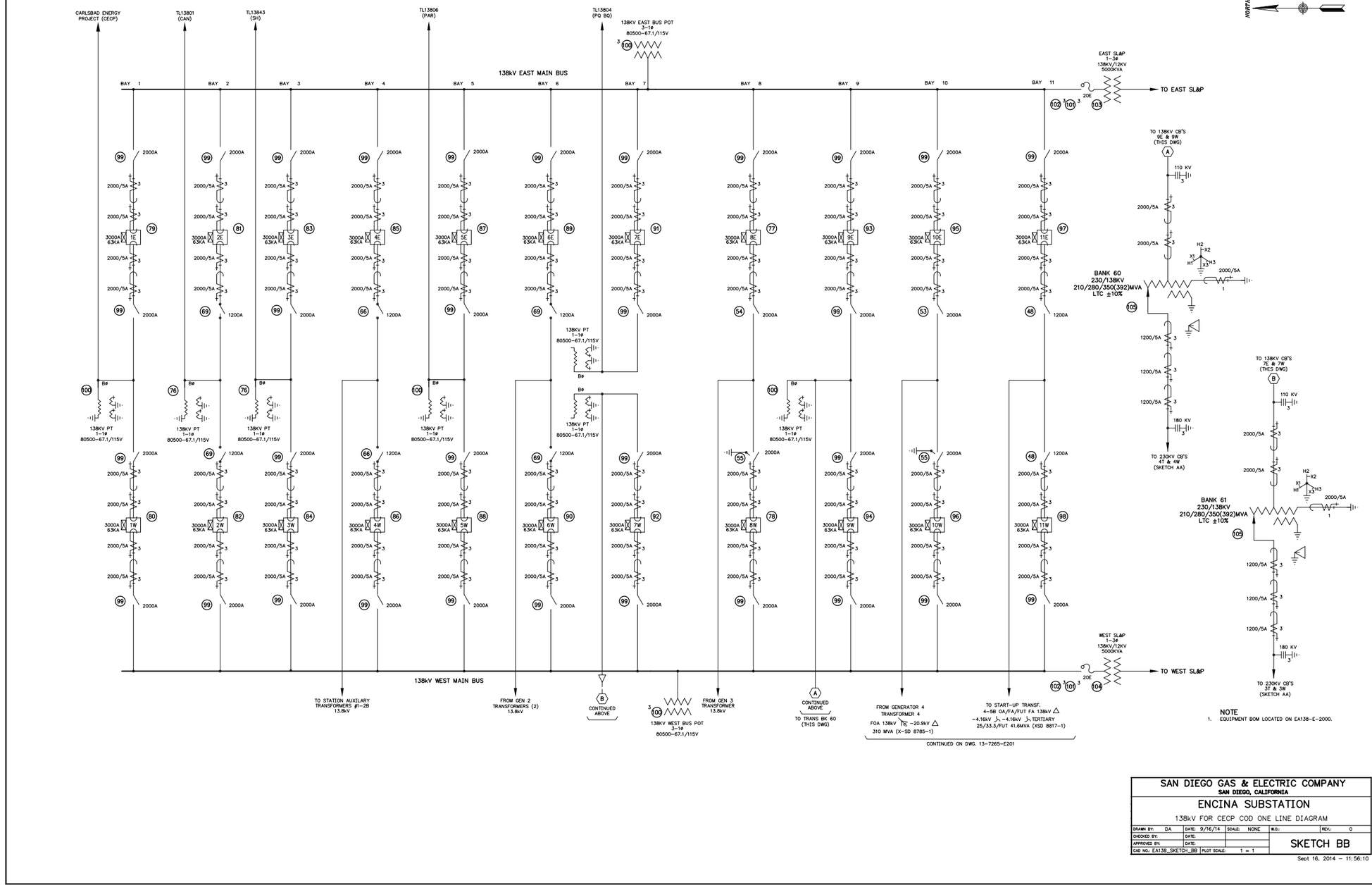
BACKGROUND: INTERCONNECTION REASSESSMENT STUDY

Since the October 22, 2013, California ISO "Interconnection Reassessment Study Report" with Individual Project Reports are not consistent with the May 2, 2014 CECP Petition to Amend (PTA), the Petitioner needs to submit a current Interconnection Reassessment Study Report by the California ISO for the proposed CECP 632 MW project (PTA, Sections 3.2.5).

DATA REQUEST

30. Submit a current Interconnection Reassessment Study Report along with the Individual Reports performed by the California ISO, in accordance with the May 2, 2014 "Petition to Amend" the Carlsbad Energy Center Project (CECP), given proposed modifications to the 540 MW Licensed CECP would result in a 632 MW Amended CECP.

Response: Project Owner has enclosed as Attachment DR30-1, a copy of California ISO's September 11, 2014 Optional Interconnection Study and Repower Report for the Amended CECP.



SAN DIEGO GAS & ELECTRIC COMPANY SAN DIEGO, CALIFORNIA					
ENCINA SUBSTATION 138kV FOR CECP COD ONE LINE DIAGRAM					
DRAWN BY: DA	DATE: 9/16/14	SCALE: NONE	W.O.:	REV: 0	
CHECKED BY:	DATE:				
APPROVED BY:	DATE:				SKETCH BB
CAD NO.: EA138_SKETCH_BB	PLOT SCALE: 1 = 1				

Sept 16, 2014 – 11:56:10

Figure DR28-3
138kV for CECP COD One Line Diagram
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend

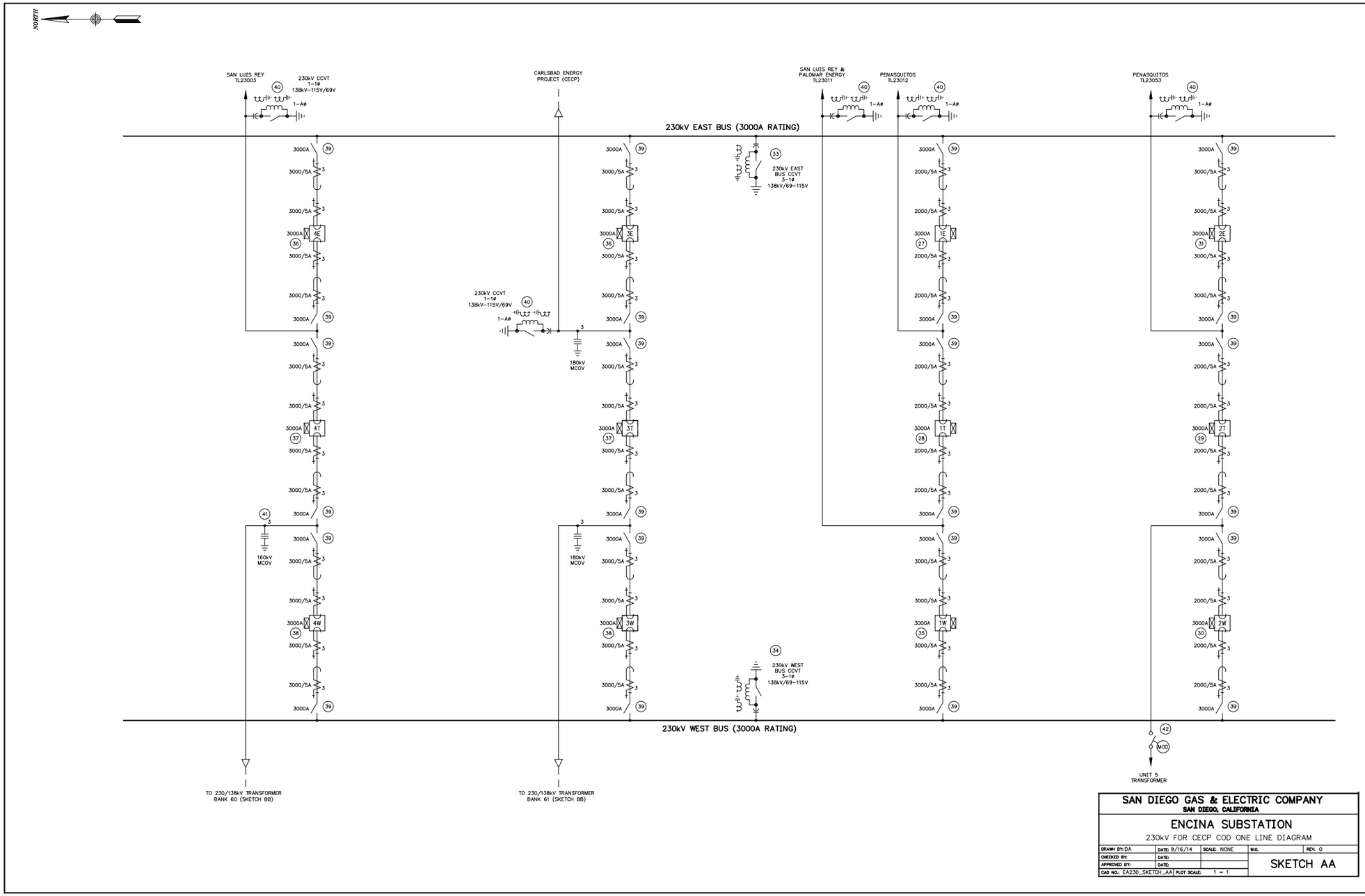
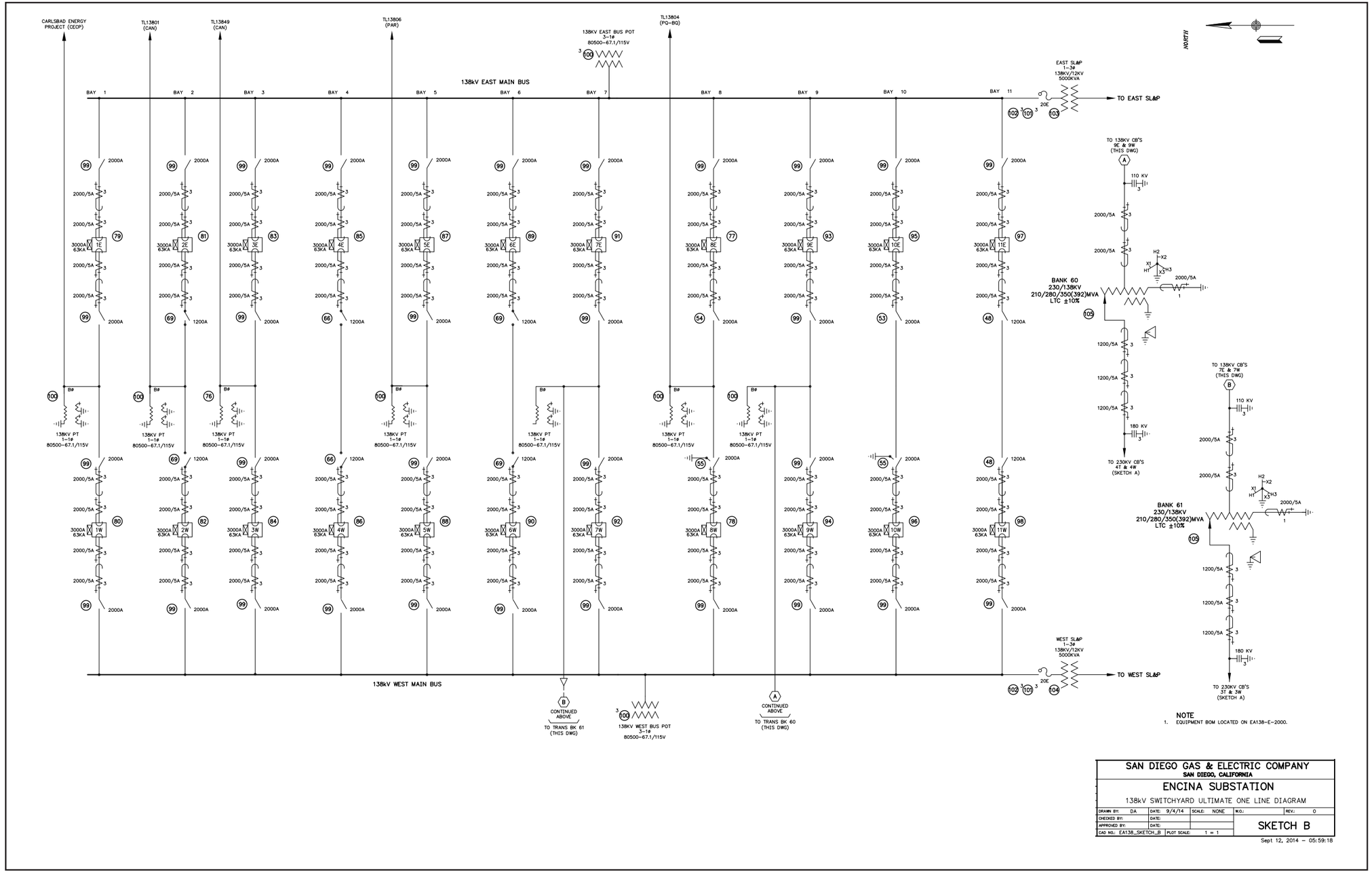


Figure DR28-4
230kV for CECP COD One Line Diagram
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend



NOTE
1. EQUIPMENT BOM LOCATED ON EA138-E-2000.

SAN DIEGO GAS & ELECTRIC COMPANY SAN DIEGO, CALIFORNIA					
ENCINA SUBSTATION 138kV SWITCHYARD ULTIMATE ONE LINE DIAGRAM					
DRAWN BY: DA	DATE: 9/4/14	SCALE: NONE	W.O.:	REV: 0	SKETCH B
CHECKED BY:	DATE:				
APPROVED BY:	DATE:				
CAD NO.: EA138_SKETCH_B	PLOT SCALE: 1 = 1				

Sept 12, 2014 – 05:59:18

Figure DR28-5
138kV Switchyard Ultimate One Line Diagram
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend

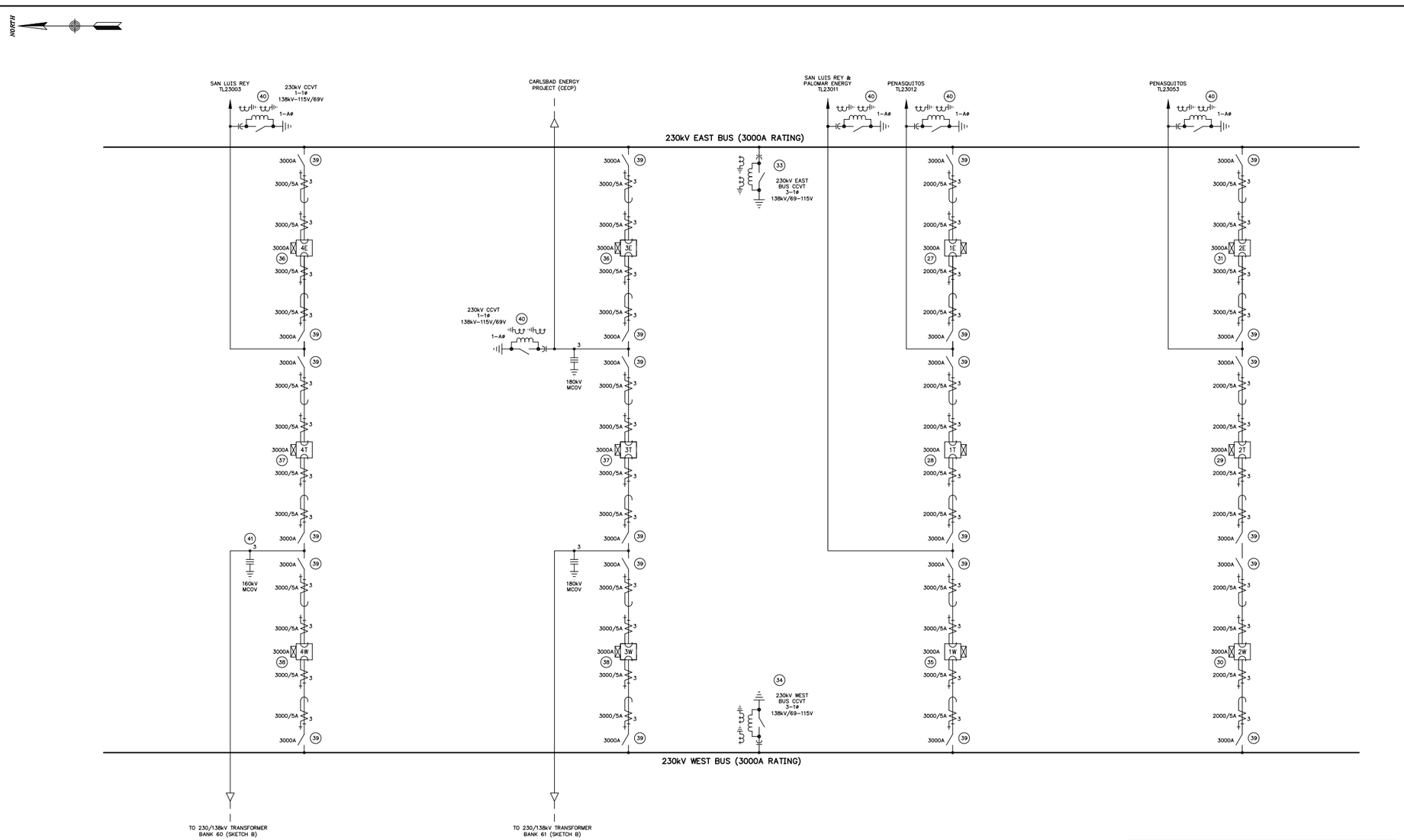
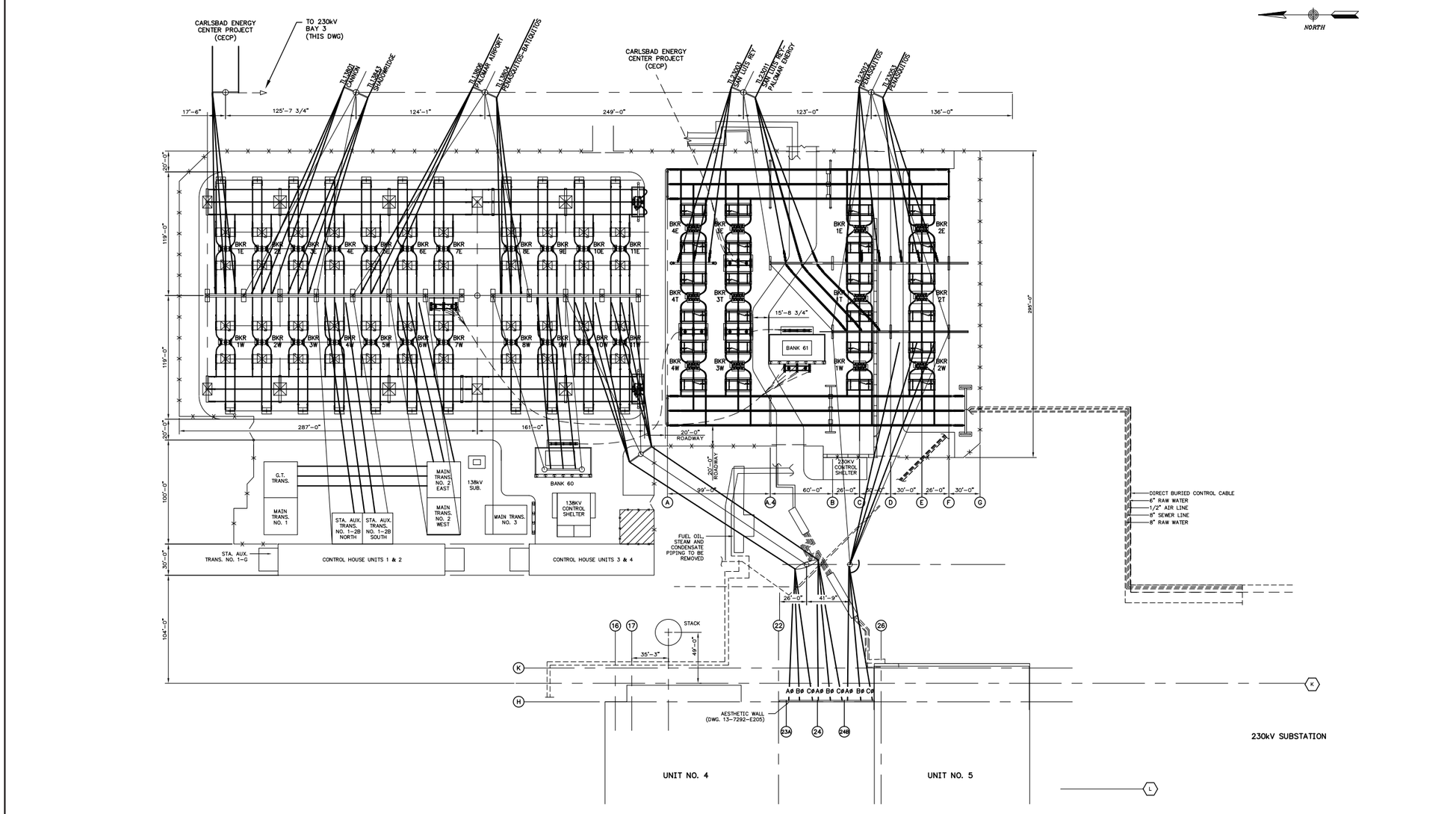


Figure DR28-6
230kV Ultimate One Line Diagram
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend



SAN DIEGO GAS & ELECTRIC COMPANY SAN DIEGO, CALIFORNIA				
ENCINA SUBSTATION ULTIMATE ARRANGEMENT FOR CECP COD				
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CHECKED BY:	DATE:		SKETCH CC	
APPROVED BY:	DATE:			
CAD NO.: EA230_SKETCH_CC	PLOT SCALE:	1 = 1		

Sept 16, 2014 – 12:51:51

Figure DR29-2
Ultimate Arrangement for CECP COD
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend

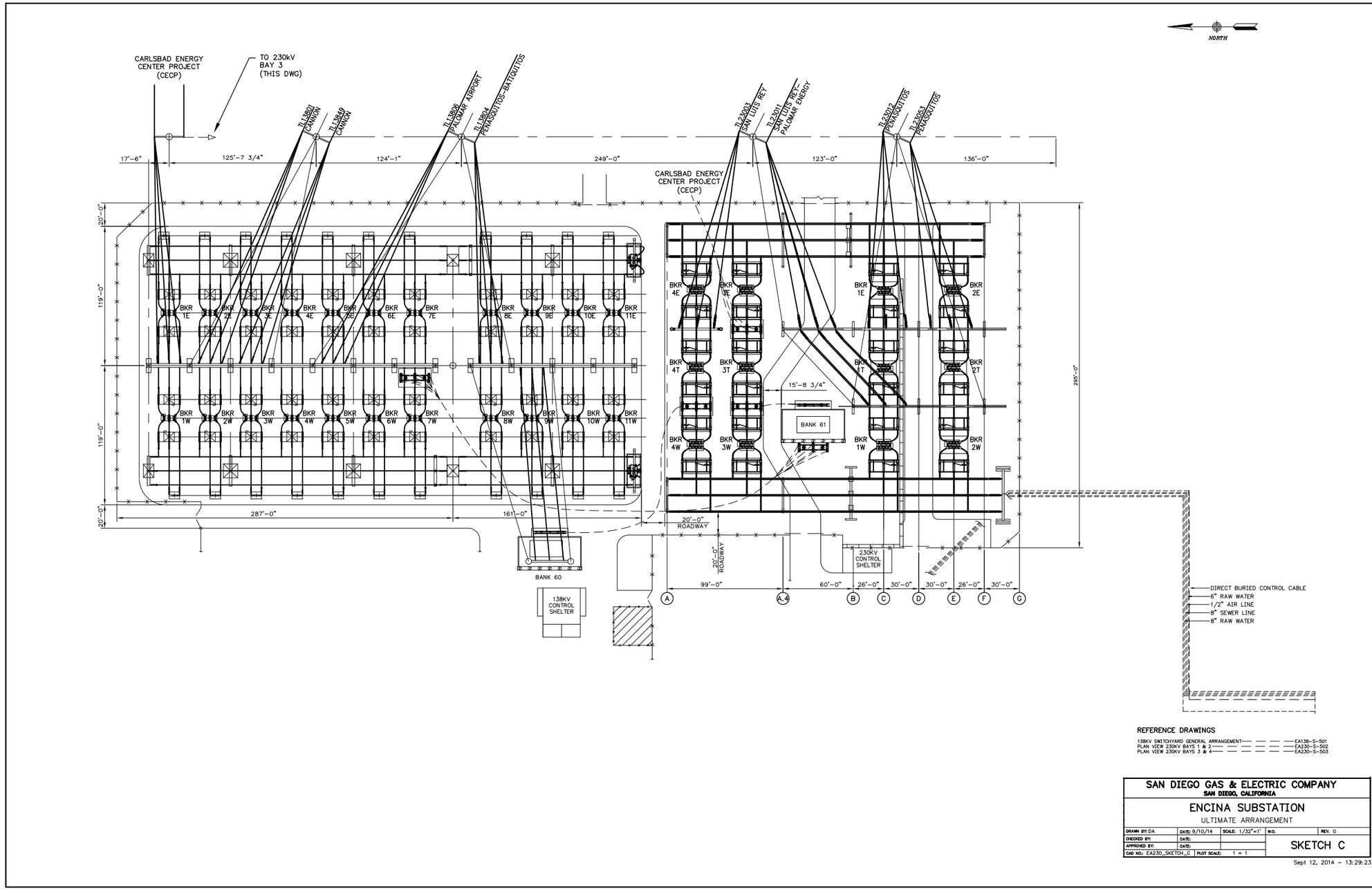


Figure DR29-3
Ultimate Arrangement
Amended Carlsbad Energy Center Project
Carlsbad, California (07-AFC-06C)
Petition to Amend

ATTACHMENT DR30-1

Optional Interconnection Study and Repower Report

Optional Interconnection Study and Repower Report

Carlsbad Energy Center LLC

Encina Peaking and Repower (Q137, Q189, and Encina Unit 5)

September 11, 2014

This study has been completed in coordination with San Diego Gas & Electric Company (SDG&E) per CAISO Tariff Appendix U Section 10 “Optional Interconnection Study” and CAISO Tariff Section 25.1.2 “Affidavit Requirement”

Table of Contents

1. Introduction

Carlsbad Energy Center, LLC, submitted an affidavit in satisfaction of the requirements in Section 25.1.2 of the CAISO Tariff for repowering of its existing Encina Unit 5 facility located at 4600 Carlsbad Boulevard, Carlsbad, CA 92008. Furthermore, the Interconnection Customer requested Optional Interconnection Studies for Q137 and Q189, per Appendix U Section 10 of the CAISO Tariff.

The previously studied generators in CAISO Queue Positions #137 and #189 and the existing Encina Unit 5, which are tied to San Diego Gas & Electric Company's (SDG&E) Encina Substation, will be replaced with new generators that have a maximum total net output to the CAISO Controlled Grid of 633 MW. The IC has indicated that the new generators are not substantially different from the existing or proposed generators and that the total capability and electrical characteristics are essentially the same.

This study determined that, as was the case for the previous interconnection studies, the generators' responses are not in violation of NERC Reliability Standards.

Study Deposit

A Study deposit of $30,000 has been received for performing the two Optional Interconnection Studies (Q137 and Q189) and Encina Unit 5 Repower study. The estimated cost for completing this study is $45,000. The CAISO will invoice the IC the remaining balance if the actual cost is higher than the collected deposit for the Optional Interconnection studies and the repowering study. If the actual cost is less than the collected deposit, the CAISO will refund the balance to the IC.

2. Schedule

Table 2-1 shows the milestones/schedules associated with the study.

Table 2-1: Study Schedule

Task	Milestone Description	Target Date
1	CAISO tenders study plan to the IC	6/5/2014
2	Interconnection Customer shall execute the Optional Interconnection Study Agreement and provide the following information: • An updated epc file that includes Transformer data. • Interconnection Request (IR) Forms (excluding Attachment A which has already been provided)	Within ten (10) Calendar Days of receipt of OSA
3	SDG&E issues draft study report to CAISO for review	Within seventy five (75) Calendar Days of OS commencement
4	CAISO issues final study report to the IC	Within five (5) Calendar Days of SDG&E issuance of draft study report to CAISO for review.
5	OS Results Meeting (if desired by IC)	Within five (5) Calendar Days of OS Report issuance to IC
6	IC formalizes decision to modify project.	Within five (5) BD of OS Report issuance to IC

3. Project and Interconnection Information

Table 3-1 provides general information about the Project.

Table 3-1: Project General Information

Project Location	4600 Carlsbad Boulevard, Carlsbad, CA 92008
Number and Type of Generators	6 Synchronous Gen., GE LMS 100
Maximum Generator Output	654 MW
Generator Auxiliary Load	21 MW
Maximum Net Output to Grid	633 MW
Power Factor	0.90 lag, 0.95 lead
Step-up Transformer	13.8/230 kV and 13.8/138 kV
Description Of Interconnection Configuration	Encina 138 kV and Encina 230 kV
Connection Voltage	138 kV and 230kV

The following dates have been proposed for the projects:

Q137

- Proposed In-Service Date: March 1, 2017
- Proposed Trial Operation Date: April 1, 2017
- Proposed Commercial Operation Date: August 1, 2017

Q189

- Proposed In-Service Date: May 1, 2017
- Proposed Trial Operation Date: June 1, 2017
- Proposed Commercial Operation Date: August 1, 2017

Encina Unit 5 Repower

- Proposed In-Service Date: March 1, 2017
- Proposed Trial Operation Date: April 1, 2017
- Proposed Commercial Operation Date: August 1, 2017

Figure 3-1 shows Encina Peaking and Repower (Q137, Q189, and Encina Unit 5), its surrounding area and the route of the transmission line to the Points of Interconnection with SDG&E.

The projects connect directly to SDG&E's Encina Substation, which is connected to the 138 and 230-kV transmission networks.

Figure 3-1: Vicinity Map

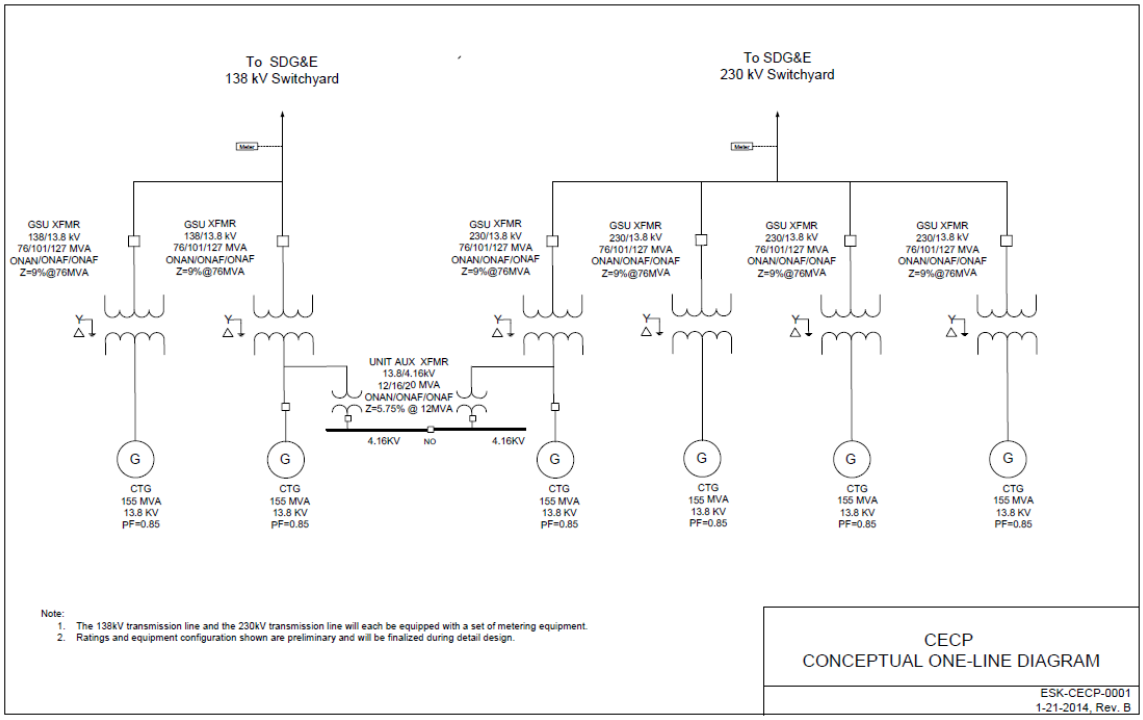


Figure 3-2: Local 230 and 138 kV System 1-Line Diagram

4. Study Assumptions

The CAISO, in coordination with SDG&E, has conducted the Study under the following assumptions:

- The maximum total net output of the projects to the CAISO Controlled Grid is 633 MW.
- Generation output
    a. Q137 Net output of 211 MW
    b. Q189 Net output of 211 MW
    c. Encina Unit 5 Net output of 211 MW
- Generator Points of Interconnection
    a. Q189: Encina 138 kV
    b. Q137 and Encina Unit 5: Encina 230 kV bus, gen-tie sharing

- The existing three-phase step-up transformer is rated 127MVA, 230/13.8 kV and 138/13.8 kV with an impedance of 9% on a 76 MVA base.

- Technical data on file accurately represents total capability and electrical characteristics of the existing generating facilities. These data, along with the technical data provided by the IC have been used for the optional and repower studies.

5. Steady State, Contingency Analysis, and Dynamic Study Results

A set of bus faults and N-1 contingencies were applied to two cases, one with OLD generators and the other with NEW generators, and the overloads and voltage violations were compared. Throughout this document OLD refers to the original Q137 and Q189 (combined cycle units) with all Encina units offline and NEW refers to the requested Q137 and Q189 Optional Study with Encina Unit 5 Repowering. In general, the case with NEW generators shows slight improvement over the case with OLD generators over the severity of the overloads. The case with NEW generators improves the pre-existing overloads of the case with OLD generation by (-0.3%). The voltages of the case with NEW generators, however, are within (-0.2% to +0.1%) of the case with OLD generators.

Also, for a smaller set of major bus faults and N-1 contingencies, a full set of Transient Stability simulation, Worst Case Analysis and Post Transient Voltage analysis were performed. In all these studies no NERC Standards violations were observed, even though some differences between the dynamic behaviors were observed and reported.

5.1 3-phase fault on Encina 230 KV bus (designated EA230) with normal 6 cycle clearing.

A 3-phase fault applied to the Encina 230 kV bus and cleared 6 cycles later shows very small differences between the dynamic behaviors of the Encina 230 kV bus voltage with the OLD generators versus the NEW generators. Even though the frequency response is different it does not violate the NERC standards. Fig. 5-1 is a plot of the voltage and frequency at Encina 230 kV bus.

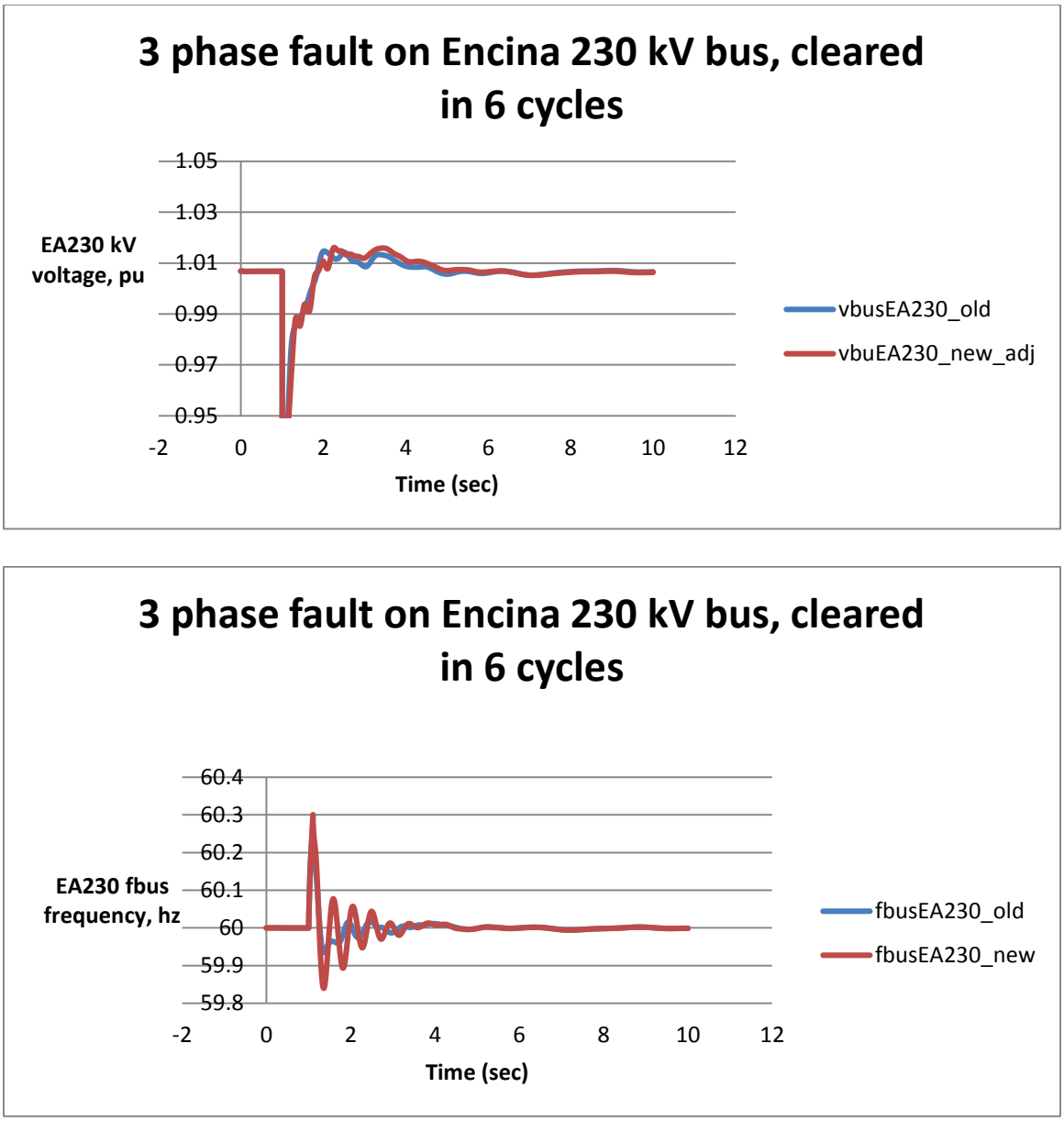


Figure 5-1: voltage and frequency response at Encina 230kV bus for a 3-phase fault at the bus

5.2 3-phase fault on Encina 138 KV bus (designated EA138) with normal 6 cycle clearing.

A 3-phase fault applied to the Encina 138kV bus and cleared 6 cycles later shows little difference between the dynamic behaviors of the system with the OLD generators versus its behavior with the NEW generators. Fig 5-2 shows the OLD versus NEW voltage and frequency response of the Encina 138 kV bus.

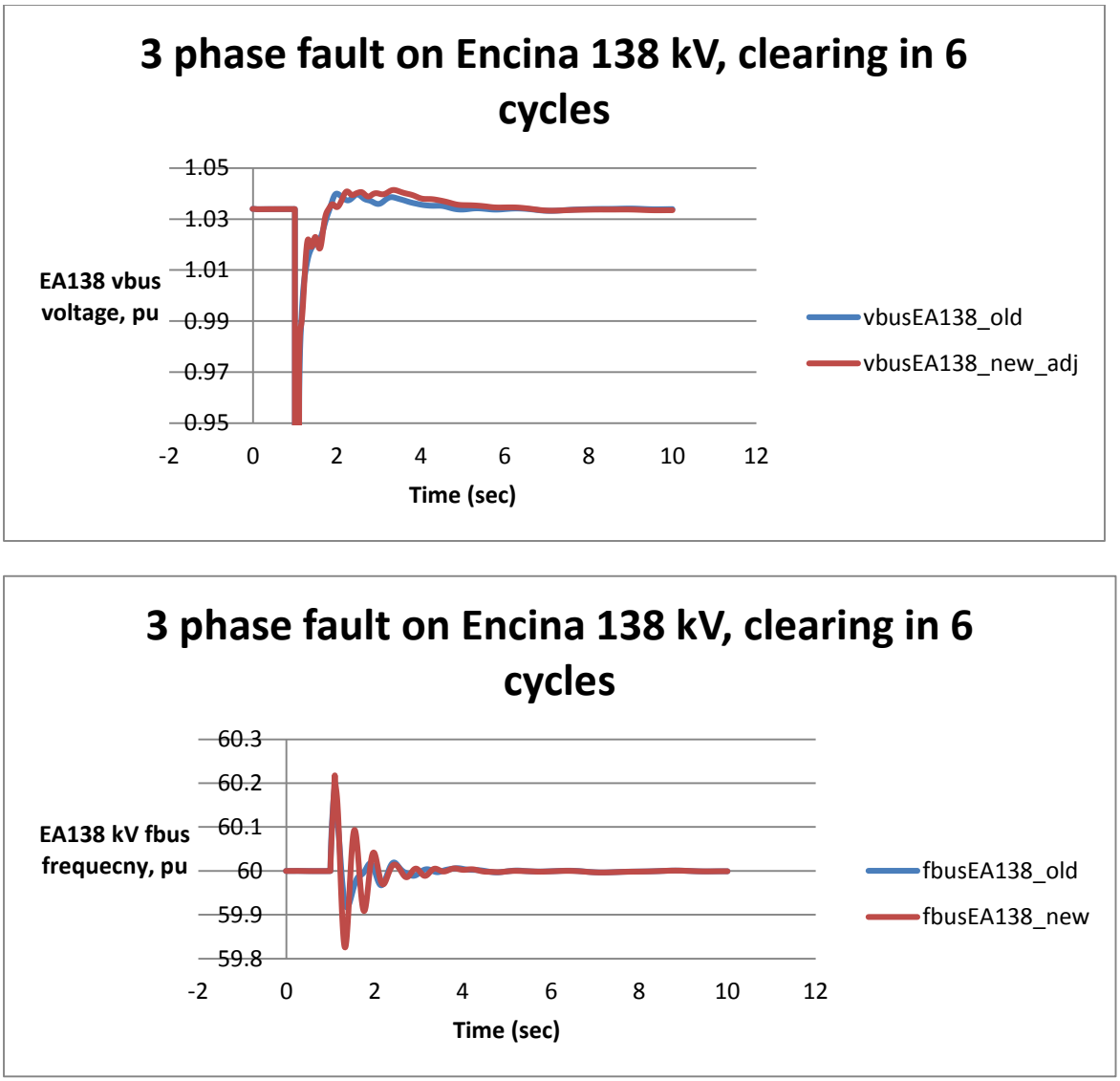


Figure 5-2: voltage and frequency response at Encina 138 kV bus for a 3-phase fault at Encina 138 kV bus

5.3 3-phase fault on Encina 230 KV bus with normal 6 cycle clearing followed by N-1 tripping of Group A – EA 230 kV line.

Figures 5-3 shows the voltage and frequency response at the Encina 230 kV bus when a 3-phase fault applied to the Encina 230kV bus and cleared 6 cycles.

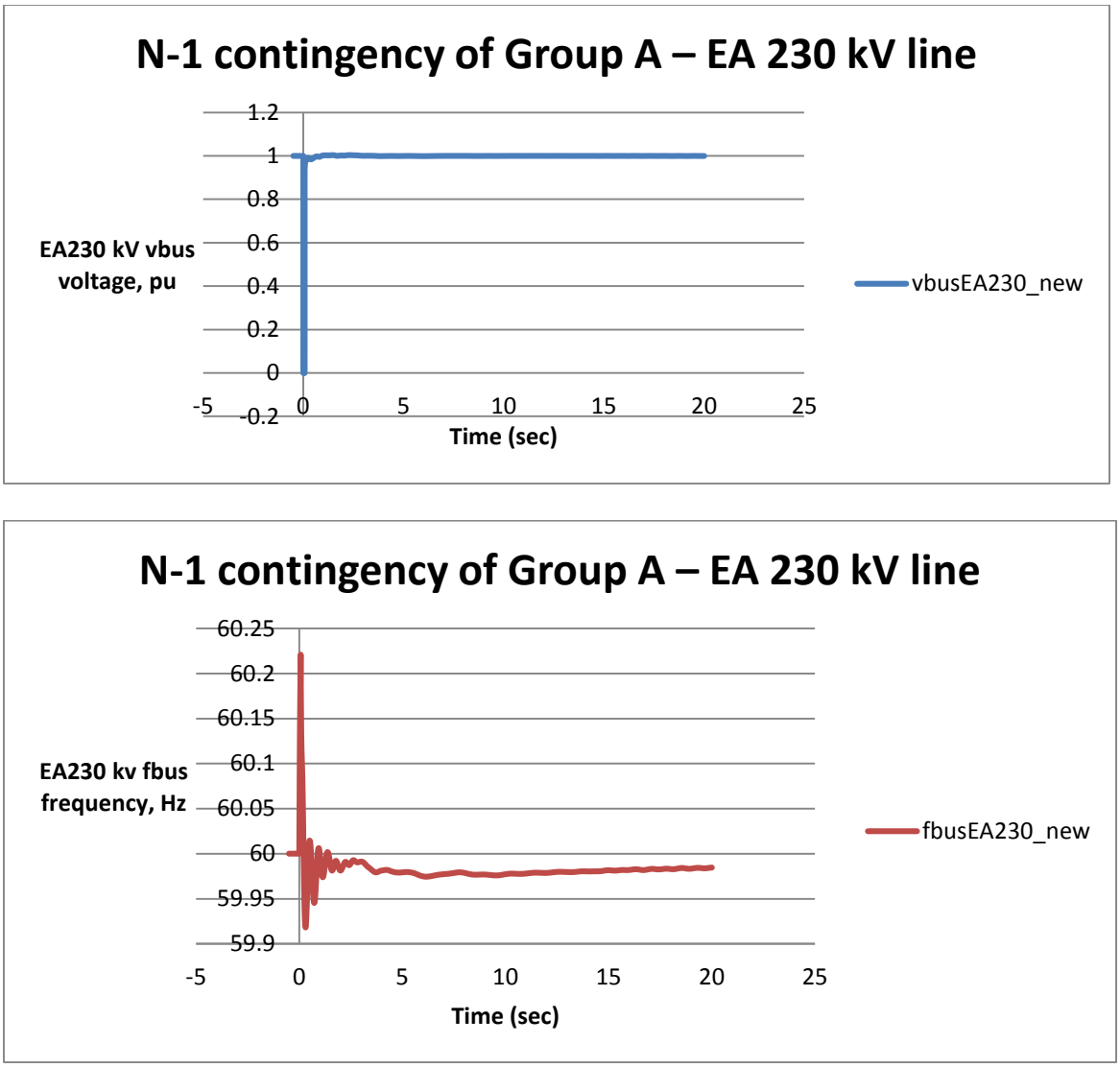
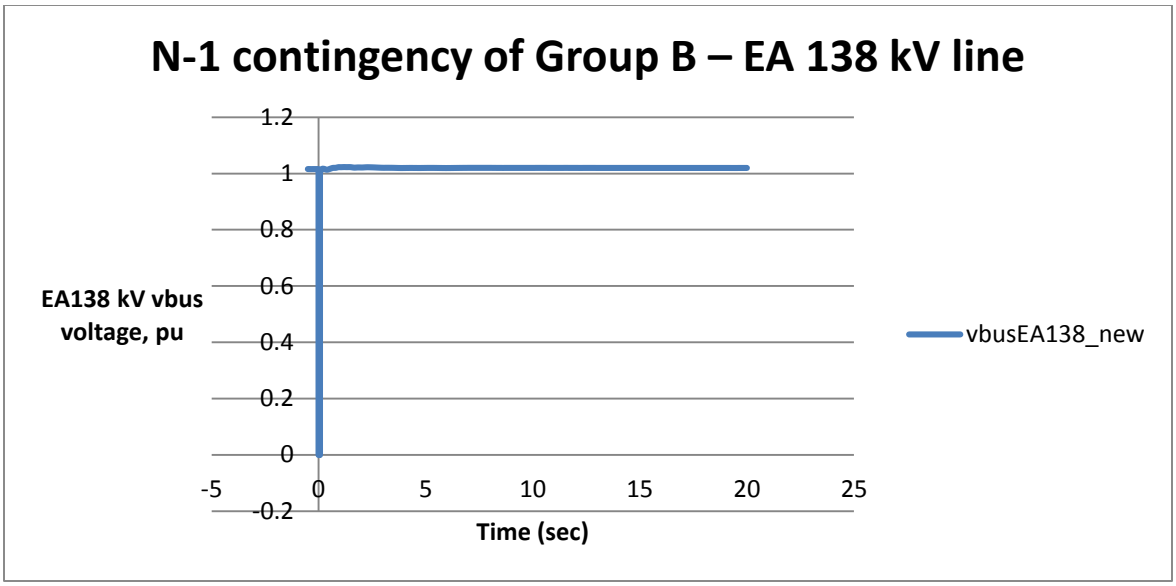


Figure 5-3: voltage and frequency response at Encina 230kV bus for a N-1 contingency of Group A-EA230 kV line



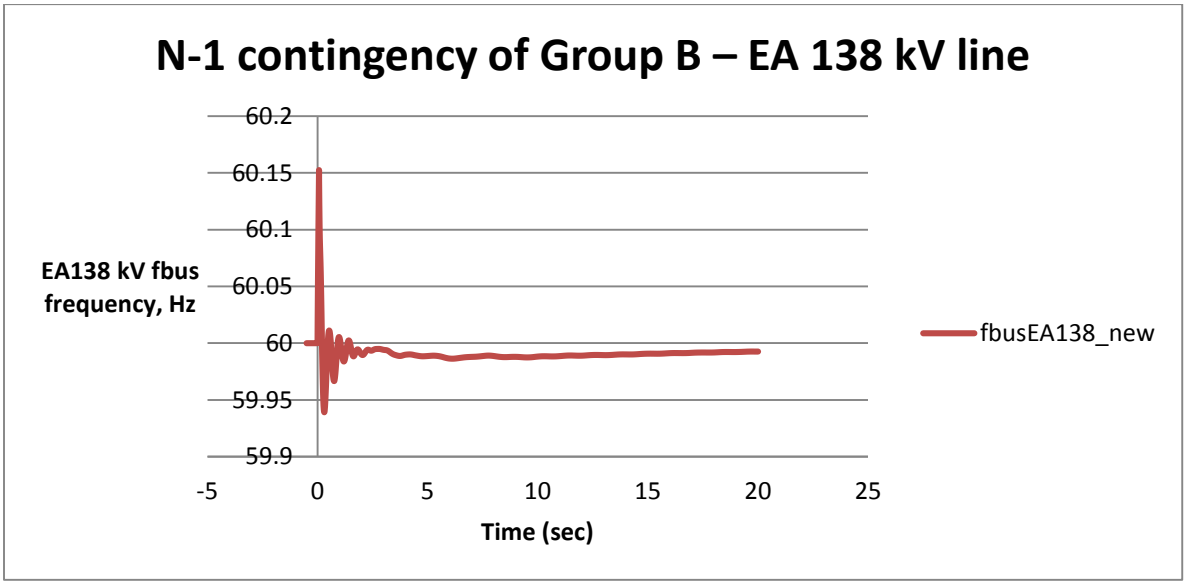


Figure 5-4 voltage and frequency response at Encina 138kV bus for a N-1 contingency of Group B-EA138 kV line

Plots for the voltage and frequency at major buses of the SDG&E area, Worst Case Analysis (WCA), and Post Transient Voltage and Reactive Power Deficiency results also do not show any noticeable issues.

6. Short Circuit Analysis Results

The system's response to 3-phase faults with normal clearing (5-cycles) was simulated with the OLD generators modeled in the case and then with the NEW generators modeled.

The short circuit analysis was done to compare the contribution of fault current from the NEW generators to that of the OLD generators. In the model for the Short Circuit study of the NEW case, there is only one single breaker for Q189, i.e., the 138 kV line, and one for the combined Q137 and Encina repower, i.e., the 230 kV line. Table 6.1 summarizes the change in available fault current at boundary buses.

Table 6.1: Short Circuit Current at Boundary Buses

Encina 138 & 230 kV Buses		Pre Project (OLD)		Post Project (NEW)		(Post Project) - (Pre Project)	
BREAKER	**BKR_CAPA**	**Duty (A)**	**Duty (%)**	**Duty (A)**	**Duty (%)**	**(A)**	**% change**
EA-AUXBK 8E	50000	36679.3	73.4	31193.6	62.4	-5485.7	-10.97%
EA-AUXBK 8W	50000	36679.3	73.4	31193.6	62.4	-5485.7	-10.97%
EA-GT4 10E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA-GT4 10W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA1 102E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA1 102W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA13801 1W	-	-	-	-			
EA13804 7E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA13804 7W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA13806 5E	40000	35879	89.7	30623.5	76.6	-5255.5	-13.14%
EA13843 3E	-	-	-	-			
EA2 206E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA2 206W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA3 309E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA3 309W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA4 411E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA4 411W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EAGT1 4E	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EAGT1 4W	40000	36679.3	91.7	31193.6	78.0	-5485.7	-13.71%
EA23003 1T	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%
EA23011 1E	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%
EA23012 2T	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%
EA23012 2W	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%
EA23053 XX	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%
EABK60	63000	47232.7	75	37099.9	58.9	-10132.8	-16.08%

This short circuit study identified no increase in the magnitude of the impact on the Encina 138 and 230 kV breakers.

7. Upgrades, Cost Estimates, and Time to Construct Estimates

The cost estimates are good faith estimates and are based on published unit costs, when applicable. Customized costs were developed when the unit costs did not reflect the unique circumstances of a project. When appropriate, these customized costs include: anticipated land acquisition costs, environmental mitigation, licensing/permitting, looping lines into substations, new switchyards, substation upgrades not included in unit costs, and PTO's Interconnection Facilities.

The In-Service Dates of the generation projects (Q137, Q189, and Encina Unit 5) are dependent on the completed construction and energizing of the identified Interconnection Facilities and Reliability Network Upgrades.

Some mitigation measures are related to the telecommunications needed for each individual SPS. SPS costs may have two components: (a) the cost for protection and communication equipment for the monitored facilities, and (b) the cost for the protection and communication equipment to interface between the PTO and each project.

The PTO's Interconnection Facilities and Reliability Network Upgrades required to physically interconnect the projects are identified in the following tables. The good faith estimate of time to construct (license/permit, design, procure material, and construct) the facilities identified in the report will be project-specific and will be based upon the assumption that the environmental permitting obtained by the IC is adequate for permitting applicable to PTO activities.

It is assumed that the Interconnection Customer will include the scope of work for the PTO's Interconnection Facilities and Network Upgrades (where applicable) in their environmental impact report to the CPUC. In the time to construct estimates, SDG&E included the time required for a PTC or CPCN, if it was anticipated. If the CEQA permitting authority requires licensing not anticipated by SDG&E, timing for the upgrade could be extended by two to three years.

The cost of the mitigation plan for (i) overloads of SDG&E owned facilities and/or (ii) violations attributed to the Encina Peaking and Repower (Q137, Q189, and Encina Unit 5) projects evaluated in this study are shown in Tables 7.1, 7.2 and 7.3.

Table 7.1: Upgrades, Estimated Costs, and Estimated Time to Construct Summary for Q137

Type of Upgrade	Upgrade		Estimated Cost x 1,000 *(Note 1)*	Estimated Time to Construct *(Note 2)*
PTO's Interconnection Facilities	Extend gen-tie from POI at the 230 kV Encina bus to the PTO property line	• Install 1-termination stand • Install 255' of 3500 KCMIL copper • Install 500' of 4/0 bare strand copper • Install 200' 6-8" conduit	$1,201	12 Months
Reliability Network Upgrades to Physically Interconnect	Extend the 230 kV Encina bus to accommodate the Project's interconnection *(Note 5)*	• Extend the 230 kV Encina low bus • Install 2-230 kV circuit breakers • Install 4-230 kV disconnects • Install control and protection panels • Update RTU	$3,455	12 Months
Reliability Network Upgrades	Implement an SPS to trip generation at Encina following the N-2 outage of Encina-San Luis Rey 230 kV and Encina-San Luis Rey-Palomar 230 kV lines	SDG&E protection and communication equipment for Encina and San Luis Rey substations *(Note 3)*	$333	12 Months
		Protection and communication equipment to interface between SDG&E and the Project *(Note 4)*	$216	12 Months
Total			**$5,205**	**12 Months**

Note 1: Estimated costs in "as year spent" dollars and in thousands of dollars, excluding Allowance for Funds Used During Construction (AFUDC). Estimated costs do not include any land purchases or licensing/permitting costs.

Note 2: Time to construct estimates includes time for licensing/permitting, when appropriate. The estimated time to construct is for a typical project; construction duration may change due to the number of projects simultaneously in construction. Multiple projects impact resources, system outage availability, and environmental windows of construction. A key assumption is SDG&E will need to obtain CPUC licensing and regulatory approvals prior to design, procurement, and construction of the proposed facilities. The time to construct is not cumulative.

Note 3: The SPS cost includes the equipment on the PTO's system. This is a one-time setup and equipment cost. The SPS cost does not include any control, protection, and/or fiber-optic communication costs at the Project's facility.

Note 4: The SPS cost includes project-specific equipment required on the PTO's system for interface with the Project, as well as equipment provided to the Project for installation at the Project's facility. Additional SPSs would require updated logic, but minimal/no cost.

Note 5: This upgrade may not be required if future projects are approved.

Table 7.2: Upgrades, Estimated Costs, and Estimated Time to Construct Summary for Q189

Type of Upgrade	Upgrade		Estimated Cost x 1,000 *(Note 1)*	Estimated Time to Construct *(Note 2)*
PTO's Interconnection Facilities	Extend gen-tie from POI at the 138kV Encina bus to the PTO property line	• Install 200' of OH conductors to the property line along the east side of the substation to Bay 1 dead-end structure • Install associated control and protection panels and communications for the new line position and add RTU points for	$553	12 Months
Reliability Network Upgrades to Physically Interconnect	Reconfigure bay positions at Encina 138kV switchyard to accommodate the Project's interconnection	• Remove Encina 1 Main Transformer OH conductors from Bay 2 • Relocate TL13801 from Bay 1 to Bay 2 • Install associate control and protection panels and communications to relocate TL13801 (Encina-Cannon) from Bay 1 to Bay 2. • Add RTU points for control, monitoring, and alarming • Upgrade (2) line disconnects and associated insulators in Bay 2 for TL13801	$1,413	12 Months
Reliability Network Upgrades	Implement an SPS to trip generation at Encina following the N-2 outage of Encina-San Luis Rey 230 kV and Encina-San Luis Rey-Palomar 230 kV lines	SDG&E protection and communication equipment for Encina and San Luis Rey substations *(Note 3)*	$0	12 Months
		Protection and communication equipment to interface between SDG&E and the Project *(Note 4)*	$216	12 Months
Total			**$2,182**	**12 Months**

Note 1: Estimated costs in "as year spent" dollars and in thousands of dollars, excluding Allowance for Funds Used During Construction (AFUDC). Estimated costs do not include any land purchases or licensing/permitting costs.

Note 2: Time to construct estimates includes time for licensing/permitting, when appropriate. The estimated time to construct is for a typical project; construction duration may change due to the number of projects simultaneously in construction. Multiple projects impact resources, system outage availability, and environmental windows of construction. A key assumption is SDG&E will need to obtain CPUC licensing and regulatory approvals prior to design, procurement, and construction of the proposed facilities. The time to construct is not cumulative.

Note 3: The SPS cost assumes all the necessary communication and relaying equipment have already been installed at Encina Substation and funded by earlier serial Project Q137.

Note 4: The SPS cost includes project-specific equipment required on the PTO's system for interface with the Project, as well as equipment provided to the Project for installation at the Project's facility. Additional SPSs would require updated logic, but minimal/no cost.

Table 7.3: Upgrades, Estimated Costs, and Estimated Time to Construct Summary for Encina 5 Repower

Type of Upgrade	Upgrade		Estimated Cost x 1,000 *(Note 1)*	Estimated Time to Construct *(Note 2)*
PTO's Interconnection Facilities (Note 6)	Extend gen-tie from POI at the 230 kV Encina bus to the PTO property line	• Install 1-termination stand • Install 255' of 3500 KCMIL copper • Install 500' of 4/0 bare strand copper • Install 200' 6-8" conduit	N/A	N/A
Reliability Network Upgrades to Physically Interconnect (Note 6)	Extend the 230 kV Encina bus to accommodate the Project's interconnection *(Note 5)*	• Extend the 230 kV Encina low bus • Install 2-230 kV circuit breakers • Install 4-230 kV disconnects • Install control and protection panels • Update RTU	N/A	N/A
Reliability Network Upgrades (Note 7)	Implement an SPS to trip generation at Encina following the N-2 outage of Encina-San Luis Rey 230 kV and Encina-San Luis Rey-Palomar 230 kV lines	SDG&E protection and communication equipment for Encina and San Luis Rey substations *(Note 3)*	$0	12 Months
		Protection and communication equipment to interface between SDG&E and the Project *(Note 4)*	$0	12 Months
Total			**$0**	**12 Months**

Note 1: Estimated costs in "as year spent" dollars and in thousands of dollars, excluding Allowance for Funds Used During Construction (AFUDC). Estimated costs do not include any land purchases or licensing/permitting costs.

Note 2: Time to construct estimates includes time for licensing/permitting, when appropriate. The estimated time to construct is for a typical project; construction duration may change due to the number of projects simultaneously in construction. Multiple projects impact resources, system outage availability, and environmental windows of construction. A key assumption is SDG&E will need to obtain CPUC licensing

and regulatory approvals prior to design, procurement, and construction of the proposed facilities. The time to construct is not cumulative.

Note 3: The SPS cost includes the equipment on the PTO's system. This is a one-time setup and equipment cost. The SPS cost does not include any control, protection, and/or fiber-optic communication costs at the Project's facility.

Note 4: The SPS cost includes project-specific equipment required on the PTO's system for interface with the Project, as well as equipment provided to the Project for installation at the Project's facility. Additional SPSs would require updated logic, but minimal/no cost.

Note 5: This upgrade may not be required if future projects are approved.

Note 6: Encina 5 is gen-tie sharing with Q137 from the 230 kV POI at the Encina substation to the POCO at the SDG&E property line. If Q137 does not develop the project will be responsible for the total cost for the PTO Interconnection Facilities and the Reliability Network Upgrades to Physically Interconnect $ 4,656,000

Note 7: This cost assumes communication and relaying equipment are already installed and funded by Q137.

8. Modeling Data

All data needed to perform the Study has been submitted by the IC and the "OLD" versus "NEW" data is listed in the tables which follow. It is assumed that the Generator-Step-Up transformer is not being replaced and the data will be the same.

Table 8.1: Power Flow Model Data

Generator	Base MVA	Power (MW)	Max Power (MW)	Qmin (MVar)	Qmax (MVar)	X'' (pu)
Q137CT (OLD)	233	190	190	-62	90	.1389
Q137ST (OLD)	83.2	70	70	-24.6	41.4	.21
Q189ST6 (OLD)	233	190	190	-62	90	.21
Q189CT5 (OLD)	83.2	70	70	-24.6	41.4	0.00035+ j.1389
BUS6 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142
BUS7 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142
BUS8 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142
BUS9 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142
BUS10 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142
BUS11 (NEW)	155.1	105	131.1	-50	100	0.004+ j.142

Table 8.2: Generator Short Circuit Data

Q137CT (OLD) Short-Circuit Data	
sub-transient	j0.1389
Transient	j0.19
Synchronous	j1.5272
negative sequence	j0.139
0 sequence	j0.0837
neutral impedance (ohms)	1111+j273

BUS6 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
transient	j0.19
synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

Q137ST (OLD) Short-Circuit Data	
sub-transient	j0.21
transient	j0.286
synchronous	j2.27
negative sequence	j0.212
0 sequence	j0.107
neutral impedance (ohms)	836+j250

BUS7 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
transient	j0.19
synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

Q189 CT5 (OLD) Short-Circuit Data	
sub-transient	0.00035+j0.1389
transient	j0.19
synchronous	j1.5272
negative sequence	j0.139
0 sequence	j0.0837
neutral impedance (ohms)	1111+j273

BUS8 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
transient	j0.19
synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

Q189 ST6 (OLD) Short-Circuit Data	
sub-transient	j0.21
transient	j0.286
synchronous	j2.27
negative sequence	j0.212
0 sequence	j0.107
neutral impedance (ohms)	836+j250

BUS9 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
transient	j0.19
synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

BUS10 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
transient	j0.19
synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

BUS12 (NEW) Short-Circuit Data	
sub-transient	.004+j0.142
Transient	j0.19
Synchronous	j1.5272
negative sequence	j0.17
0 sequence	j0.093
neutral impedance (ohms)	836+j250

Table 8.3: Generator Dynamics Model

NEW Generator

Model	genrou
Bus#	6
Bus Name	BUS6
ID	1
Voltage	13.8
mva	155.1
ld	2.3
lpd	0.196
lppd	0.142
lq	2.1
lpq	0.24
lppq	0.142
ll	0.08
ra	0.004
tpdo	12.5
tppdo	0.05
tpqo	3.8
tppqo	0.05
s1	0.113
s12	0.396
h	1.738
d	0
rcomp	0
xcomp	0
accel	0
kis	0
pfd	0
pkd	0
pfq	0
pkq	0
speed	0
angle	0
dpfd	0
dpkd	0
dpfq	0
dpkq	0
dspeed	0
dangle	0

NEW Exciter

Model	esac7b
Bus#	6
Bus Name	BUS6
ID	1
tr	0
kpr	10
kir	10
kdr	0
tdr	0
vrmax	3.91
vrmin	0
kpa	55.2
kia	60
vamax	11.5
vamin	-11.5
kp	0
kl	999
te	0.44
vfemax	0
vemin	0
ke	0.47
kc	0
kd	0.53
kf1	0
kf2	1
kf3	0
tf	0
e1	4.352
se1	0.038
e2	5.83
se2	0.117
spdmlt	0

OLD Generator

Model	genrou
Bus#	22246
Bus Name	Q189CT
ID	Q
Voltage	16.5
mva	233
ld	1.9339
lpd	0.2455
lppd	0.185
lq	1.8837
lpq	0.4265
lppq	0.185
ll	0.1568
ra	0.00202
tpdo	10.48
tppdo	0.048
tpqo	1.16
tppqo	0.084
s1	0.114
s12	0.489
h	5.48
d	0
rcomp	0
xcomp	0
accel	0
kis	0
pfd	0
pkd	0
pfq	0
pkq	0
speed	0
angle	0
dpfd	0
dpkd	0
dpfq	0
dpkq	0
dspeed	0
dangle	0

OLD Generator

Model	genrou
Bus#	22245
Bus Name	Q189ST
ID	Q
Voltage	13.8
mva	83.2
ld	2.7
lpd	0.301
lppd	0.209
lq	2.56
lpq	0.541
lppq	0.209
ll	0.166
ra	0.0039
tpdo	6.72
tppdo	0.043
tpqo	2.5
tppqo	0.15
s1	0.059
s12	0.285
h	2.36
d	0
rcomp	0
xcomp	0
accel	0
kis	0
pfd	0
pkd	0
pfq	0
pkq	0
speed	0
angle	0
dpfd	0
dpkd	0
dpfq	0
dpkq	0
dspeed	0
dangle	0

OLD Exciter

Model	esst6b
Bus#	22246
Bus Name	Q189CT
ID	Q
tr	0.0167
kpa	20.9
kia	52.3
vamax	5.6
vamin	-4.7
kff	1
km	1
kg	1
tg	0.04
vrmax	5.6
vrmin	-4.7
vmult	1
oelin	1
ilr	3.74
kcl	1
klr	30
ts	0

OLD Exciter

Model	esac7b
Bus#	22245
Bus Name	Q189ST
ID	Q
tr	0
kpr	33.3
kir	66.6
kdr	0
tdr	1
vrmax	15.6
vrmin	0
kpa	6.03
kia	30.2
vamax	33.6
vamin	-33.6
kp	0
kl	10
te	0.95
vfemax	15.6
vemin	0
ke	1
kc	0.71
kd	1.78
kf1	0
kf2	1
kf3	0
tf	1
e1	14.7
se1	0.06
e2	12.8
se2	0.009
spdmlt	0

NEW Governor

Model	ggov1
Bus#	6
Bus Name	BUS6
ID	1
r	0.05
rselect	1
tpelec	1

NEW Stabilizer

Model	pss2b
Bus#	6
Bus Name	BUS6
ID	1
j1	1
k1	0
j2	3

maxerr	0.05
minerr	-0.05
kpgov	1.88
kigov	0.783
kdgov	0
tdgov	0.1
vmax	1
vmin	0.0907
tact	0.4
kturb	2.213
wfnl	0.0961
tb	0.1
tc	0
flag	0
teng	0
tfload	0.3
kpload	1
kiload	3.3
ldref	1
dm	0
ropen	99
rclose	-99
kimw	0
pmwset	106
aset	99
ka	10
ta	0.01
db	0.02
tsa	1
tsb	1
rup	99
rdown	-99

k2	0
vsi1max	0.5
vsi1min	-0.5
tw1	10
tw2	10
vsi2max	2
vsi2min	-2
tw3	10
tw4	0
t6	0
t7	10
ks2	2.12
ks3	1
t8	0.6
t9	0.12
n	1
m	5
ks1	5
t1	0.25
t2	0.04
t3	0.25
t4	0.04
t10	0.18
t11	0.03
vstmax	0.1
vstmin	-0.1
a	1
ta	0
tb	0
ks4	1

OLD Governor

Model	ggov1
Bus#	22246
Bus Name	Q189CT
ID	Q
r	0.043
rselect	1
tpelec	0.1
maxerr	0.05

OLD Stabilizer

Model	pss2b
Bus#	22246
Bus Name	Q189CT
ID	Q
j1	1
k1	0
j2	3
k2	0

minerr	-0.05
kpgov	18.4
kigov	3.1
kdgov	0
tdgov	1
vmax	1
vmin	0.1
tact	0.3
kturb	1.24
wfnl	0.196
tb	0.59
tc	0
flag	0
teng	0
tfload	3
kpload	2
kiload	0.67
ldref	10
dm	0
ropen	0.1
rclose	-0.1
kimw	0
pmwset	0
aset	999
ka	999
ta	10
db	0
tsa	1
tsb	1
rup	99
rdown	-99

vsi1max	0.5
vsi1min	-0.5
tw1	10
tw2	10
vsi2max	2
vsi2min	-2
tw3	10
tw4	0
t6	0
t7	10
ks2	0.912
ks3	1
t8	0.6
t9	0.12
n	1
m	5
ks1	20
t1	0.0167
t2	0.0167
t3	0.14
t4	0.014
t10	0
t11	0
vstmax	0.1
vstmin	-0.1
a	1
ta	0
tb	0
ks4	1