Application No.:	15-08-027
Exhibit No.:	CAISO-
Witness:	Weiwu Chen

In the Matter of the Application of NEXTERA ENERGY TRANSMISSION WEST, LLC for a Certificate of Public Convenience and Necessity for the Suncrest Dynamic Reactive Power Support Project	Application 15-08-027

TESTIMONY OF WEIWU CHEN
ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

May 16, 2017

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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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TESTIMONY OF WEIWU CHEN ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

I. INTRODUCTION

Q1. What is your name and by whom are you employed?

A1. My name is Weiwu Chen and I am employed as a Regional Transmission Engineer Lead at the California Independent System Operator Corporation (CAISO), 250 Outcropping Way, Folsom, California.

Q2. Please describe your educational and professional background.

A2. I hold a Master of Engineering degree from University of Alberta, Canada, and received both Bachelor of Science and Master of Science degrees in electrical engineering from Xi'an Jiaotong University, China. I have been in the electric power industry for 28 years. More specifically, I have experience in transmission planning, system operation, resource adequacy, and energy economics. I have worked at the CAISO for 8 years and before that I spent 8 years with Kansas City Power & Light. Prior to working at Kansas City Power & Light I spent 12 years with Hatch consulting firm and State Grid Energy Research Institute in Canada and China, respectively.

Q3. What is the purpose of your testimony?

A3. The purpose of this testimony is to provide an overview of the CAISO's technical analysis underlying the CAISO's recommendation that the Commission approve NextEra Energy Transmission West, LLC's (NEET West's) application for a certificate of public convenience and necessity authorizing the construction of the Suncrest Dynamic Reactive Power Support Project (Proposed Project). This testimony presents an updated analysis of

the policy-driven need for the Proposed Project to achieve the California greenhouse gas emission targets and meet California's Renewables Portfolio Standard (RPS) goals. The CAISO analysis confirms the need for the Proposed Project, which provides an important network addition to achieve the state-mandated RPS goals and significant additional benefits for CAISO.

Q4. Please provide an overview of the Proposed Project and why it is needed as a policy-driven project addition to the CAISO Controlled Grid.

A4. The 2013-14 CAISO Transmission Plan identified a need for a dynamic reactive power device connected to the Suncrest substation as a policy-driven transmission addition to the CAISO Controlled Grid[1] necessary to meet the RPS goal. The Proposed Project meets the reactive power requirements by installing a +300/-100 mega volt-ampere reactive ("Mvar") static var compensator (SVC) that will be connected to the existing Suncrest substation via a 1.5 mile 230 kV underground transmission line. The initial driver for the Project was a post-transient voltage deviation performance concern in the southern California transmission grid based on the 33% RPS goal, which was established in 2002 under Senate Bill 1078, accelerated in 2006 under Senate Bill 107, and expanded in 2011 under Senate Bill 2. The concern was mainly caused by the addition of renewable generation in the general Imperial area as part of the RPS portfolios, coupled with the early retirement of generation in the southern California area, including the San Onofre Nuclear Generating Station (SONGS), and gas-fired generation that plans to close in compliance with the State's policy to eliminate coastal water use in once-through cooling. Since the 2013-14 Transmission Plan, there have been some changes in the southern California power grid that this analysis takes into account. The updated analysis confirms that the Proposed Project is required to meet California state RPS policy while meeting all applicable system reliability performance requirements specified in the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) standards and CAISO planning standards grid operation procedures. If

[1] Terms not otherwise defined herein are defined in the CAISO Tariff, Appendix A.

the Proposed Project is approved by the Commission, it will provide various benefits to the CAISO Controlled Grid in the southern California area, which include, but are not limited to:

- increasing renewable generation deliverability from the Imperial, Baja, and Arizona renewable energy zones to the CAISO Controlled Grid by as much as 1045 MW, while ensuring system operation within applicable reliability criteria and the grid operation procedures;
- increasing San Diego power import capability by as much as 306 MW. This increased import capability helps to accommodate more renewable energy by allowing the California wholesale energy market to access lower cost electricity, and making the grid operation less constrained to address the oversupply concerns;
- reducing the risk of potential post-transient voltage instability under emergency conditions in the San Diego area and Los Angeles Basin by boosting the San Diego Import Transmission (SDIT) system potential Interconnected Reliability Operating Limit (IROL) by as much as 220 MW;
- providing additional reliability benefits by deferring or alleviating potential needs for reliability upgrades in the San Diego area that are estimated to cost $48 million-$136 million;
- reducing local capacity requirements in the San Diego area and Miramar sub-area by about 326 MW and 30 MW, respectively;
- reducing the potential exposure of cross-tripping SDG&E's 230 kV tie with CENACE[2], which may jeopardize reliability in the CENACE system and result in potential voltage instability in the Los Angeles Basin and the San Diego area.

The CAISO details each of these benefits below.

[2] CENACE is the grid operator for Baja California, which is electrically interconnected with the CAISO and WECC system.

II. BACKGROUND

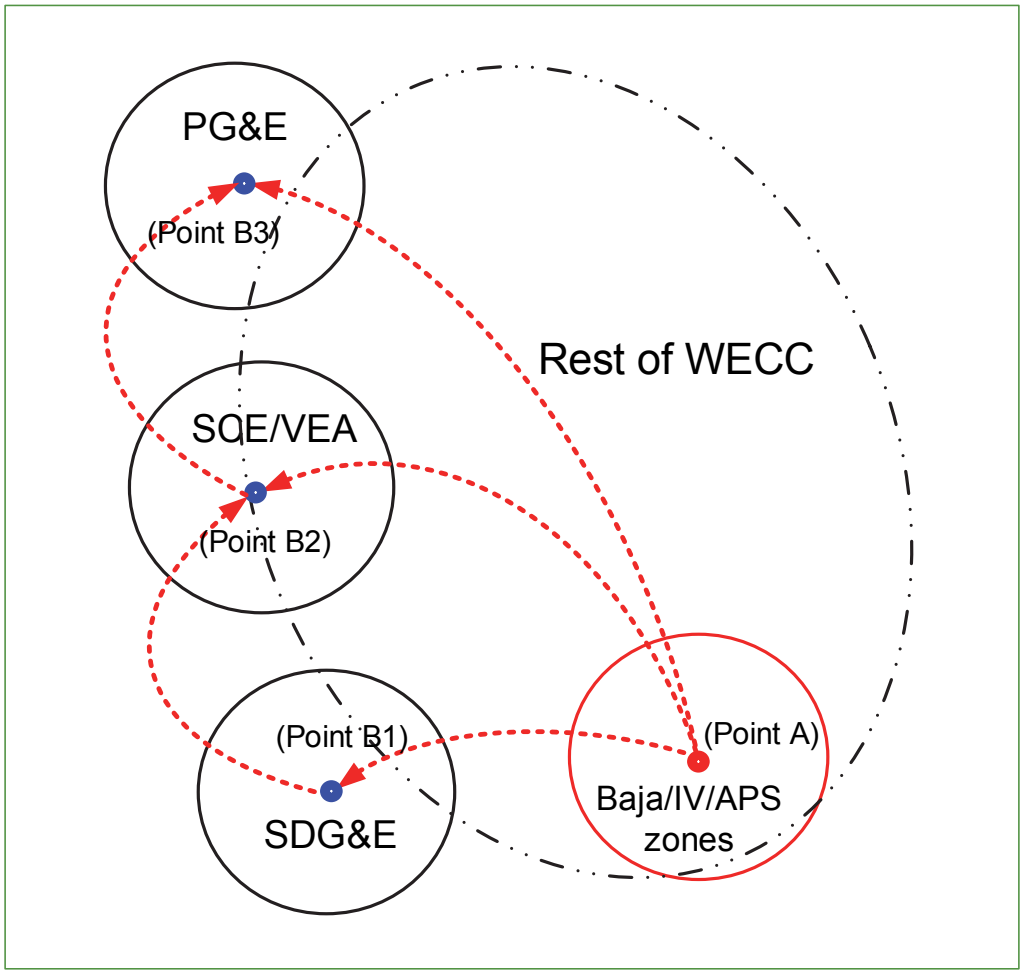
Q5. Please explain the CAISO's assumptions and approaches used to update its analysis.

A5. The CAISO conducted power flow simulations to update the technical assessments that justify the need for the Proposed Project. The underlying assumptions are based on the Commission-developed RPS portfolio used in the CAISO's 2015-16 transmission planning process. The CAISO also verified the need based on the California Energy Commission's latest load demand forecast and the unified planning assumptions in the CAISO 2016-17 TPP cycle. The key assumptions are summarized in Appendix A. Below is a brief description of the CAISO's four approaches to calculate the incremental benefits of the Proposed Project discussed above.

1. Deliverability Benefits

The CAISO approximated generation deliverability, based on transmission system transfer capability, to calculate potential increases in deliverability of renewable generation attributable to the Proposed Project. The benefit was estimated based on differences between electrical transmission system performance under two distinct operational conditions. In each operational condition, the CAISO determined the levels of deliverability with and without the Proposed Project. Figure 1 illustrates generation deliverability paths from the renewable zones (Point A) to the CAISO Controlled Grid (Point B1/B2/B3).

Figure 1: Generation Deliverability Path to CAISO Controlled Grid

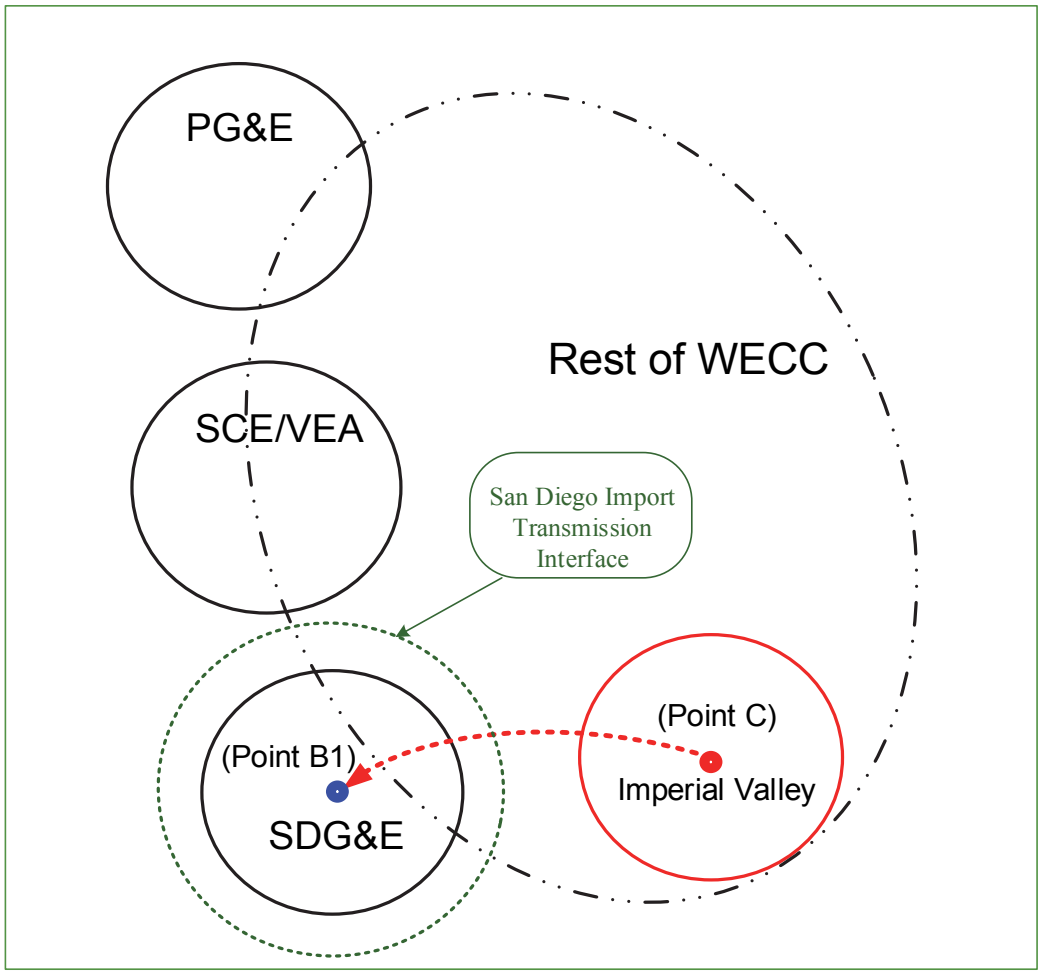


2. San Diego Import Capability Benefits

The CAISO used its System Operating Limits Methodology for the Planning Horizon to calculate power import or transfer capabilities for the SDG&E Import Transmission System. Post-transient governor power flow analysis was carried out as required to evaluate system performance under stressful power flow conditions for applicable contingencies to identify thermal, voltage, and voltage stability limits. The SDIT system performances, such as System Operating Limits (SOL) and Interconnected Reliability Operating Limits (IROL), were compared between two scenarios with and without the Proposed Project in order to quantify the benefits of the Proposed Project. Figure 2

illustrates the power transfer path via the SDIT System from the Imperial Valley area (Point C) to the San Diego area (Point B1).

Figure 2: Transfer Path via SDG&E Import Transmission (SDIT) System



3. Reliability Benefits

The CAISO evaluated reliability benefits, such as the potential to defer reliability upgrades or alleviate reliability concerns, by comparing power flow impacts on associated facilities with and without the Proposed Project.

4. Local Capacity Requirement Benefits

The CAISO used the local capacity technical study approach to test long-term local capacity requirements with and without the Proposed Project.

III. DISCUSSION

Q6. Please provide a brief overview of the interconnected nature of the southern California transmission system.

A6. The southern California transmission system is heavily interconnected. Modifications to the system condition and configuration are carefully designed to address clean energy trends by working in conjunction with existing and planned system elements.

In this case, the Proposed Project delivers maximum system benefits when combined with an operational modification to bypass existing series capacitors on the Southwest Powerlink (SWPL) and Sunrise Powerlink (SPL) 500 kilovolt (kV) transmission lines. In general, bypassing the series capacitors increases thermal constraint limits and also results in lower voltage constraint limits. The Proposed Project mitigates the voltage constraint and therefore increases the overall transmission capability. Neither the Proposed Project nor the operational modification can increase the transmission capability alone, but together they achieve the system performance necessary to deliver renewable generation to load in conformance with the RPS goals. The relationship between the Proposed Project and bypassing the series capacitors is discussed in detail in the sections describing the project benefits.

A. Deliverability Benefits

Q7. Please explain how much incremental renewable generation deliverability can be attributed to the Proposed Project.

A7. In the 2014-15 CAISO Transmission Plan, the CAISO described the need to bypass series capacitors on the SWPL and Sunrise 500 kV transmission lines to allow an incremental 900 to 1,100 megawatts (MW) of renewable generation in the Baja and Imperial zones to

be deliverable.[3] As described in Q&A 6, that deliverability benefit could not be achieved without bypassing the 500 kV series capacitors on SWPL and SPL. Without bypassing the series capacitors the thermal limit (1705 MW) is the binding constraint. Bypassing the series capacitors increases the thermal limit, but creates unacceptable voltage performance in the SPL system that reduces the voltage limit to 1676 MW. The Suncrest SVC project together with the bypassing increases the binding constraint by over 1000 MW, to 2750 MW. Both the bypassing and the Suncrest SVC project are necessary to achieve the incremental increase in deliverability. The CAISO identified the Suncrest SVC project as a cost-effective solution to mitigate the voltage problem and therefore the generation deliverability benefit is attributable to the Proposed Project.

Q8. Please describe the studies that were performed to demonstrate the incremental renewable generation deliverability and why it is attributable to the Suncrest SVC project?

A8. Renewable generation deliverability from the Imperial Valley, Baja California and Arizona renewable zones is confined by a binding constraint that is either thermal or voltage related, depending on the utilization of series capacitors on the SWPL and SPL lines. Table 1 presents approximate renewable generation deliverability estimates without the Proposed Project under two distinct operational conditions: (1) with the series capacitors in SWPL and SPL energized (*i.e.*, not bypassed); and (2) with the series capacitors de-energized (*i.e.*, by-passed). Bypassing the series capacitors alone increases the thermal limit to 2750 MW from 1705 MW, but reduces the voltage limit from 3088 MW to 1676 MW because the bypass causes a voltage concern at the Suncrest substation in SPL. Despite the fact that bypassing the series capacitors increases the thermal limits, it would actually reduce renewable generation deliverability by 29 MW by reducing the voltage limit. The Proposed Project effectively mitigates the voltage concern and makes

[3] The additional 900 MW to 1,100 MW of generation deliverability is estimated by comparing between the 1900-2100 MW of deliverable generation in the Baja and Imperial zones that is asserted on page 219 of the CAISO 2014-2015 Transmission Plan and the 1000 MW of deliverable generation discussed on page 202 of the CAISO 2013-2014 Transmission Plan.

the bypass a feasible operational mitigation solution to increase the generation deliverability by as much as 1045 MW (from 1705 MW to 2750 MW). The voltage concern was identified in the Suncrest 500/230 kV substation based on the WECC regional reliability standard TPL-001-WECC-CRT-3 and CAISO's Operation Procedure 3100, which is discussed in Q&A 11.

Table 1.
Approximate Generation Deliverability Results with and without the Suncrest SVC Project

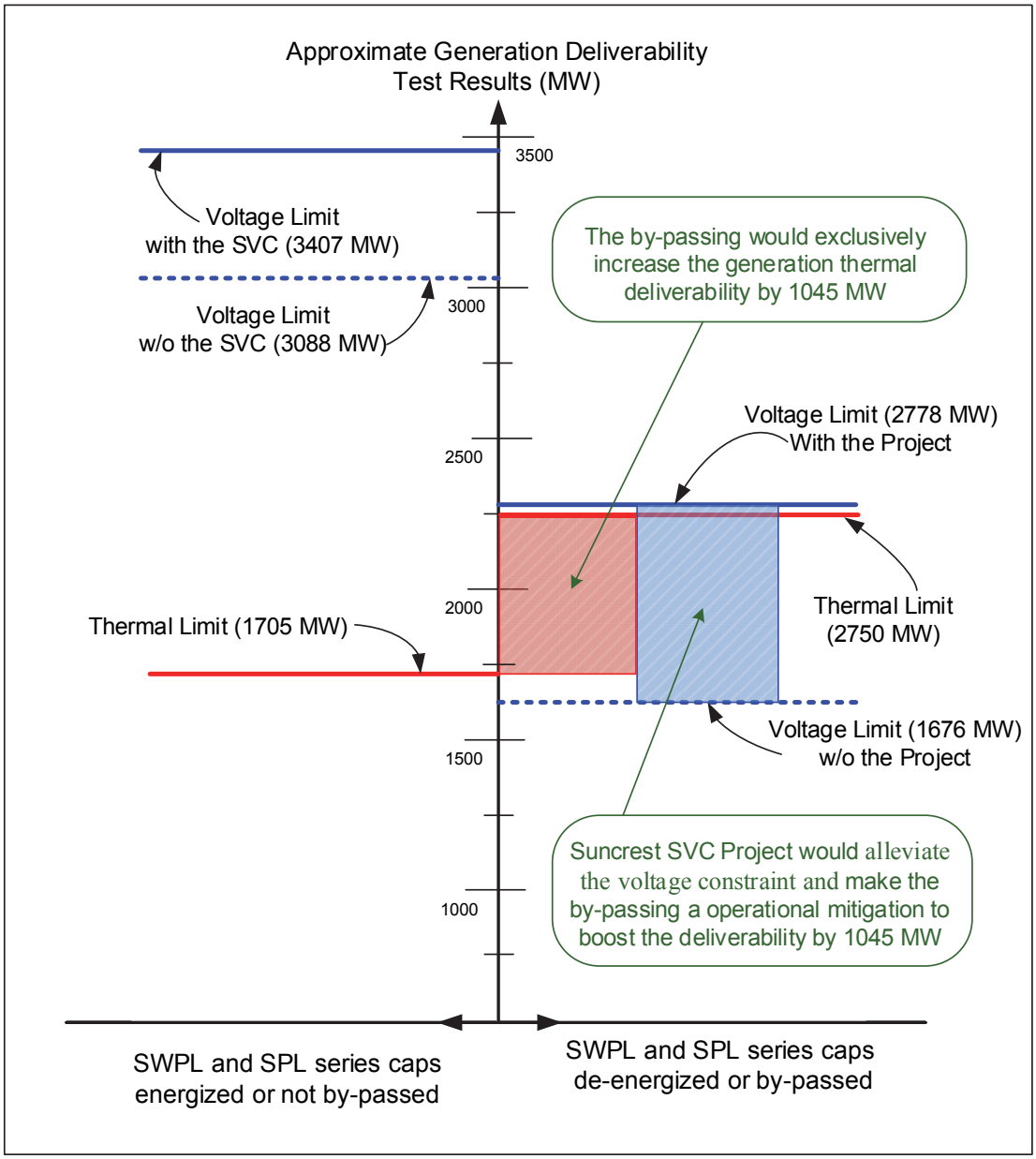
Status of SWPL and SPL Series Capacitors	Constraint				Deliverability in MW	
	Worst Contingency	Limiting Element	NERC Category	Type	w/o the Project	with the Project
Energized (Not Bypassed)	Ocotillo-Suncrest 500 kV line with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P1	Thermal	1705	1705
	ECO-Miguel 500 kV line with SPS Gen Tripping at IV	Suncrest 500 kV bus	P1	Voltage	3088	3407
De-energized (Bypassed)	Ocotillo-Suncrest 500 kV line with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P1	Thermal	2750	2750
	ECO-Miguel 500 kV line with SPS Gen Tripping at IV	Suncrest 500 kV bus	P1	Voltage	1676	2778

Table 1 shows the deliverability estimates with and without the Suncrest SVC project under the same two operational conditions (*i.e.*, both with and without the series capacitor by-passed). The results demonstrate that the Proposed Project would effectively alleviate the Suncrest 500 kV bus voltage constraint and boost the voltage limit to 2778 MW, which would no longer be the binding constraint because it is 28 MW higher than the 2750 MW thermal limit. Therefore, generation deliverability can be increased from 1705 MW to as high as 2750 MW after the bypassing. In other words, the Proposed Project enables the CAISO to bypass the series capacitors, which results in approximately 1045

MW of additional renewable generation deliverability available from the renewable zones to the CAISO Controlled Grid.[4] Figure 3 illustrates the binding approximate generation deliverability results by consolidating the results in Table 1.

[4] This conclusion echoes Section 4.3.3 SDG&E Area Policy-Driven Deliverability Assessment Results and Mitigations of the CAISO 2014-2015 Transmission Plan on page 219 that state "deliverability of new renewable resources in the Baja and Imperial zones is limited by Category B and C overloads in the Imperial Valley area. Using an SPS to trip generation is not sufficient to eliminate all of the identified overloads. The overloads can be partially mitigated by by-passing the series capacitors on the ECO-Miguel and Ocotillo-Suncrest 500 kV lines under normal conditions. This mitigation is sufficient to make 1,900 to 2,100 MW of the Baja and Imperial zones deliverable". This was concluded assuming existence of the Suncrest SVC project.

Figure 3. Illustration of the Approximate Generation Deliverability Results



Q9. Can the CAISO only bypass the series capacitors in SWPL but leave the series capacitors energized in the Ocotillo-Suncrest 500 kV line to avoid the voltage problem on the Suncrest 500 kV bus?

A9. This question is worth considering because bypassing the series capacitors on the Ocotillo-Suncrest 500 kV line creates the voltage problems that drive the need for the Suncrest SVC project. The CAISO did further investigation assuming that the series

capacitors on the Sunrise 500 kV line were not bypassed when the series capacitors on the ECO-Miguel 500 kV line were de-energized or by-passed. Table 2 presents associated thermal constraint limits on the generation deliverability. As can be seen from the table, although the voltage constraint on the Suncrest 500 kV bus is not binding anymore, the thermal constraint on the Suncrest-Sycamore 230 kV lines for the single contingency of ECO-Miguel 500 kV line (P1) will become binding. The generation deliverability is reduced to 1405 MW, which is 1345 MW lower than with the series capacitors on both lines bypassed and the Proposed Project.

Table 2.
Approximate Generation Deliverability Results
with Series Capacitors De-Energized on SWPL but not on SPL

	Constraints				Generation Deliverability
	Worst Contingency	Limiting Element	NERC Category	Type	MW
No Upgrade	ECO-Miguel 500 kV line with SPS Gen Tripping at IV	Suncrest-Sycamore 230 kV lines	P1	Thermal	1405
	Ocotillo-Suncrest 500 kV line with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P1	Thermal	2656

B. San Diego Import Capability Benefits

Q10. How much can the San Diego power import capability be increased by the Suncrest SVC project?

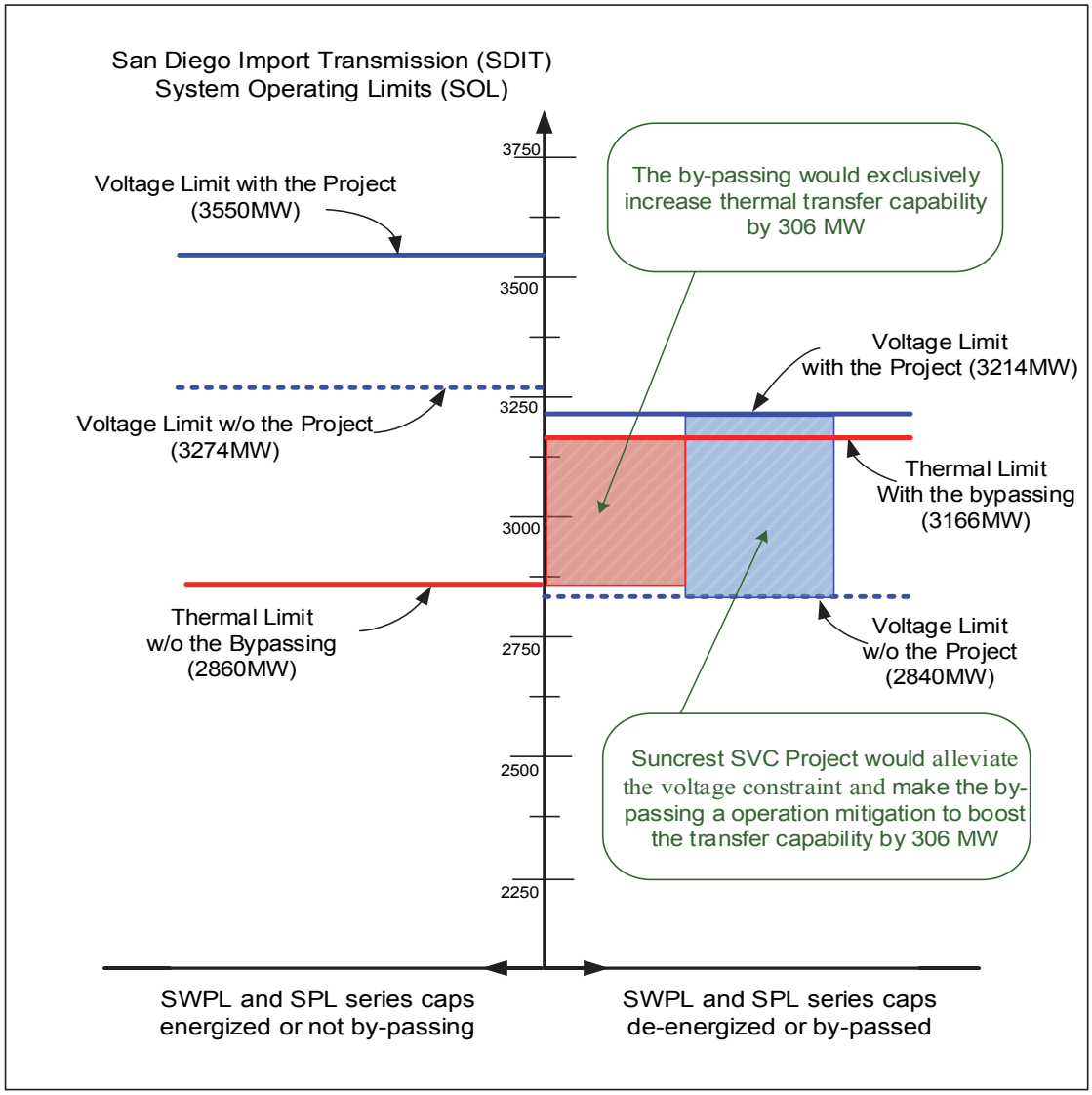
A10. The San Diego power import capability is known as San Diego System Operating Limit (SOL) via the SDIT system. Table 3 presents a comparison of San Diego import capability test results under thermal and voltage constraints for the two scenarios with and without the Proposed Project, assuming that the series capacitors on SWPL and SPL

are energized (not bypassed) and de-energized (bypassed), respectively. Figure 4 illustrates the thermal and voltage constraint limits of the SDIT system accordingly.

Table 3.
Approximate System Operating Limits of San Diego Import Transmission System

Status of the 500 kV Series Capacitors	Constraint				SOL in MW	
	Worst Contingency	Limiting Element	NERC Category	Type	w/o the Project	with the Project
Energized (Not Bypassed)	Ocotillo-Suncrest 500 kV line with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P1	Thermal	2860	2860
	ECO-Miguel 500 kV line with SPS Gen Tripping at IV	Suncrest 500 kV bus	P1	Voltage	3274	3550
De-energized (Bypassed)	Ocotillo-Suncrest 500 kV line with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P1	Thermal	3166	3166
	ECO-Miguel 500 kV line with SPS Gen Tripping at IV	Suncrest 500 kV bus	P1	Voltage	2840	3214

Figure 4. Illustration of the San Diego Import Capability Test Results



As can be seen in Table 2 and Figure 4:

- without the Proposed Project, the lower voltage constraint becomes binding and limits the San Diego import capability to 2840 MW after the SPL series capacitors are de-energized or bypassed, about 20 MW lower than the 2860 MW of thermal transfer limit before by-passing the series capacitors;
- with the Project, the voltage constraint is alleviated, and the SDIT thermal limit would become a binding constraint. The San Diego import capability increases to

3166 MW, or 306 MW higher than the 2860 MW before by-passing the series capacitors.

As the development of renewable generation grows to achieve the 33% and the 50% RPS goals, the benefits of increasing San Diego import capability will grow. The higher San Diego import capability makes the grid more reliable and less constrained, thereby helping the California energy market to import clean renewable energy, avoid oversupply conditions, and access to more economic electricity.

C. Reliability Benefits

Q11. Is the Suncrest SVC project needed to comply with the NERC, WECC, and CAISO Reliability Standards while achieving the California regulatory policies?

A11. Yes. The CAISO's updated analysis confirms the policy-driven need for the Proposed Project to meet all applicable reliability requirements while achieving the California greenhouse gas emission targets and meeting the RPS goals. These reliability requirements are specified in NERC Standard TPL-001-4 and WECC regional reliability standard TPL-001-WECC-CRT-3. In addition to the NERC and WECC standards, the CAISO plans its transmission system to meet California ISO Planning Standards along with its grid operation practices.

Table 4 presents post-transient voltage performances under the two scenarios with and without the Proposed Project, assuming the 500 kV series capacitors in SWPL and SPL are bypassed. Without the Proposed Project, the voltage and voltage deviation on the Suncrest 500 kV and 230 kV buses will be lower than 0.90 pu and equal to the 8% of threshold for the single contingency of ECO-Miguel 500 kV line (NERC category P1 event). The voltage issues were identified under an assumption that all available facilities and operational procedures are utilized to protect the buses against the voltage issues. This does not meet the requirements specified in WECC reliability criterion TPL-001-

WECC-RBP-3[5] and CAISO operation procedure 3100.[6] The results in the table demonstrate that the Project can mitigate the unacceptable voltage performances while maintaining the generation deliverability and the San Diego import capability. The Proposed Project is required to support the voltage performance requirements in the Sunrise system during the outage to maintain the generation deliverability and the SDIT import capability.

Table 4.
Post-Transient Voltage Performance

	Worst Single Contingency (P1)	Concern	Unit	Suncrest 500 kV Bus	Suncrest 230 kV bus
No Upgrade	ECO-Miguel 500 kV line outage followed by SPS gen tripping at IV	Low Voltage	pu	0.87	0.89
		Voltage Deviation	%	-8	-8
With Suncrest SVC Project		Low Voltage	pu	0.90	0.94
		Voltage Deviation	%	-4	-3

Q12. Does the Suncrest SVC project provide a reliability benefit by alleviating potential post-transient voltage instability under emergency conditions in the San Diego and Los Angeles Basin areas?

A12. Yes. The CAISO performed post-transient voltage stability analysis with 5% positive reactive power margin in the SDG&E area and Los Angeles Basin for the 2025 planning horizon in accordance with the CAISO SOL/IROL Methodology. A post-transient voltage stability concern was identified for the single outage of ECO-Miguel 500 kV line with high import via the SDIT system when there is low generation support in the San Diego area and Los Angeles Basin.[7] This established a potential Interconnected

[5] WR1.1.2 of TPL-001-WECC-CRT-3 requires that steady-state voltages at all applicable BES buses shall stay within 0.90 pu to 1.05 pu of nominal voltage for P1-P7 events (WR1.1.2), and WR1.2 requires post-contingency steady-state voltage deviation at each applicable BES bus serving load shall not exceed 8% for P1 events.
[6] CAISO OP3100B requires that voltage in SDG&E 500/230 kV system shall stay above 0.90 pu of nominal voltage for post-contingency.
[7] For the purpose of this analysis, thermal overloads and low voltage concerns are ignored. This section focuses on the relative impact of the Proposed Project on post-transient voltage instability.

Reliability Operating Limit (IROL) in SDIT that, if violated, could lead to instability, uncontrolled separation, or cascading events that adversely impact reliability in the southern California bulk transmission system.

Table 5 presents SDIT's potential IROL test results under the two scenarios with and without the Project, assuming the series capacitors in SWPL and SPL are bypassed.[8] The Proposed Project increases the potential IROL by as much as 220 MW (from 3346 MW to 3566 MW) and effectively reduces the risk of post-transient voltage instability concern in the San Diego area and Los Angeles Basin.

Table 5.
IROL Transfer Limits of San Diego Import Transmission System

Constraint				IROL in MW	
Worst Contingency	Limiting Element	NERC Category	Type	without the Project	with the Project
TL50001 ECO-Miguel 525 kV line with CGCC[9] and SPS Gen Tripping at IV	Voltage Instability Concern in the San Diego Area and LA Basin	P1	Post-Transient Voltage Instability	3346	3566

Q13. Does the IROL of 3566 MW with the Suncrest SVC project or 3346 MW without the Proposed Project mean that the ISO can normally import that much power into the San Diego area?

A13. Not necessarily, because import limits depend on system conditions. The IROL indicates that under emergency conditions, such as after the loss of a large generating facility, the system is not at risk of voltage collapse or instability for a subsequent contingency as long as the flow is below the IROL. The normal import capability or SOL is established

[8] WR5.3 of TPL-001-WECC-CRT-3 requires that all P0-P1 events shall demonstrate a positive reactive power margin at a minimum of 105 percent of forecasted peak load.
[9] The automatic centralized capacitor control schemes were assumed to be available in the areas

by ensuring that there are no thermal overloads and voltages concerns under the single contingency.

Q14. Can the Proposed Project provide other potential reliability benefits in the southern California area and its adjacent systems?

A14. Yes. In addition to the benefits described above, the Proposed Project also provides the following reliability benefits:

- Deferring the potential need to mitigate a reliability concerns on the southern San Diego 230/138/69 kV system from Bay Boulevard to Old Town substations. The 2015-16 CAISO Transmission Plan identified that one of the two transformer banks in the planned Bay Boulevard 230/69 kV substation overloaded for Category P2, P4, or P6 outages. Separately mitigating this concern would cost an estimated $13 million to $101 million.
- Either deferring a potential reliability network upgrade or reducing customer load shedding in the Poway area to address a potential thermal overload concern on the Sycamore-Pomerado 69 kV lines. Table 6 shows that one of the two Sycamore-Pomerado 69 kV lines is loaded as high as 98.2% of its emergency rating in the event of a single outage of other Sycamore-Pomerado 69 kV line (Category P1). Bypassing the series capacitors could defer a future need for a network addition to address the potential thermal overload. Mitigation would cost an estimated $35 million. In addition, without the potential upgrade, an N-1-1 event (Category P6) would result in local load shedding. It is estimated that bypassing the series capacitors could reduce exposure to load shedding by up to 25 MW.
- Lessening the potential thermal overloading concern in CENACE's 230 kV system between La Rosita and Tijuana under an N-1-1 contingency (Category P6), that would consequently trigger CENACE's existing Valle–Costa Path SPS designed to cross trip one of the two 230 kV tie lines between SDG&E and CENACE. The cross-tripping will result in a radial connection between the two

systems, which may jeopardize reliability in the CENACE system and result in potential voltage instability in the Los Angeles Basin and the San Diego area.

Table 6 presents detailed power flow impact on the Bay Boulevard 230/69 kV transformers, the Sycamore-Pomerado 69 kV lines, and CENACE's 230 kV path between La Rosita and Tijuana, with and without bypassing the series capacitors.

Table 6.
Power Flow Impact on the potential reliability concerns

Area	Worst Contingency	Overloaded Facility	NERC Category	Post-Contingency Power Loading (%)		Incremental Flow Impact
				Series Capacitors in SWPL and SPL NOT Bypassed	Series Capacitors in SWPL and SPL Bypassed	%
Southern San Diego	Bay Blvd-Silvergate 230 kV line followed by one of the two 230/69 kV Banks in Bay Blvd Substation	Other 230/69 kV Bank at Bay Blvd	P6	106.9	103.8	3.1
Poway	One of the two Sycamore-Pomerado 69 kV Lines	other Sycamore-Pomerado 69 kV Line	P1	98.2	93.5	4.7
	One of the two Sycamore-Pomerado 69 kV Lines + Sycamore-Artesian 230 kV line	other Sycamore-Pomerado 69 kV Line	P6	132.5	122.4	10.1
CENACE	ECO-Miguel 500 kV line + Ocotillo-Suncrest 230 kV line	ROA-RUM 230 kV line	P6	96.3	87.9	8.4

D. Local Capacity Requirement Benefits

Q15. What is the reduction in local capacity requirements in the San Diego area attributable to the Proposed Project?

A15. As discussed earlier, bypassing the series capacitors in SWPL and SPL can alleviate power flow stress in the San Diego area. This also results in reduction of local capacity requirements in the following sub-areas:

- San Diego sub-area – The Proposed Project reduces local capacity requirements by as much as 326 MW (from 3104 MW to 2778 MW);
- Miramar sub-area – The Proposed Project reduces local capacity requirements in the Miramar sub-area by as much as 30 MW (from 118 MW to 88 MW).

Table 7 shows the local capacity requirement test results and associated constraints in the San Diego and Miramar sub-areas with and without bypassing the SWPL and SPL series capacitors banks.

Table 7.
Local Capacity Requirement (LCR) Test Results

Sub-Area	Constraint			Long-term Local Capacity Requirement (MW)		LCR Reduction
	Worst Contingency	Overloaded Facility	NERC Category	Series Capacitors in SWPL and SPL NOT Bypassed	Series Capacitors in SWPL and SPL Bypassed	MW
San Diego	Otay Mesa Plant out of service followed by the Ocotillo-Suncrest 500 kV line outage with SPS Gen tripping at IV	ECO-Miguel 500 kV line	P3	3104	2778	326
Miramar	The Sycamore-Penasquitos 230 kV line outage followed by the Bay Blvd-Silvergate 230 kV line outage	Sycamore-Scripps 69 kV line	P6	118	88	30

E. Project Timing

Q16. When is the Suncrest SVC project needed?

A16. As discussed above, the major system change that drives the need for the Proposed Project is the renewable generation development in the Imperial, Arizona, and Baja zones. The Proposed Project, together with bypassing the series capacitors, is designed to improve transfer capability for renewable generation with the existence of the Imperial Valley phase shifting transformers project, which was placed in service in May 2017. There is a total of approximately 2724 MW of renewable resources operational under the CAISO control in the greater Imperial Valley, Baja, and Arizona areas by the end of 2017. This is approaching the 2820 MW identified in the latest Commission-developed RPS portfolio. The CAISO confirmed the low voltage concern discussed above in a recent transmission planning stakeholder process, based on anticipated delay of the Proposed Project beyond the initial in-service date. Therefore deliverability of existing renewable generation is limited today, which is discussed in Q&A 17. The Proposed Project is needed as soon as possible, preferably before the summer of 2018 because even more renewable generation is expected to be coming on-line in the Imperial, Arizona, and Baja areas.

Q17. Did the CAISO conduct any updated analysis on the need for the Proposed Project based on the 2016-2017 transmission plan?

A17. Yes, the 2016-2017 transmission plan again confirms the need for the Proposed Project. The voltage concern limiting renewable generation deliverability was confirmed based on the latest California Energy Commission (CEC) load forecast under the 2018 summer peak base case. Table 8 presents the voltage results with and without the project assuming the 500 kV series capacitor banks in SWPL and SPL are bypassed. The voltage results are similar to the previous results. The results indicate that the Proposed Project need and its incremental benefits are primarily driven by the renewable generation and are not significantly affected by other circumstances, such as load growth. In addition, this updated analysis indicates that most of the CAISO connected, Imperial area

renewable generation in the Commission-developed RPS portfolio has materialized and will be on-line by 2018.

Table 8.
Post-Transient Voltage Performance based on the latest information

	Worst Contingency	Concern	Unit	Suncrest 500 kV Bus	Suncrest 230 kV bus
No Upgrade	ECO-Miguel 500 kV line outage followed by SPS gen tripping at IV	Low Voltage	pu	0.88	0.90
		Voltage Deviation	%	-9.10	-9.00
Suncrest SVC Project		Low Voltage	pu	0.93	0.95
		Voltage Deviation	%	-3.80	-2.60

IV. CONCLUSION

Q18. Please summarize your testimony.

A18. The Proposed Project is necessary to meet the State's RPS goals. The CAISO's updated analysis confirms that without the Proposed Project, the transmission system will not be capable of meeting applicable reliability standards while simultaneously enabling deliverability for existing and planned renewable resources in the Imperial, Arizona and Baja areas.

In addition to the deliverability benefits necessary to meet the RPS goals, the Proposed Project provides considerable secondary benefits in the form of increased import capability into the San Diego area, positive effects on existing or emerging southern California reliability concerns and reductions in long-term local capacity requirements.

Based on these significant benefits, the Commission should approve the Proposed Project.

APPENDIX A

The assumptions utilized in the CAISO's updated analysis on the Suncrest SVC project are consistent with the CAISO 2015~2016 TPP, which includes:

- Load forecast by California Energy Commission (CEC);
- San Onofre Nuclear Generating Station (SONGS) retirement;
- Once-Through Cooled (OTC) generation retirement schedule;
- The Commission's 33% Renewable Portfolio Standards;
- CEC/Commission Long-Term Procurement Process Track-1 and Track-4 decisions, including energy efficiency (AAEE), behind the meter solar, Energy Storage, Demand Response, and conventional resources;
- Network upgrade projects implemented and approved by CAISO, including the Imperial Valley phase shifting transformers and the Delaney-Colorado River 500 kV line projects.

Load forecast

Table A-1 summarizes the load assumption used in the 2025 Summer Peak cases. The forecasted SDG&E 1-in-10 coincident peak load in the 2025 Summer Peak case is 5850 MW. In addition, there is 401 MW of load reduction built into the 2025 Summer Peak case as a result of projected energy efficiency. Therefore, the net peak load in the 2025 Summer Peak case is about 5449 MW. The CEC's latest load demand forecast in 2018 is also presented in the table, which was used for the analysis in Q&A 17.

Table A-1.
1-in-10 Load Forecast in the SDG&E Area

1-in-10 Load Level	Unit	2025 Demand in CAISO 2015-16 TPP	2018 Demand (2016 CEC Forecast)
Load Forecast	MW	5850	4906
Energy Efficiency (AAEE)	MW	-401	-120
Net Load	MW	5449	4786

Generation Resources

Table A-2 lists a summary of the generation resources under CAISO operational control in the San Diego study area by location and technology, respectively, which includes all available resources modeled in the study years. The heavy renewable generation output assumptions are shown in Table A-3.

Table A-2.
Resources in the SDG&E-Imperial Valley Area under CAISO Control

Generation Resources		MW (in year 2025)
by location	San Diego Metro	2607
	ECO	255
	Ocotillo	265
	Imperial Valley	2065
	Arizona	582
by technology	Gas	3544
	PV	1593
	Wind	570
	Biomass	27
	Storage	40
Total		5774

Table A-3
Heavy Renewable Generation Output

Type	Area	Pgen
		% of net capacity (Pmax)
Wind	SDGE**	37%
	SCE Eastern**	47%
Solar	SDGE*	96%
	SCE Eastern**	93%
Biomass		100%

Note: * 20% exceedance level
** 50% exceedance level

Transmission Upgrades

The transmission system modeled in the analysis include the existing system and all future transmission projects that received ISO approval in the 2014-2015 or earlier ISO transmission plans. This includes the South Orange County Reliability Enhancement Project, the Sycamore Canyon-Penasquitos 230 kV line, the phase shifting transformers at the Imperial Valley 230 kV substation, and new reactive power support facilities at San Luis Rey and SONGS. NEET's Suncrest SVC project and status is turned on or off based on the purpose of test studies. Figure A-1 is a one-line diagram of the SDG&E bulk transmission system representing the year 2025, assuming the Project is in service. .

Definition of San Diego Gas & Electric Import Transmission interface

Figure A-1 also illustrates the San Diego Gas & Electric Import Transmission interface that consists of Southwest Powerlink, Sunrise Powerlink, south of SONGS path, and Otay Mesa-Tijuana 230 kV tie with CFE (TL23040), including following transmission elements:

- ECO-MIGUEL 500 kV Ckt#1 Line
- OCOTILLO-SUNCRESTE 500 kV Ckt#1 Line
- OTAY MESA-TIJUANA 230 kV Ckt#1 Line
- SONGS-SAN LUIS REY 230 kV Ckt#1 Line
- SONGS-SAN LUIS REY 230 kV Ckt#2 Line
- SONGS-SAN LUIS REY 230 kV Ckt#3 Line
- SONGS-TALEGA 230 kV Ckt#1 Line
- SONGS-CAPISTRANO 230 kV Ckt#1 Line

Figure A-1. San Diego-Imperial Valley Bulk Transmission System Configuration by the Year of 2025