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California ISO

California Independent System Operator Corporation

September 27, 2016

Robert Sims
Project Director
AES Alamitos Energy, LLC
690 North Studebaker Road
Long Beach, CA
90803

RE: Alamitos Energy Center Project 25.1.2 Repowering Request

Dear Mr. Sims,

The California Independent System Operator Corporation ("CAISO") and Southern California Edison ("SCE") have completed their assessment of AES Alamitos Energy, LLC's request dated April 8, 2016 to repower the Alamitos Energy Center ("Project"). The CAISO and SCE used the complete data set received on May 17, 2016, to determine if the total capability and electrical characteristics of the 1423.3 MW Facility remain substantially unchanged in accordance with Section 25.1 of the CAISO tariff.

Based on the attached Alamitos Energy Center Repower Study Report ("Report"), the CAISO agrees that the Project can forgo the interconnection queue process as the total capability and electrical characteristics of the units interconnected to the Alamitos 220 kV substation are substantially unchanged from the existing project. As outlined in the Report, an additional interconnection facilities study between SCE and the IC will be required to assure that Interconnection Facilities and telemetry or protective relay equipment are compliant with SCE's current interconnection requirements and standards, as well as any other relevant standards (e.g., NERC, WECC). Any additional interconnection facilities required as a result from this interconnection facility study will be incorporated into the Generator Interconnection Agreement ("GIA").

AES Alamitos Energy, LLC may request a Study Results meeting if one is desired within five (5) calendar days of the report issuance, and AES Alamitos Energy, LLC must formalize the decision to proceed with the repower request within ten (10) business days of the report issuance (i.e. by October 11, 2016). Please reply as soon as possible if you desire a results meeting before the due date to make your election to accept the report results.

The CAISO and SCE look forward to working with AES Alamitos Energy, LLC to repower this project. Please feel free to contact Jennifer White at 916-608-7311 or at jwhite@caiso.com with any questions.

Kindest regards,

Deborah A. Le Vine
Director of Infrastructure Contracts & Management

ACKNOWLEDGED AND AGREED:

AES Alamitos Energy, LLC

By: DocuSigned by: 55AAE3CC22DE476...

Title: President

Date: 9/28/2016

Cc: Andrew Claude Bautista Lopez (SCE)
Jorge Chacon (SCE)

Repowering Study Report

AES Alamitos Energy, LLC

Alamitos Energy Center Project

September 27, 2016

This study has been completed in coordination with Southern California Edison (SCE) per CAISO Tariff Section 25.1.2

Table of Contents

1. Introduction

On April 8, 2016, AES Alamitos Energy, LLC (AES) submitted a Generating Unit Repowering request to the California Independent System Operator (CAISO). AES's request is to repower the Alamitos facility which is also referred to as the AES Alamitos generating facility. After initial review of the information, the CAISO and Southern California Edison (SCE) determined that additional work was needed to complete the review. On June 7, 2016, AES provided a complete package of all materials needed to complete evaluation of the repowering request. In addition, AES provided a notarized affidavit representing that the total capability and/or electrical characteristics of the 1,392.2 MW electric generating facility will remain substantially unchanged in satisfaction of the requirements under Section 25.1.2 of the CAISO Tariff for repowering. The requested in-service date for the repower project are April 1, 2019 for the combined cycle gas turbine (CCGT), April 1, 2020 for the battery energy storage system (BESS), and January 1, 2021 for the combustion turbines (CTs).

AES also requested the repower project study to involve two scenarios dependent on whether units 5 & 6 at Alamitos are able to secure new contracts that support continued operation beyond May 31, 2018. Should units 5 & 6 not secure new contracts, the following 2024 scenario will commence in which all of the existing Alamitos Units 1 – 6 will be retired and all of the repowering units will be online. The repowering units include the 689 MW CCGT connecting into the SCE Alamitos East 220 kV Switchyard and the 403.2 MW CT plus the 300 MW BESS units connecting into the SCE Alamitos West 220 kV Switchyard.

However, should units 5 & 6 secure new contracts to continue operating beyond 2018, the second scenario studied will include interconnecting only the combined cycle generation into the SCE Alamitos East 220 kV Switchyard with temporary current limiting reactors (CLR) in the year 2020 assuming that Alamitos unit 3, 4 and 6 are still in operation.

A technical assessment to ascertain and verify that the repower request does not result in substantially change to the total capability and/or electrical characteristics of the electric generating facility. The assessment was performed following Section 12 of Business Practice Manual ("BPM") for Generator Management which describes the CAISO's procedures for evaluating repower requests by an owner of an existing generating unit made pursuant to Section 25.1.2 of the CAISO tariff. The Technical Bulletin describes the CAISO's procedures for evaluating repower requests by an owner of an existing generating unit made pursuant to Section 25.1.2 of the CAISO tariff. Section 25.1.2 of the CAISO tariff allows such entities to obtain a CAISO interconnection agreement without having to participate in the CAISO generator interconnection and deliverability allocation study process if they demonstrate that the total capability and electrical characteristics of the generating unit will be substantially unchanged.

Based on the results of the assessment, the repower request does not result in substantially changing the total capability and/or electrical characteristics of the electric generating facility. However, a Facilities Study is required to further define scope, cost, and schedule of Interconnection Facility upgrades needed to support the repower project so that such scope can be properly described in the Interconnection Agreement. The AES Alamitos generating facility will not be allowed to repower without the completion of the Facilities Study, the

incorporation of any required upgrades into an Interconnection Agreement and the execution of an Interconnection Agreement addressing the repower and corresponding upgrades.

2. Conditions and Assumptions

The evaluation was conducted by utilizing a 2020 WECC base case for both peak and off-peak conditions and applying the CAISO Reliability Criteria. The evaluation considered generation dispatch conditions that maximized local Metro area generation to stress the transmission system in the area of the project. Critical local area stability assessment will consider various double-outage (N-2) conditions.

3. Scope of Work Associated With Repowering

As described in the Project Description provided to the CEC under docket #: 13-AFC-01 and the repowering affidavit, construction would commence in three phases with the first phase consisting of the CCGT electrical generating facility while the second phase would involve adding the BESS and the last phase consist of adding four single cycle generating turbines GTs. The Alamitos Energy Center Project (AEC) is a modification to the licensed Alamitos Center Project with replacing power block 1 with two natural-gas-fired combustion turbine generators in a combined cycle configuration with two unfired heat recovery steam generators (HRSG) and one steam turbine generator (STG), an air cooled condenser, an auxiliary boiler, and any related ancillary equipment. Power Block 2 would consist of four (4) natural gas-fired, simple-cycle gas turbines (SCGT) with fin-fan coolers and ancillary facilities. The BESS consist of battery storage coupled with one hundred twenty nine (129) individual sub array inverters.

The project base option for the “2024 and Beyond" alternative 1 consists of three blocks, Block 1: Natural gas-fired, air cooled, CCGT comprised of 2 General Electric combustion turbine generators and 1 Toshiba/Tosmap steam turbine generator constructed behind a single circuit breaker, Block 2: SCGTs comprised of four (4) GE LMS100s behind a single circuit breaker, and Block 3: BESS comprised of three (3) units each having 2 x 50 MW blocks behind a single circuit breaker.

The project base option for the “2020” alternative 2 consists of one (1) block, Block 1: Natural gas-fired, air cooled, CCGT comprised of 2 General Electric combustion turbine generators and 1 Toshiba/Tosmap steam turbine generator constructed behind temporary current limiting reactors (CLR) and a single circuit breaker.

The AEC would interconnect to the existing SCE 230 kV Alamitos switchyard. No new offsite natural gas lines would be necessary for the project as they would be supplied via an existing 30 inch diameter service pipeline owned and operated by SoCalGas. AES would require a new natural gas metering facility and construction of two new natural gas compressor buildings within the AEC footprint. The AEC would include a new 1,000 linear-foot process/sanitary wastewater pipeline to the first point of interconnection with the existing LBWD sewer system and would eliminate the current practice of treatment and discharge of process/sanitary wastewater to the San Gabriel River.

Table 1 provides general information about the Project while Figure 1 provides a map for the Project with transmission facilities in the vicinity of the Project. Figure 2 and Figure 3 provide a conceptual single line diagram of the Project configurations evaluated.

Table 1: Project General Information

Project Location	Long Beach, CA
SCE Planning Area	Metro Area
Number and Type of Generators	2020 Scenario: • 3 – Synchronous Generators 2024 Scenario: • 7 – Synchronous Generators • 129 – BESS Sub-arrays (units); each including 63 x 44 kVA inverters
Maximum Generator Output	2020 Scenario: 710.1 MW 2024 Scenario: 1423.3 MW
Generator Auxiliary Load	2020 Scenario: 21.1 MW 2024 Scenario: 31.1 MW
Maximum Net Output at generator terminal	2020 Scenario: 689.0 MW 2024 Scenario: 1392.2 MW
Power Factor	0.9 lagging/0.95 leading for all synchronous generators 0.9 lagging/leading for all BESS inverters
Step-up Transformer	Scenario 2020 & 2024 Combined Cycle (x1) 171/228/285 MVA 230/18 kV with Z = 12% @ 171 MVA (x2) 169/225/282 MVA 230/18 kV with Z = 12% @ 169 MVA Scenario 2024 Peaker Units (x4) 73/97/122 MVA 230/13.8 kV with Z = 10% @ 73 MVA Scenario 2024 BESS Units (x3) 74/100/124 MVA 230/13.8/13.8 kV with Z=10% @ 37MVA (x129) 2.5/2.8 MVA 13.8/0.42 kV with Z= 6% @2.5 MVA
Description Of Interconnection Configuration	The Peaker and BESS units will connect to the CAISO controlled grid at the Alamitos West Section A 220 kV Substation. The Combined Cycle units will connect to the CAISO controlled grid at the Alamitos East Section B 220 kV Substation.
Connection Voltage	220 kV

Figure 1: Vicinity Map

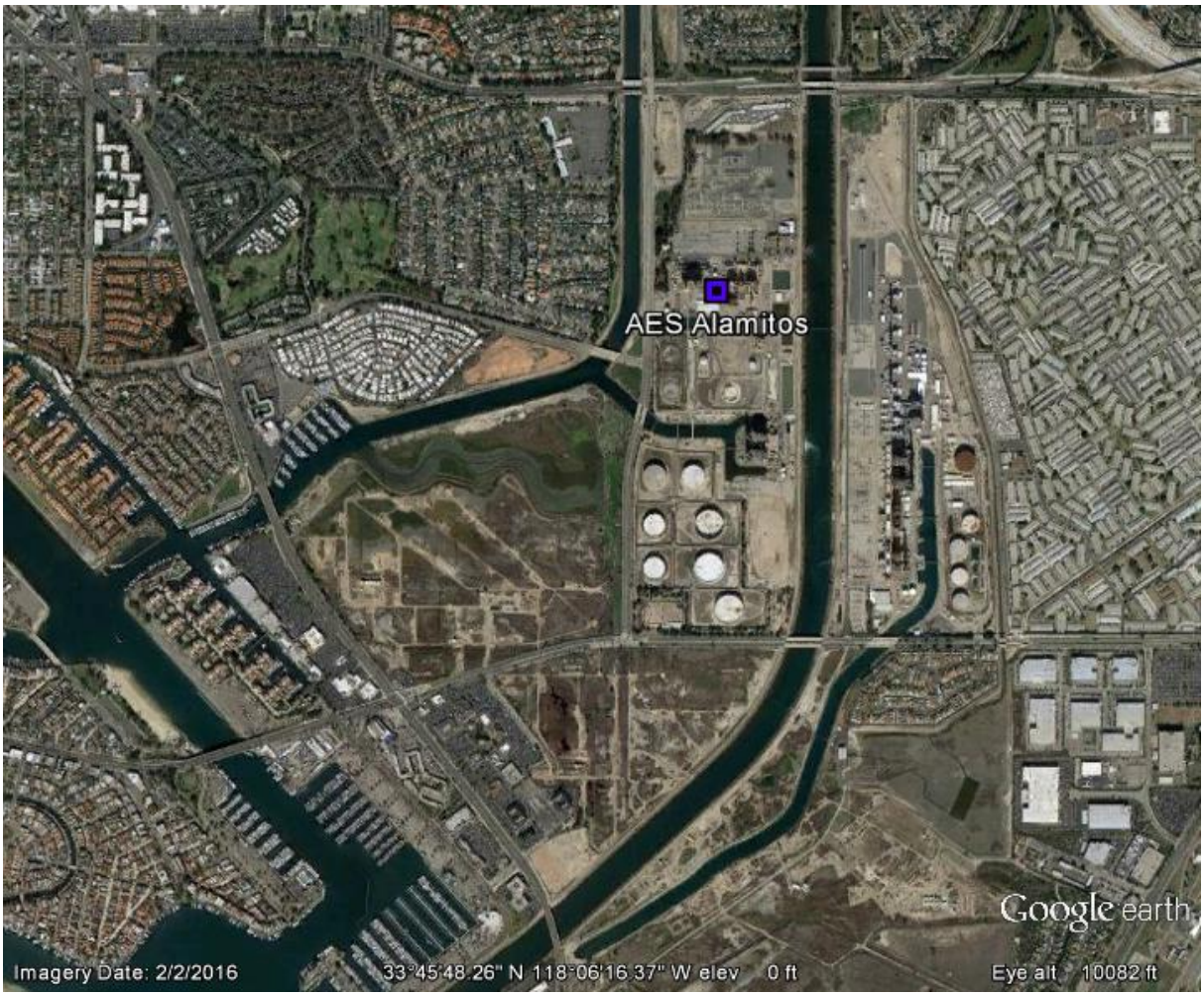


Figure 2: Single Line Diagram for Alamitos Energy Center Project Alternative 1

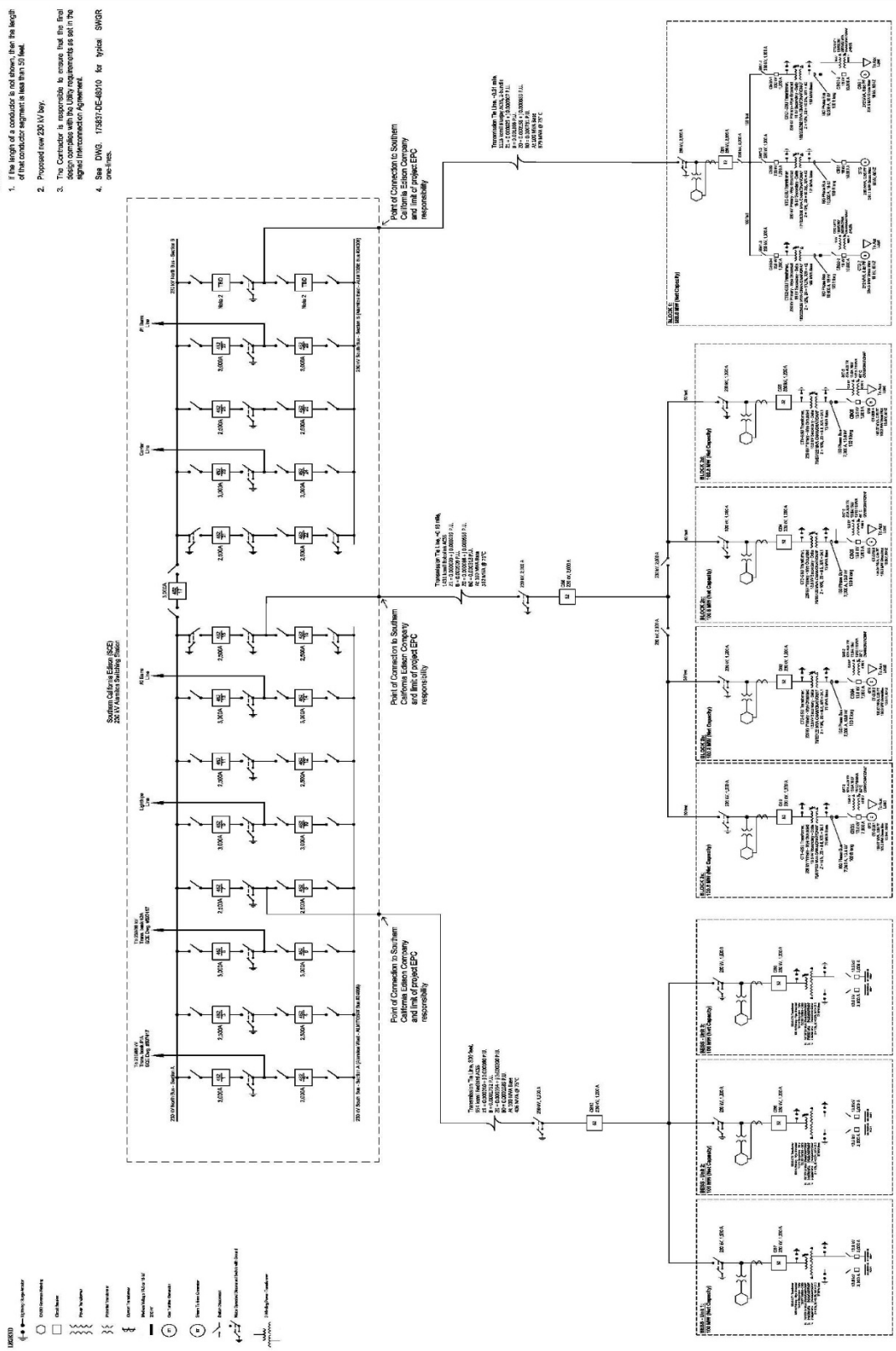
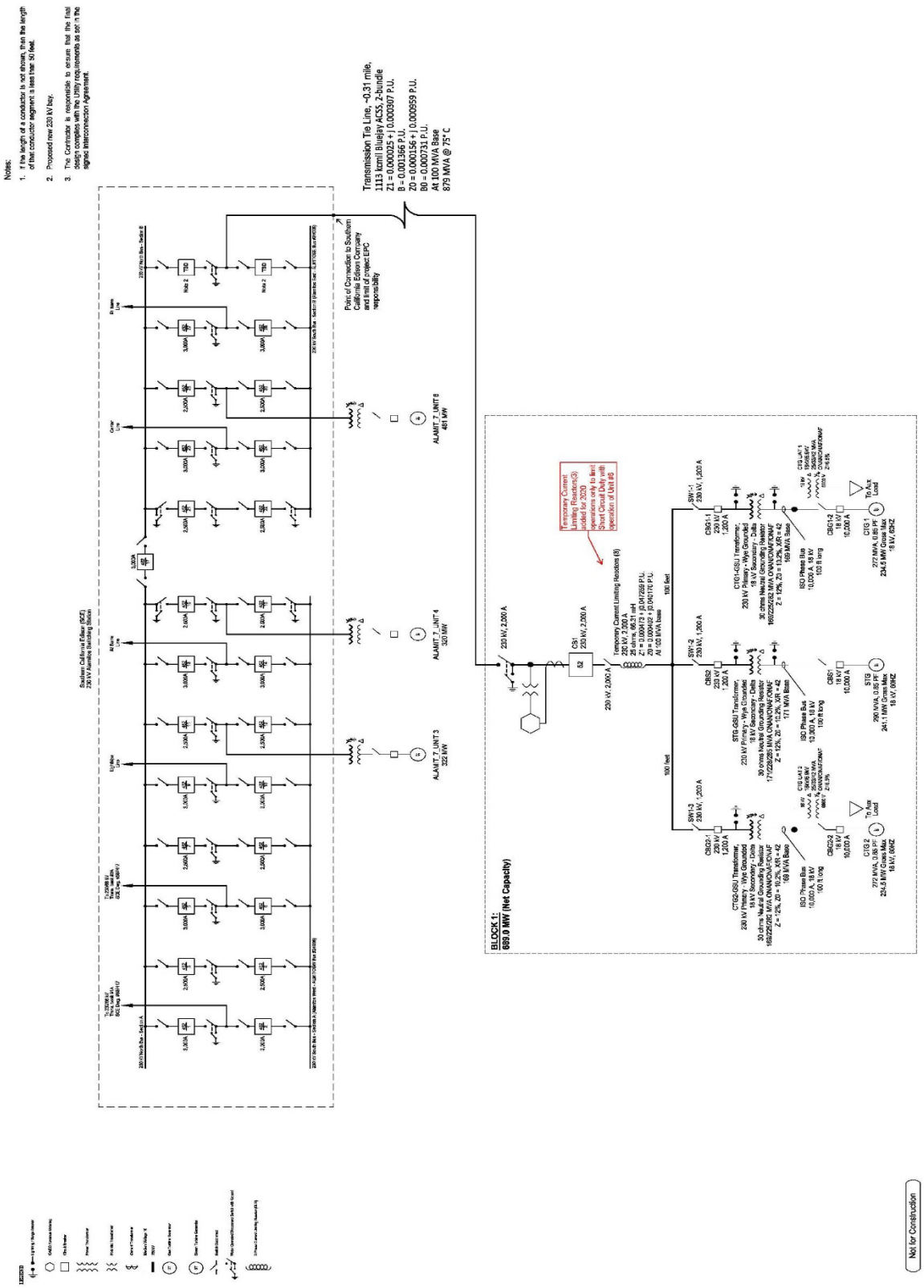


Figure 3: Single Line Diagram for Huntington Beach Energy Project Alternative 2



4. Results of Evaluation

It is understood that any repower of a generating unit, unless replaced with identical equipment, will result in some changes to the total capability and electrical characteristics of the generating unit and therefore some degree of change to the performance of the transmission system. Most of these changes can be attributed to improvements in technology or the unavailability of original equipment. The CAISO considers changes to be 'substantial' if there is a proposed change in fuel source or they are found to have an adverse impact on the transmission system, either of which would require the project to be evaluated pursuant to the CAISO's generator interconnection and deliverability allocation procedures.

Adverse impacts to a transmission system would include increasing the power flow during normal or contingency conditions, any increase in the short circuit duty impacts, or adverse angular or voltage stability impacts, as compared to the impacts associated with the original generating unit.

A. Power Flow Impact

The Generating Unit Repowering Technical Bulletin published by the CAISO on September 12, 2013 states that a repower of a generating unit that results in the same or less MW capacity is not to be considered a substantial change to the total capability of the generating unit from a flow impact standpoint provided all CAISO tariff requirements regarding reactive power are met by the new generating unit.

Based on the technical data provided, the repower project involves two scenarios dependent on whether units 5 & 6 at Alamitos are able to secure new contracts that support continued operation beyond May 31, 2018. Should units 5 & 6 not secure new contracts, the following 2024 scenario will commence in which all of the existing Alamitos Units 1 – 6 will be retired and all of the repowering units will be online. The repowering units include the 689 MW CCGT connecting into the SCE Alamitos East 220 kV Switchyard and the 403.2 MW CT plus the 300 MW BESS units connecting into the SCE Alamitos West 220 kV Switchyard.

However, should units 5 & 6 secure new contracts to continue operating beyond 2018, the second scenario studied include interconnecting only the combined cycle generation into the SCE Alamitos East 220 kV Switchyard with temporary current limiting reactors in the year 2020 assuming that Alamitos unit 3, 4 and 6 are still in operation.

This scope of work results in a reduction of total net MW capability from 1,956 MW down to 1392.2 MW for scenario 1 and down to 1833.1 MW for scenario 2. As far as reactive power requirements, since the generation units are synchronous generators, the repowered units inherently meet all CAISO tariff requirements regarding reactive power. Consequently, the repower of the Alamitos facility as well as the operational implication in 2020 with only the CCGT on is not considered a substantial change to the total capability of the generating unit from a flow impact standpoint as there would be no adverse power flow impact on the transmission grid under normal and contingency conditions as compared with the original generating unit.

B. Short Circuit Duty Impact

The Generating Unit Repowering Technical Bulletin published by the CAISO on September 12, 2013 states that any reduction in the short circuit duty of the repowered generating unit as compared with the original generating unit will not be considered an adverse impact and will not be considered a substantial change to the electrical characteristics.

To evaluate the change of short-circuit duty corresponding to the repower project, the evaluation calculated the maximum symmetrical three-phase-to-ground and single-phase-to-ground short-circuit duties at the Alamitos West 220 kV bus and the Alamitos East 220 kV bus for both the existing units and the resulting configuration following the repower project. Generation and transformer data represented in the generator and transformer data sheets provided by the customer were utilized. Results of the SCD evaluation for Scenario 1 and Scenario 2 are provided below in Table 2 and Table 3 respectively.

Table 2
Three-Phase-to-Ground and Single-Phase-to-Ground Short-Circuit Duties
Repower Scenario 1

Fault Location	Fault Type	Existing		Repower		Delta kA
		kA	X/R	kA	X/R	
Alamitos West 220 kV (Section A)	3Φ	35.6	24.6	29.9	19.2	-5.7
	1Φ	31.9	24.6	28.7	12.4	-7.3
Alamitos East 220 kV (Section B)	3Φ	32.2	15.4	31.1	14.4	-1.1
	1Φ	31.2	13.5	27.7	10.3	-3.5

Table 3
Three-Phase-to-Ground and Single-Phase-to-Ground Short-Circuit Duties
Repower Scenario 2

Fault Location	Fault Type	Existing		Repower		Delta kA
		kA	X/R	kA	X/R	
Alamitos West 220 kV (Section A)	3Φ	35.6	24.6	30.7	21.2	-4.9
	1Φ	31.9	24.6	26.5	10.7	-5.4
Alamitos East 220 kV (Section B)	3Φ	32.2	15.4	31.4	14.9	-0.8
	1Φ	31.2	13.5	28.3	12.5	-2.9

Based on a reduction in SCD at the Alamitos West and Alamitos East 220 kV Substations, the repower of the Alamitos facility as well as the operational implication in 2020 with only the CCGT and Alamitos units 3, 4 and 6 online is not considered a substantial change to the electric characteristics.

C. Angular and Voltage Stability Impact

The Generating Unit Repowering Technical Bulletin published by the CAISO on September 12, 2013 states that angular and voltage stability impacts of a *g*enerating unit directly depends on the type of generator and the power system control functions that the generating unit encompasses. To evaluate angular and voltage stability impacts, local area N-2 contingencies were evaluated for transient stability and post-transient voltage performance. The evaluation was conducted to determine performance according to NERC/WECC planning criteria for the repower project. The double contingencies evaluated that affect the area of interest are listed below in Table 4.

Table 4
Transient Stability and Post-transient Voltage Critical Study Cases

Outage	Bus Fault Location	Fault Type	Duration
Alamitos E-Barre No.1 & Alamitos W-Barre No.2 230 kV T/Ls	Alamitos W 230 kV	3Φ	4 cycles
Alamitos E-Center & Alamitos W-Lighthipe 230 kV T/Ls	Alamitos W 230 kV	3Φ	4 cycles
Alamitos W-Barre No.2 & Del Amo-Barre 230 kV T/Ls	Alamitos W 230 kV	3Φ	4 cycles
Alamitos W-Lighthipe & Del Amo-Hinson 230 kV T/Ls	Alamitos W 230 kV	3Φ	4 cycles

No transient stability problems or post-transient voltage issues were identified in the repower of the Alamitos facility. In addition no issues were identified in operational year 2020 with only the CCGT and Alamitos units 3, 4 and 6 online. Consequently, the repower of the Huntington Beach facility is not considered a substantial change to the electric characteristics.

5. Conclusions

Based on the results of the assessment, the repower request does not result in substantially changing the total capability and/or electrical characteristics of the electric generating facility. However, a Facilities Study is required to further define scope, cost, and schedule of Interconnection Facility upgrades needed to support the repower project so that such scope can be properly described in the Interconnection Agreement. The Alamitos facility will not be allowed to repower without the completion of the Facilities Study, the incorporation of any required upgrades into an Interconnection Agreement and the execution of an Interconnection Agreement addressing the repower and corresponding upgrades.

6. Facilities Study

Although the evaluation has concluded that the capability and electrical characteristics for the Alamitos repower project is substantially unchanged and therefore does not need to be submitted into the CAISO generation interconnection queue, a Facilities Study is required to assure that interconnection facilities and telemetry or protective relay equipment are compliant with the Participating TO's current interconnection requirements and standards. A high-level evaluation of these facilities has identified the need to perform a detailed review to adequately support the repower project. Based on the customer's request and one line provided on June 7, 2016, the activities required involve:

Either, the combination of option 2020 & part of option 2024:

- Option 2020:
  1. Remove three (3) 220 kV positions (pos 2, 4, & 11) which are connected with the customers unit 1, 2, & 5 respectively.
  2. Extend the Alamitos section B Bus to equip one (1) 220 kV position for the new gen tie line (block 1).

- Option 2024: (assuming Option 2020 happened/in place)
  1. Remove three (3) 220 kV positions (pos 6, 8, and 13) which are connected with the customers unit 3, 4, & 6.
  2. Equip two (2) 220 kV gen tie line positions at Alamitos section A bus (BESS 3 units & block 2a units).

Or, only option 2024:

- Option 2024: (assuming Option 2020 never happened)
  1. Remove all six (6) 220 kV positions (pos 2, 4, 6, 8, 11 and 13) which are connected with the customers unit 1, 2, 3, 4, 5 & 6.
  2. Extend the Alamitos section B Bus to equip one (1) 220 kV position for the gen tie line (block 1) and equip two (2) 220 kV gen tie positions at Alamitos section A bus (BESS 3 units & block 2a units) (all together equip three (3) 220 kV positions)

- The Facilities Study will also look at the following elements inside the Alamitos Substations and develop scope, cost and schedule of any Interconnection Facility upgrades needed to support interconnection of the repower of the Alamitos facility:

    - Transmission
    - Substation
    - Protection
    - Telecommunications
    - Environmental Health and Safety
    - Licensing
    - Real Properties

Such scope, cost, and schedule will form the basis for properly defining Interconnection Agreement.