Appendix A – T215

Individual Project Report

Sempra Generation

Rumorosa Wind Expansion Project

Final Report

May 4, 2010

This study has been completed in coordination with San Diego Gas & Electric Company per CAISO Tariff Appendix Y Large Generator Interconnection Procedures (LGIP) for Interconnection Requests in a Queue Cluster Window

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Attachments:

1. Executive Summary

Since the completion of the Transition Cluster Phase I Study and subsequent to the Phase I Results Meeting, Sempra Generation, an Interconnection Customer (IC), has provided an Appendix B, Large Generator Interconnection Study Process Agreement (Appendix B to LGIP, for their proposed Rumorosa Wind Expansion (Project), interconnecting to the CAISO Controlled Grid. The Project is a wind generation facility with an output of 420 MW to the primary Point of Interconnection (POI) which is at San Diego Gas & Electric Company's (SDG&E) proposed East County (ECO) Substation 230 kV bus in San Diego County, California. The Permit to Construct for ECO is under review by the California Public Utilities Commission. The proposed Commercial Operation Date of the Project is December 31, 2014. The Project occupies Queue Position 215 in the CAISO Queue.

As part of this Appendix B submission, the IC elected Energy Only Deliverability Status.

In accordance with Federal Energy Regulatory Commission (FERC) approved Large Generator Interconnection Procedures (LGIP) for Interconnection Requests in a Queue Cluster Window (ISO Appendix Y), this project was grouped with "Transition Cluster" projects (Transition Cluster Phase II Study) to determine the impacts of the group as well as impacts of this Project individually, on the CAISO Controlled Grid.

The Group Report has been prepared separately to identify the combined impacts of all projects in the Transition Cluster on the CAISO Controlled Grid. This report focuses only on the impacts of this project.

The report provides the following:

1. Transmission system impacts caused by this project,

2. System reinforcements necessary to mitigate the adverse impacts caused by this project under various system conditions,

3. Required facilities and a non-binding, good faith estimate of this project's cost responsibility and time to construct these facilities.

The Phase II Study concluded that the following:

A. Transmission system impacts caused by this project

    1. The Project did not cause any adverse impacts to the steady-state thermal or voltage performance of the SDG&E transmission system. However, this project must participate in the Imperial Valley Special Protection System (IV SPS).

    2. The individual power factor study indicated that the Project will be capable of providing sufficient reactive support to satisfy SDG&E's operating voltage schedule requirements.

3. The Project may cause or exacerbate pre-Project overloads in Imperial Irrigation District's (IID) transmission system. Thus, the IID transmission system was identified as an Affected System.

4. Due to the generation dispatch limitations imposed by the CAISO generation tripping limits, the Project did not cause any adverse impacts to the CFE transmission system. However, different base case assumptions, especially in the CFE generation dispatch, may indicate adverse impacts to the CFE transmission system.

5. There were no fault duty impacts identified due to the addition of T215.

6. The Project did not negatively impact the transmission system's transient stability performance following selected contingencies. No criteria violations due to the Project were identified.

7. Post-transient voltage stability analysis indicated that T215 does not contribute to any violations of the NERC/WECC post-transient voltage criteria.

8. Post-transient reactive margin analysis indicated, with the addition of the Transition Cluster projects including T215, there is sufficient reactive margin in the SDG&E transmission system.

B. Adverse impacts identified by the study are mitigated by:

1. Participation in the existing IV SPS to mitigate adverse impacts caused by this project as part of the EOM Cluster. T215 is required to participate in the existing IV SPS, which protects SDG&E, IID, and CFE, following various N-1 and N-2 contingencies. The modified SPS will include contingencies with Sunrise Powerlink.

2. T215 is required to participate in a new SPS to trip generation for the outage of the single 500/230 kV transformer at ECO Substation.

3. As stated in Section A.3, impacts to IID's transmission system need to be further investigated.

C. Specification of required facilities, a non-binding, good faith estimate of this project's cost responsibility and approximate time to construct the required facilities:

1. The +/- 20% estimate of the PTO's Interconnection Facilities[1] to interconnect the Project is $0, exclusive of ITCC[2]. No new PTO's Interconnection Facilities are required because the Project proposes to utilize the Interconnection Facilities to be installed for the higher-queued project in Queue Position 159A (Q159A). The +/- 20% cost estimate for the

[1] The transmission facilities owned, controlled, or operated by the PTO from the Point of Change of Ownership to the Point of Interconnection necessary to physically and electrically interconnect the Project to the CAISO Controlled Grid.
[2] Income Tax Component of Contribution

Network Upgrades[3] to interconnect the Project would be approximately $300 thousand.

2. The non-binding, good faith estimate of time to construct (design, engineer, and construction of the facilities) is approximately 12 months (excluding permitting/licensing) from the date of signing the Large Generator Interconnection Agreement (LGIA). Based on this estimate of time to construct, an In-Service Date of December 1, 2013 appears to be feasible if ECO and Q159A's Interconnection Facilities are in-service.

2. Project and Interconnection Information

Table 2.1 provides general information about the Project. Sempra Generation modified their generator type for this project shortly after the completion of Phase I of the Transition Cluster study process. The data received was in .epc and .dyd format. A revised Attachment A to LGIP Appendix 1 was not provided, and therefore information typically obtained in this Attachment still has not been provided.

Table 2.1: Project General Information

Project Location	San Diego County, California
Number and Type of Generators	168 Wind Turbines (each rated for 2.5 MW)
Interconnection Voltage	230 kV
Maximum Net Output to Grid	420 MW
Point of Interconnection	230 kV Bus at Proposed East County Substation
Alternative Point of Interconnection	None
Commercial Operation Date	December 31, 2014

Figure 2.1 provides the map for the Project and the transmission facilities in the vicinity. Figure 2.2 shows the conceptual single line diagram of the Project.

[3] The transmission facilities, other than Interconnection Facilities, beyond the Point of Interconnection necessary to accommodate the interconnection of the Project to the CAISO Controlled Grid.

Figure 2.1: Map of the Project Location

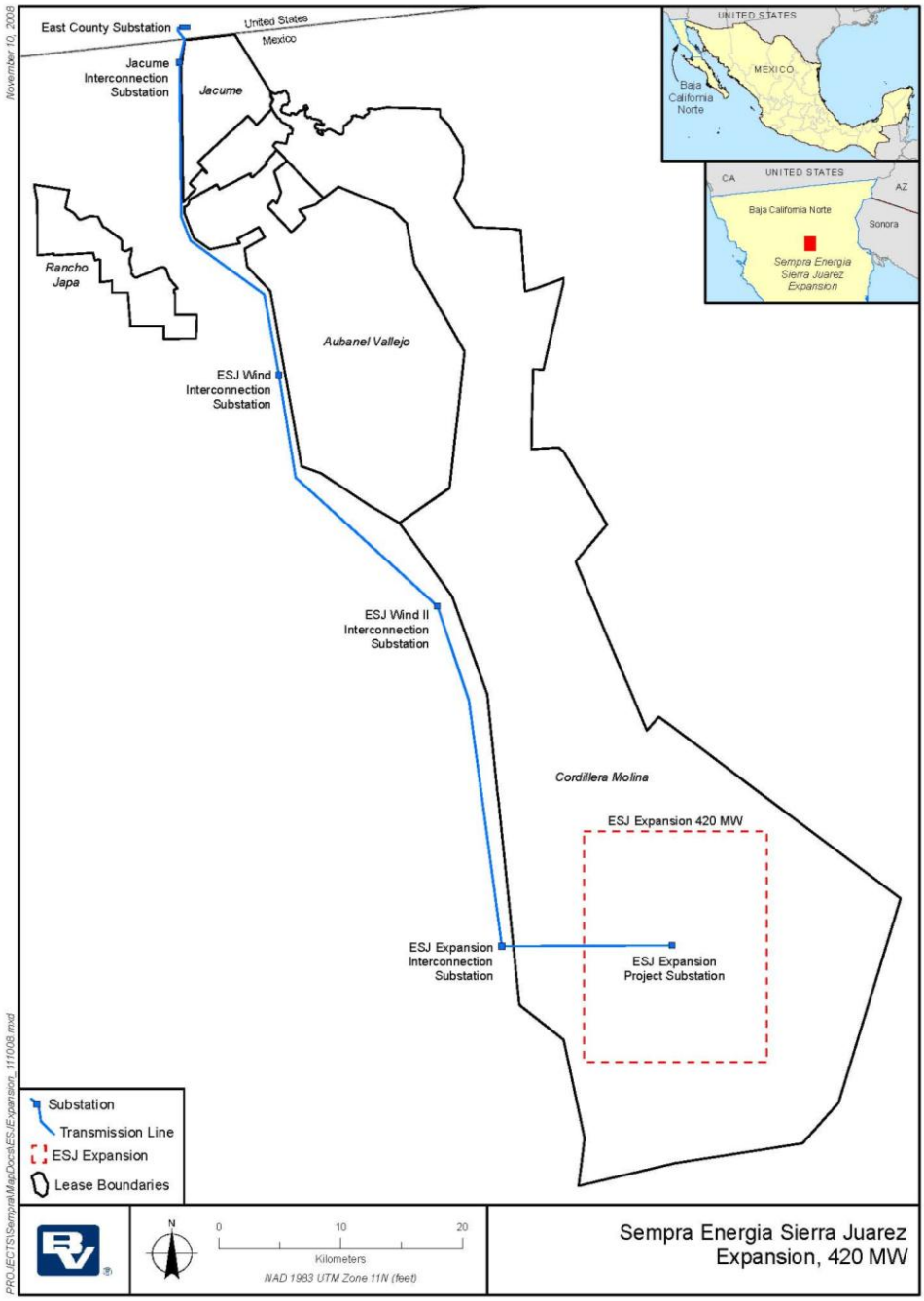
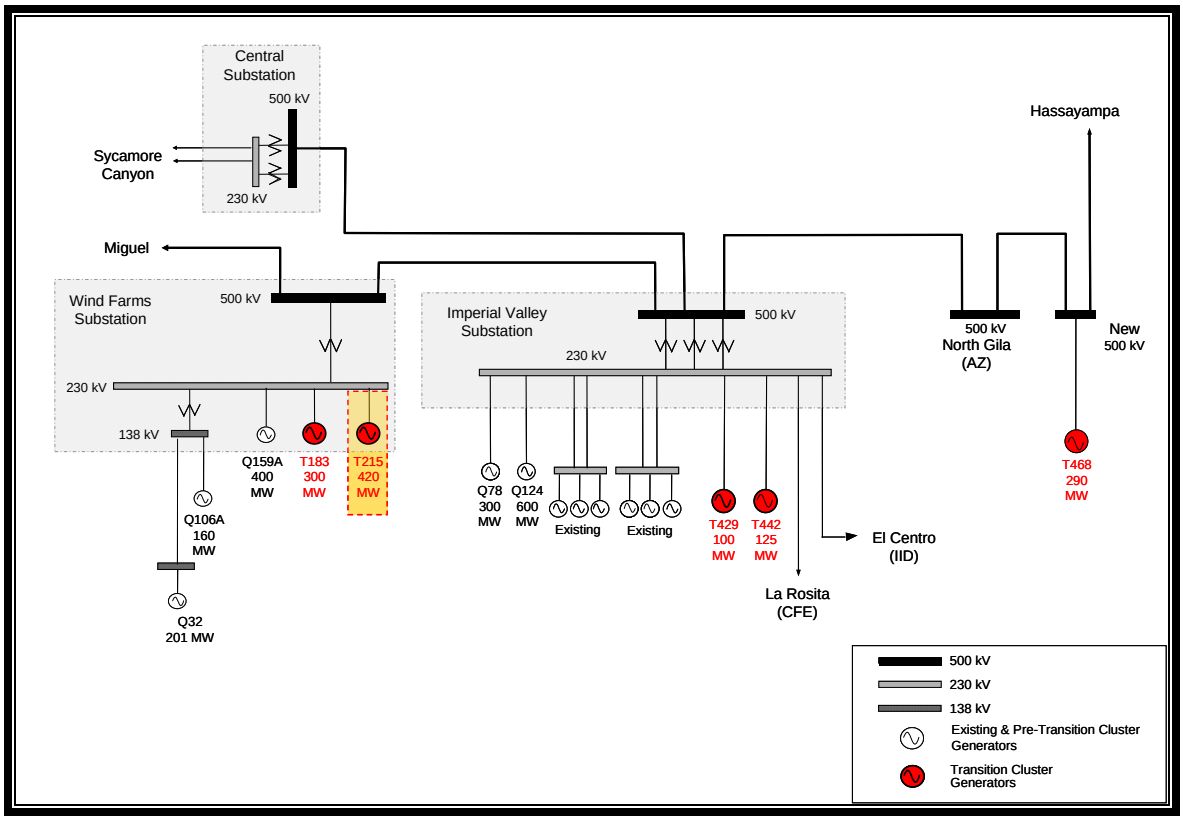


Figure 2.2: Proposed Single Line Diagram



3. Study Assumptions

For detailed assumptions, please refer to the Group Report. The following assumptions are only specific to this project:

1. The requested In-Service date of the Project is December 31, 2013.
2. The expected Commercial Operation Date of the Project is December 31, 2014.
3. The IC will engineer, procure, construct, own, and maintain its project facility.

4. Reliability Study Steady-State Analysis

Imperial Valley SPS

T215 was studied as part of the EOM Cluster, the results of which can be found in the Group Report, Section 7.2, Study Results. Per Section 4.6 of the Group Report, dispatch of all existing and proposed Imperial Valley area generation is limited due to CAISO generation tripping limits of 1,150 MW for N-1 and 1,400 MW for N-2 contingencies. Because the Project will be injecting power to the Imperial Valley Substation, which is also the POI for

other Imperial Valley generation projects that participate in the IV SPS, T215 will be required to participate in the Imperial Valley SPS.

4.1 Steady-State Thermal Overloads in SDG&E System

Contingent upon the Project's participation in the Imperial Valley SPS, the Project will not cause any Category A, B, or C overloads on SDG&E transmission facilities.

4.2 Steady-State Voltage Results in SDG&E System

No steady-state voltage violations were attributed to the Project.

4.3 Power Factor Results

A joint power factor study was performed for Transition Cluster Phase II projects T183 and T215 due to the shared Interconnection Facilities with the higher-queued project in Queue Position 159A at the ECO 230 kV Bus. This power factor study indicated that the Project will be capable of providing sufficient reactive support to satisfy SDG&E's operating voltage schedule requirements. No additional power flow or voltage issues arose from these studies. Detailed results for this power factor study can be found in Attachment 2.

4.4 Affected Systems

Due to the maximum dispatch of EOM Cluster generation in both pre- and post-EOM Cluster cases, the IID transmission system was identified as an Affected System (refer to Group Report, Section 7.2.4, Affected Systems, Table 7.5).

Although IID provided an updated model of their system and it was incorporated into the base cases prior to performing the studies, SDG&E questions the accuracy of the PSLF power flow model of the IID transmission system due to its simplified equivalent model. SDG&E and the CAISO recommend that IID provides to the CAISO and SDG&E an updated model of their system that is a more accurate, detailed representation of the IID transmission system and therefore, the model can be consistently used in all the studies.

Since IID's transmission system is the Affected System that may be negatively impacted by the Project, the IC should coordinate with IID the required additional technical analyses and implementation of additional upgrades on the IID transmission system, if these upgrades appear to be needed. After the additional studies of the IID system are completed, the results should be provided to the CAISO and SDG&E. Per the CAISO LGIP tariff, Appendix Y, Section 3.7, studies required to determine the impact of the Project on Affected Systems will be coordinated with the involved parties.

No CFE impacts were observed because the study cases modeled the Sunrise Powerlink as in-service and respected generation dispatch limitations due to the CAISO generation tripping limits of 1,150 MW for N-1 contingencies and 1,400 MW for N-2 contingencies. However, different base case assumptions, especially in the CFE generation dispatch, may indicate adverse impacts to the CFE transmission system.

5. Short Circuit Analysis

Short circuit studies were performed to determine the fault duty impact of adding the Transition Cluster projects to the transmission system. The fault duties were calculated with and without the projects to identify any equipment overstress conditions. Once overstressed circuit breakers are identified, the fault current contribution from each individual project in the Transition Cluster is determined. If the fault current contribution of any project is higher than the threshold value of 100 amperes, that project will be responsible for its share of the upgrade cost based on the rules set forth in CAISO Tariff Appendix Y.

5.1 Short Circuit Study Input Data

Currently, there is no industry consensus on photovoltaic (PV) and wind plant fault duty analysis modeling. An IEEE Power Engineering Society Joint Working Group on Fault Current Contributions from Wind Plants has been established to further study, refine, and develop a report on the subject.

While this Working Group continues to develop conclusions, preliminary input has been taken from ASPEN, developers of the OneLiner program used to conduct SDG&E fault duty studies.

To be conservative, T215 is modeled as two (2) conventional synchronous machines with fault contributions at the POI equaling approximately the total rated steady state current output.

As such, the following short circuit model input data was used in conjunction with the Station Step-up Transformer data provided by the IC to determine fault duty impacts of the Project:

A. Equivalent Wind Generator Unit 1 of 2 Short Circuit Data @ 204.7 MVA Base:

   1. Positive Sequence subtransient reactance (X"1) = 0.6415 p.u.
   2. Negative Sequence reactance (X'2) = 0.6415 p.u.
   3. Zero Sequence reactance (X'0) = 0.6415 p.u.

B. Equivalent Wind Generator Unit 2 of 2 Short Circuit Data @ 188.8 MVA Base:

   1. Positive Sequence subtransient reactance (X"1) = 0.6415 p.u.
   2. Negative Sequence reactance (X'2) = 0.6415 p.u.
   3. Zero Sequence reactance (X'0) = 0.6415 p.u.

C. 34.5/0.69 kV Equivalent Station Step-up Transformer for Equivalent Wind Generator Unit 1 of 2

   Modeled as a three-phase 34.5/0.69 kV, Delta-Y ground step-up with the following impedances on a 231.4 MVA base:

1. Positive Sequence reactance (X1) = 0.02655 p.u.

2. Zero Sequence reactance (X0) = 0.02655 p.u

D. 34.5/0.69 kV Equivalent Station Step-up Transformer for Equivalent Wind Generator Unit 2 of 2

Modeled as a three-phase 34.5/0.69 kV, Delta-Y ground step-up with the following impedances on a 241.8 MVA base:

1. Positive Sequence reactance (X1) = 0.02655 p.u.

2. Zero Sequence reactance (X0) = 0.02655 p.u.

E. 230/34.5 kV Collector Station Transformers (Total of Two (2))

Modeled as a three-phase 34.5/0.69 kV, Delta-Y ground step-up with the following impedances on a 120 MVA base:

1. Positive Sequence reactance (X1) = 0.09 p.u.

2. Zero Sequence reactance (X0) = 0.09 p.u.

5.2 Results

The available short circuit duty at the existing and planned SDG&E transmission buses resulting from the addition of the Transition Cluster projects and T215 individually is listed in Attachment 3. These results were used to determine if any equipment would become overstressed by the interconnection of the Transition Cluster projects.

Results indicate that there are no fault duty impacts to existing or planned (if the planned rating is known) SDG&E transmission circuit breakers due to the addition of T215.

Thus, this Project is not responsible for mitigating any fault duty impacts.

5.3 Preliminary Protection Requirements

The IC is responsible for the protection of its own system and equipment and must meet the requirements per the SDG&E Interconnection Handbook. The SDG&E Interconnection Handbook can be found at
http://sdge.com/documents/business/GenInterconectionHandBook.pdf

6. Transient Stability Analysis

Transient Stability studies were conducted using both the 2014 Heavy Summer and 2014 Light Load scenarios to ensure that the transmission system remains in operating equilibrium, as well as operating in a coordinated fashion, through abnormal operating conditions after the Transition Cluster projects begin operation. The generator dynamic models, as provided by the IC, were used in the study of this project and are shown in Attachment 4.

6.1 Transient Stability Study Scenarios

Disturbance simulations were performed for a study period of 10 seconds for Pre-EOM Cluster violations and 20 seconds for Post-EOM Cluster violations to determine whether the Transition Cluster projects would create any system instability or cause criteria violations during a variety of line and generator outages. For this project, the following line and generator outages were evaluated as shown in Table 6.1.

Descriptions of the switching sequences can be found in Appendix H.

Table 6.1: T215 Switch Files

#	Switch Files
1	FLAT.swt (No contingency)
2	Dev-Val_slo.swt
3	IV_NGila_slo.swt
4	IV_ROA_6.swt
5	IV-Wnd1_noRAS_slo.swt
6	IV-Wnd1_noXTrp_slo.swt
7	IV-Wnd1_RAS_slo.swt
8	IV_Wnd_dlo_noXTrpR1.swt
9	ML_Wnd_noRAS_slo.swt
10	ML_Wnd_noXTrp_slo.swt
11	ML_Wnd_RAS_slo.swt
12	PaloVerde-g1.swt
13	PaloVerde-g2.swt
14	SONGS-g1.swt
15	SONGS-g2.swt
16	T468_HAA_slo.swt
17	T468_NGila_slo.swt

6.2 Results

The study concluded that the Project would not cause the transmission system to become unstable for the switching sequences shown in Table 6.1. The results of the study are provided in the form of plots in Attachment 5.

7. Post-Transient Voltage Stability Analysis

Post-transient voltage stability analysis indicated that the Transition Cluster projects, including T215, did not cause voltage deviations of 5% or more for Category B contingencies and 10% or more for Category C contingencies from the pre-project levels or cause the SDG&E system to fail to meet applicable voltage criteria. This indicates that T215 does not contribute to any violations of the NERC/WECC post-transient voltage criteria.

8. Reactive Power Deficiency Analysis

Post-transient reactive margin analysis indicated that each power flow case converged for a 5% SDG&E area load increase followed by Category B contingencies and a 2.5% SDG&E area load increase followed by Category C contingencies. This indicates that, with the addition of the Transition Cluster projects including T215, there is sufficient reactive margin in the SDG&E transmission system.

9. Deliverability Assessment

9.1 On-Peak Deliverability Assessment

CAISO performed an On-Peak Deliverability Assessment. The analysis concluded that the Project would not cause any criteria violations. The power flow study results for Category A, B, and C contingencies are detailed in Attachment 6.

9.2 Off-Peak Deliverability Assessment

A modified version of the power flow 2013 Summer Off-Peak base case was created to perform the Off-Peak Deliverability Assessment of the Transition Cluster projects. The assumptions to create this case are listed in the Group Report. The analysis concluded that the Project would not cause any criteria violations. Detailed results are shown in Attachment 6.

10. Environmental Evaluation/Permitting

10.1 CPUC General Order 131-D

SDG&E is subject to the jurisdiction of the California Public Utilities Commission (CPUC) and must comply with CPUC General Order 131-D (Order) on the construction, modification, alteration, or addition of all electric transmission facilities (i.e., lines, substations, switchyards, etc.). This includes facilities to be constructed by others and deeded to SDG&E. In most cases where SDG&E's electric facilities are under 200 kV and are part of a larger project (i.e. electric generation plant), the Order exempts SDG&E from obtaining an approval from the CPUC provided its planned facilities have been included in the larger project's California Environmental Quality Act (CEQA) review, the review has included circulation with the State Clearinghouse, and the project's lead agency (i.e., California Energy Commission) finds no

significant unavoidable environmental impacts. SDG&E or the project developer may proceed with construction once SDG&E has filed notice with the CPUC and the public on the project's exempt status, and the public has had a chance to protest SDG&E's claim of exemption. If SDG&E facilities are not included in the larger project's CEQA review, or if the project does not qualify for the exemption, SDG&E may need to seek approval from the CPUC (i.e., Permit to Construct) taking as much as 18 months or more since the CPUC would need to conduct its own environmental evaluation (i.e. Negative Declaration or Environmental Impact Report).

When SDG&E's transmission lines are designed for immediate or eventual operation at 200 kV or more, the Order requires SDG&E to obtain a Certificate of Public Convenience and Necessity (CPCN) from the CPUC unless one of the following exemptions applies: the replacement of existing power line facilities or supporting structures with equivalent facilities or structures, the minor relocation of existing facilities, the conversion of existing overhead lines (greater than 200 kV) to underground, or the placing of new or additional conductors, insulators, or their accessories on or replacement of supporting structures already built. Obtaining a CPCN can take as much as 24 months if the CPUC needs to conduct its own CEQA review

Regardless of the voltage of the PTO's Interconnection Facilities, SDG&E recommends that the project proponent include those facilities in its project description and application to the lead agency performing CEQA review on the project. The lead agency must consider the environmental impacts of the interconnection electric facility, whether built by the developer with the intent to transfer ownership to SDG&E or to be built and owned by SDG&E directly. If the lead agency makes a finding of no significant unavoidable environmental impacts from construction of substation or under 200 kV power line facilities, SDG&E may be able to file an Advice Letter with the CPUC and publish public notice of the proposed construction of the facilities. The noticing process takes about 90 days if no protests are filed, but should be done as early as possible so that a protest does not delay construction. SDG&E has no control over the time it takes the CPUC to respond when issues arise. If the protest is granted, SDG&E may then need to apply for a formal permit to construct the project (i.e. Permit to Construct).

Please see Section III, in General Order 131-D. This document can be found in the CPUC's web page at:

http://www.cpuc.ca.gov/PUBLISHED/GENERAL_ORDER/589.htm

10.2 CPUC Section 851

Because SDG&E is subject to the jurisdiction of the CPUC, it must also comply with Public Utilities Code Section 851. Among other things, this code provision requires SDG&E to obtain CPUC approval of leases and licenses to use SDG&E property, including rights-of-way granted to third parties for Interconnection Facilities. Obtaining CPUC approval for a Section 851 application can take several months or years, and requires compliance with the California Environmental Quality Act (CEQA). SDG&E recommends that Section 851 issues be identified as early as possible so that the necessary application can be prepared and processed. As with GO 131-D compliance, SDG&E recommends that the project proponent include any facilities that may be affected by Section 851 in the lead agency CEQA review so

that the CPUC does not need to undertake additional CEQA review in connection with its Section 851 approval.

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

To determine the cost responsibility of each generation project in the Transition Cluster, the CAISO developed Cost Allocation Factors for Delivery Network Upgrades based on the individual contribution of each project (Attachment 6), if applicable. There are no Delivery Network Upgrades assigned to this Project. The cost allocation for the PTO's Interconnection Facilities and Network Upgrades for which this project is solely responsible is shown in Table 11.1. The cost for obtaining permitting is not included in the cost estimates, unless specifically noted.

The non-binding, good faith estimate of time to construct (design, engineer, procure, and construct) the facilities is based on the assumptions outlined in Section 3 of this report, and is applicable from the date of signing the Large Generator Interconnection Agreement (LGIA). This is also based upon the assumption that the environmental permitting obtained by the IC is adequate for permitting all SDG&E activities. With the estimate of time to construct of approximately 12 months, the ISD of December 1, 2013 appears to be feasible if ECO and Q159A's Interconnection Facilities are in-service.

It is assumed that the Interconnection Customer will include the PTO's Interconnection Facilities and Network Upgrades work scope, as they apply to work within public domains, in its environmental and permitting processes. However, note that CPUC may still require SDG&E to obtain a Permit to Construct (PTC) or a Certificate of Public Convenience and Necessity (CPCN) for the generator tie line and Network Upgrades work associated with the Project. Hence, the time to complete the construction of facilities could require an additional two to three years.

Table 11.1: Upgrades, Estimated Costs, and Estimated Time to Construct Summary for T215

Type of Upgrade	Upgrade	Description	Cost Allocation Factor	Estimated Cost x 1000 *(Note 1)*	Estimated Time to Construct *(Note 2)*
PTO's Interconnection Facilities *(Note 3)*	None	--	--	--	--
Reliability Network Upgrades	Participation in Existing IV Generation SPS for multiple N-1 and N-2 contingencies and new Wind Farms SPS *(Note 4)*	SDG&E communication interface for IV SPS *(Notes 5 & 6)*	25%	$75	12 Months
		Communication equipment between SDG&E and Project *(Note 7)*	100%	$200	12 Months
		SDG&E communication interface for Wind Farms SPS *(Note 6)*	50%	$25	12 Months
Delivery Network Upgrades	None	--	--	--	--
Total				**$300**	

Note 1: No licensing or permitting costs are included.

Note 2: Time to construct estimates do not include time for permitting and licensing.

Note 3: The Interconnection Customer is obligated to fund these upgrades and will not be reimbursed.

Note 4: All Special Protection Systems are classified as Reliability Network Upgrades because their cost is less than $1 million. This is to prevent overburdening of CAISO's congestion management system which can increase processing time to a point that could create reliability concerns.

Note 5: The existing Imperial Valley SPS protects SDG&E, IID, and CFE following various N-1 and N-2 contingencies, such as the outage of the SWPL.

Note 6: 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 projects' facility.

Note 7: 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 facility. Additional SPSs would require updated logic, but minimal/no cost.

12. Local Furnishing Bonds

Section 16 of the Transition Cluster Phase II Interconnection Study Report identifies additional requirements for generators that connect to the SDG&E wholly-owned transmission system.

If the output for this project is fully contracted to SDG&E, an Impairment will not occur from the construction and energization of new Interconnection Facilities and Network Upgrades that are required for this project located within the Local Transmission System. However, in the event output from this project is not fully contracted to SDG&E, then an Impairment may occur and the means by which such Impairment, if any, is

resolved is set forth in SDG&E's Appendix B (SDG&E Encumbrances) to the CAISO's Transmission Control Agreement. This procedure requires SDG&E, in good faith, to promptly seek an opinion from a nationally recognized bond counsel selected by SDG&E that the requested action or inaction will not adversely affect the tax-exempt status of the LFBs. This procedure further requires that such opinion be of the type generally considered by the municipal bond market as unqualified. If SDG&E is unable to obtain such unqualified opinion, then pursuant to a written request by an Eligible Entity (as defined in the SDG&E Encumbrances), SDG&E, in good faith, will promptly seek a ruling from the IRS that the requested action or inaction will not adversely affect the tax-exempt status of interest on the LFBs. In addition, pursuant to certain provisions of the Code, SDG&E may also be required to redeem a portion of the LFBs in order to mitigate an Impairment.

The Project proposes to connect to SDG&E's Local Transmission System and therefore is required to meet either of the two following requirements:

A. The energy from the Project must be fully contracted to SDG&E, or

B. The Project must:

    1. Pay any costs SDG&E incurs in mitigating the Impairment, and

    2. Obtain a FERC order under Section 211 of the Federal Power Act compelling SDG&E to provide transmission service, including interconnection service.

13. Items Not Covered in this Study

The Phase II Study does not address any requirements for standby power that the Project may require. If interested, the IC should make proper arrangements with the appropriate parties regarding this service.