APPENDIX E

California ISO Study Report: Assembly Bill 1318 Grid Reliability Results for San Onofre Nuclear Generation Backup Plan Studies

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California ISO
Shaping a Renewed Future

Study Report

Assembly Bill 1318 Grid Reliability Results for San Onofre Nuclear Generation Backup Plan Studies

May 7, 2013

1. Background

As set out in section 4.6 of the Unified Planning Assumptions and Study Plan for the 2012-2013 Transmission Planning Process,[1] the ISO examined the long-term grid reliability impact in the absence of the two nuclear generating stations, Diablo Canyon Power Plant (DCPP) and San Onofre Nuclear Generating Station (SONGS), which are located in the ISO balancing authority. This section provides the study results related to SONGS absence study scenarios that were performed as part of the 2012-2013 transmission planning process.

The studies addressed the recommendations from the CEC, which were made in consultation with the CPUC, in the *2011 Integrated Energy Policy Report* that "to support long-term energy and contingency planning, the California ISO (with support from PG&E, SCE, and planning staff of the CPUC and the CEC) should report to the Energy Commission as part of its 2013 IEPR and the CPUC as part of its 2013 Long-Term Procurement Plan on what new generation and/or transmission facilities would be needed to maintain system and/or local reliability in the event of a long-term outage at Diablo Canyon, SONGS, or Palo Verde". The 2011 Integrated Energy Policy Report (IEPR) also recommended that the utilities "should report to the CPUC on the estimated cost of these facilities" (i.e., electrically equivalent replacement generation and/or transmission facilities).

As part of the 2012-2013 transmission planning cycle, two studies related to the nuclear generation backup plan were performed. One addressed the extended outage scenario at SONGS for an intermediate time frame (2017-2018). The other considered the reliability concerns and potential mitigation options in the long term (i.e., 2022 time frame). The mid-term study is considered contingency planning for future unplanned long-term outages. The study addressed a request from the CEC 2011 IEPR. The study also incorporates once-through cooling policy implications for generating units that have compliance schedules up to the intermediate 2018 and longer 2022 time frame. The mitigation measures focus on actions that are reasonably implementable by summer 2018. The long-term study (2022) was undertaken by the ISO for information purposes. The study related to SONGS absence focuses on grid reliability implications for southern California and ISO overall.

2. Qualifications for the Grid Assessment Studies

The studies included evaluations for potential transmission reliability concerns and potential mitigation options. These studies are not intended as a basis for a decision to

[1] 2012/2013 Transmission Planning Process Unified Planning Assumptions and Study Plan (http://www.caiso.com/Documents/2012-2013ISOTransmissionPlanningProcessStudyPlan.pdf)

keep or retire the two nuclear generating power plants. Other studies beyond grid reliability assessments would be needed to provide a more complete assessment and would include asset valuations, environmental impacts of green-house gas emissions, compliance with AB 32, impacts on flexible generation requirements, least-cost best-fit replacement options, generation planning reserve margin, market price impacts, customer electricity rate impacts and impacts to natural gas systems for replacement generation. These issues are outside the scope of the ISO's transmission reliability study.

3. Relationship with Prior Studies without SONGS

As mentioned above, an intermediate study year for grid reliability assessment (2018) was evaluated for the extended outage scenario. This study was synched with a previously completed study for a 2013 SONGS absence. The completed report, which is an addendum to the 2013 LCR studies for the scenario without SONGS, was posted on the ISO website (link provided here). The 2013 SONGS absence studies included the following recommendations:

- Convert Huntington Beach Units 3 and 4 to 2x140 MVAR synchronous condensers;
- Install one 79.2 MVAR capacitor bank each at Johanna and Santiago Substations, and two 79.2 MVAR capacitor banks at Viejo Substation; and
- Re-configure Barre-Ellis 230kV lines from two to four circuits.

The above mitigation measures were modeled in-service for the 2018 mid-term studies and only the latter two measures were modeled in the 2022 long-term studies. Huntington Beach synchronous condensers were removed from the long-term studies (except in one sensitivity case as noted) because of proposed repowering plan of the Huntington Beach generation by AES Corporation that would require demolition of the existing site for units 3 and 4 to build a second block of combined cycle gas turbine plant.

4. Key Load Forecast and Resource Assumptions

The following is a summary of key load forecast and resource assumptions used for the studies.

Load Forecast Assumptions

The most recent CEC-adopted 2012-2022 mid-case demand forecast, posted on the agency's website in August 2012, was used for the studies. Consistent with the ISO reliability study methodology, a 1-in-10 year weather-related peak load was utilized for local capacity area reliability assessments. Future energy efficiency benefits of 8,000 MW statewide, including continued funding of utility programs, was embedded in the CEC demand forecast. The CEC demand forecast also included the impacts of an additional approximately 800 MW of behind-the-meter distributed generation, for a total of over 3,500 MW. (System-connected distributed generation is discussed in the resource section below.) The following table provides a summary of the load forecast used in the studies.

Table 1: Summary of CEC demand forecasts used in the Local Capacity Requirement Studies (LA Basin and San Diego Areas)

Area	**Local Capacity Requirement Studies (1-in-10 Weather-Related Load Forecast)** **(MW)**	
	2018	**2022**
SCE LA Basin Area	21,870	22,917
SDG&E	5,652	6,056

CPUC and CEC Renewable Portfolios

The CPUC's Commercial Interest portfolio was used as the base case for the assessment. The High Distributed Generation (High DG) portfolio was used as sensitivity study case for 2022 assessment to determine how much thermal generation requirements in the LA Basin and San Diego local reliability areas would be lowered if

higher penetration of DG could materialize. For more discussions on the renewable portfolios, please refer to the ISO 2012/2013 Transmission Plan[2], Section 4.1.

Demand Response

Demand response is considered a supply resource and not a load modifier. This assessment is based on the CEC-adopted mid-case demand forecast with associated committed preferred demand resource programs (such as funded energy efficiency, etc.). The ISO also performed sensitivity studies with incremental uncommitted energy efficiency, combined heat and power and demand response. The study results that include these assumptions are provided in Section 8 later in this report.

5. Grid Reliability Assessments for the Absence of San Onofre Nuclear Generating Station (SONGS)

a. 2013 SONGS Absence Study

As mentioned previously, the mid-term (2018) and long-term (2022) evaluation included mitigation plans identified and recommended for the short-term (2013) without SONGS scenario. The completed report, which is an addendum to the ISO's 2013 LCR studies for the scenario without SONGS, was posted on the ISO website (link provided here). Transmission reliability study results were included in the "2012-2013 Reliability Assessment: Final Study Results" also posted on the ISO website (link provided here). The 2013 SONGS absence studies included the following recommendations:

- Install one 79.2 MVAR capacitor bank each at Johanna and Santiago Substations, and two 79.2 MVAR capacitor banks at Viejo Substation;
- Re-configure Barre-Ellis 230kV lines from two to four circuits
- Convert Huntington Beach Units 3 and 4 to 2x140 MVAR synchronous condensers;

The capacitor bank projects and the Barre-Ellis re-configurations were approved by the ISO Management for summer 2013 preparedness after a Board of Governors briefing on September 13, 2012 on "2013 Summer Outlook". The capacitor bank projects are expected to be in-service by June 1, 2013. The reconfiguration of the Barre-Ellis lines is expected to be completed by June 15, 2013. Authorization to proceed with reliability must run contracts with the Huntington Beach 3 and 4 as synchronous condensers was approved by the ISO Board of Governors for summer 2013 on September 13, 2012, and the completion of the conversion work on units 3 and 4 is anticipated to be completed by June 26, 2013. Based on this information, the above mitigation measures were

[2] The Board-approved ISO 2012/2013 Transmission Plan is saved at http://www.caiso.com/Documents/BoardApproved2012-2013TransmissionPlan.pdf

modeled in-service for the 2018 mid-term studies. However, for the 2022 long-term studies, only the Barre-Ellis reconfiguration project was modeled and not the Huntington Beach synchronous condensers. Based on AES Corporation's Application for Certification of repowering plan for Huntington Beach power plant, Huntington Beach units 3 and 4 would need to be removed to build a second block of proposed combined cycle gas turbine plant. The exact timing of the start of construction of Block 2 would be dependent on such factors as timing of the CEC decision on the AFC permit, whether the repowering project would have Power Purchase Agreements with Load Serving Entities approved by the CPUC. Therefore to be prudent, the ISO at this time assessed the 2022 long-term grid reliability with the assumptions that these two units (3 and 4) would be removed and unavailable because of the planned construction of the new Block 2 CCGT on the same site.

b. Mid-Term (2018) Reliability Assessment

Local reliability assessments were performed for the LA Basin and its sub-areas (i.e., West LA and Ellis), as well as San Diego-Imperial Valley and San Diego sub-LCR areas. Table3 and Table4 list the study results for these LCR and sub-LCR areas. Studies were performed initially without the following once-through cooled generating units based on compliance schedule with state OTC policy: El Segundo units 3 and 4, and Encina units 1 - 5. The capacity of these units, as well as SWRCB compliance date and scheduled retirement date, are summarized in the following table.

Table 2: Capacity of El Segundo and Encina generating units

Generating Plant	**Total Plant Capacity (MW)**	**Individual Unit Capacity (MW)**	**LCR Area**	**SWRCB Compliance Date**	**Scheduled Retirement Date***
El Segundo	670	Unit 3 (335) Unit 4 (335)	LA Basin	12/31/2015 (for both units)	Unit 3 (Q1 2013)**
Encina	946	Unit 1 (106) Unit 2 (103) Unit 3 (109) Unit 4 (299) Unit 5 (329)	San Diego	12/31/2017 (for all of these units)	

Notes:

* Only publicly announced retirement is indicated in the table

**El Segundo Unit 3 is required to shut down to offset air emission credits needed for the El Segundo Energy Center (564 MW) with a target on-line date of June 1, 2013. However, Power Purchase Tolling Agreement (PPTA) with SCE does not start until August 1, 2013.

The following is the summary of these study results:

- For the LA Basin LCR area, the most critical contingency is the overlapping Category C (N-1-1) contingency of Sunrise Powerlink, system readjusted, followed by the outage of the Southwest Powerlink (SWPL) 500 kV line. This contingency would cause post-transient voltage instability in the southern region.

- For the Western LA sub-LCR area, the most critical contingency is the Category C contingency of overlapping outage of Serrano – Lewis #1 and Serrano – Villa Park #2 230 kV lines, causing Serrano – Villa Park #1 230 kV line to be overloaded. However, the area has sufficient generation to mitigate this loading concern.

- For the Ellis sub-LCR area, the most critical contingency is the Category C contingency of N-2 of either Barre-Ellis #1 & #2 230 kV lines, or Barre-Ellis #3 & #4 lines, overloading the adjacent Barre-Ellis double circuit tower lines. The area, however, has sufficient generation to mitigate this loading concern.

- For the San Diego sub-LCR area, the following critical reliability concerns were identified:

    - Normal overloads on the Miguel – Bay Blvd. 230kV line, causing a generation deficiency of about 2,132 MW (this overload was also identified in generation interconnection studies and in the policy-driven transmission need assessment);

    - Post transient voltage instability because of overlapping outage of Sunrise Powerlink, followed by SWPL line. With this constraint, this sub-LCR area has a generation deficiency of about 1,835 MW;

    - Thermal overloading concerns for 19 various facilities with voltages from 69 kV to 230 kV. This is due to the absence of SONGS and San Diego northwest generation (for a combined total of 3,211 MW of generation).

- For the San Diego-Imperial Valley LCR area, the most critical contingency is the Category B outage with overlapping G-1 of Otay Mesa and Imperial Valley – North Gila 500 kV line, causing post-transient voltage deviation at SCE-owned Viejo substation. This area, however, has sufficient generation to mitigate the identified reliability concern.

The following are the mid-term mitigation alternatives.

Mitigations (for both Alternative 1 and Alternative 2 below)

Table 4 lists the transmission facility loading concerns identified in the study with and without various mitigation measures. Two alternative mitigation plans were designed during the course of the study that would mitigate the voltage and facility loading concerns identified. The two alternative mitigation plans were designed with the intent

of representing a reasonable range of possible alternatives. Also, during the course of the study the ISO discovered that two particular mitigation measures were highly effective at mitigating a large number of the loading and voltage concerns. It was found that continued reactive support was needed at Huntington Beach in both identified mitigation scenarios. It was also found that over half of the identified loading concerns could be mitigated with a new transmission line connected between the Sycamore and Penasquitos substations. Therefore the following projects listed below were identified as common mitigations to both of the alternative mitigation plans:

- The ISO assumed that the Huntington Beach synchronous condensers will be available for the intermediate (i.e., 2018) time frame and will assume their continued use or equivalent support. This was identified as part of the need for the SONGS absence scenario for summer 2013.

- Installation of 80 MVAR of shunt capacitor each for Johanna and Santiago Substations, and 160 MVAR of shunt caps for Viejo Substation. This was identified as part of the mitigation for the SONGS absence scenario for summer 2013

- Reconfiguration of the Barre – Ellis 230kV lines from two to four circuits. This was also identified in the SONGS absence scenario for summer 2013.

- Constructing an 11-mile 230 kV line from Sycamore to Penasquitos will mitigate over half of the identified thermal loading concerns. This was identified as common mitigation for the Mid-Term alternatives.

Given the long lead time for the Sycamore to Penasquitos line and the need for this line in a reasonable range of possible alternative mitigation plans, next steps for proceeding with the development of this line would need to commence immediately to address the identified mid-term and long-term needs.

Mid-Term Alternative #1

- Add new or replace 820 MW of northwest San Diego generation.

- Add new 300 MW of generation in the southeast San Diego area.

- Install a total of 650 MVAR of dynamic reactive support (i.e., static VAR compensator or synchronous condensers) at SONGS (or its proximity) and Talega Substations.

- Common mitigations (Huntington Beach synchronous condensers and Sycamore-Penasquitos 230 kV transmission line)

Mid-Term Alternative #2

- Add new or replace 965 MW of northwest generation in San Diego.

- Install a total of 1,460 MVAR of SVC or SC for dynamic reactive support at SONGS, Talega, Penasquitos, San Luis Rey and Mission Substations.

- Common mitigations (Huntington Beach synchronous condensers and Sycamore-Penasquitos 230 kV transmission line)

The figure below provides an illustration of the above mitigation alternatives.

Figure 1: Mid-term mitigation alternatives for loss of SONGS

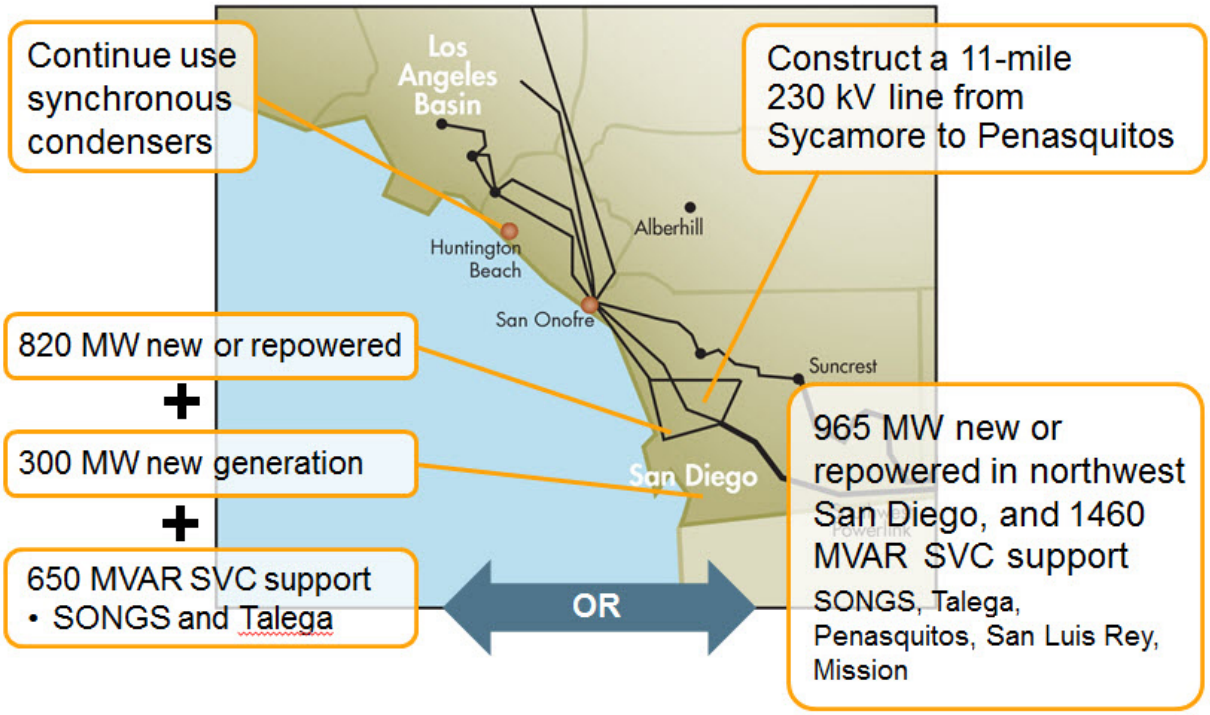


Table 3: 2018 Local reliability assessment of LA Basin and San Diego areas

	LA Basin	**W. LA**	**Ellis**	**San Diego**	**SD/IV**
Total Generation (MW)	10,918	6,540		2,135	4,361
Category A	N/A	N/A	N/A	Normal conditions	N/A None other than the ones identified in the San Diego sub-area
Identified Reliability Concerns				Normal overloads on Miguel - Bay Blvd. 230kV line (20%)	
Required Generation (MW)				4,267	
Deficiency (MW)				(2,132)	
Category B	N/A Category C contingency is the overriding contingency for LCR need for this area	N/A Category C contingency is the overriding contingency for LCR need for this sub-area	N/A	G-1/N-1: Palomar CCGT/Miguel-Mission 230kV #1 line	G-1/N-1: Otay Mesa/IV-N.Gila 500kV
Identified Reliability Concerns	Category C reliability concerns established LCR needs	Category C reliability concerns established LCR needs	Category C reliability concerns established LCR needs	Emergency overloads on Miguel - Bay Blvd. 230kV line (10%)	Post-transient voltage deviation beyond 7% at SCE's Viejo 230kV
Required Generation	See notes above	See notes above	See notes above	3,382	4,191

	LA Basin	W. LA	Ellis	San Diego	SD/IV
Category C	N-1-1: Sunrise, system adj., followed by SWPL	N-1-1: Serrano-Lewis #1, followed by Serrano-Villa Park #2 230kV	N-2: Barre-Ellis #1&2 or Barre-Ellis #3&4 230kV lines	N-1-1: Sunrise, system adj., followed by SWPL	Category B contingency is the overriding contingency for LCR need for this area
Identified Reliability Concerns	Post-transient voltage instability	Overloading concern on the Serrano-Villa Park #1 230kV line	Overloading of the remaining DCTL Barre-Ellis 230kV lines	Post-transient voltage instability	See notes above
Description of Mitigations	(1) Continue using HB synchronous condensers AND replace or add new generation in San Diego (820 MW in the northwest and 300 MW in the southeast) AND install 650 MVAR of SVC/SC support at SONGS and Talega; (2) Continue using HB synchronous condensers AND replace or add new 965 MW generation in the northwest San Diego AND install total of 1460 MVAR of SVC/SC support at SONGS, Talega, Penasquitos, San Luis Rey and Mission	Existing generation is adequate to mitigate identified reliability concerns		(1) Replace or add new generation in San Diego (820 MW in the northwest and 300 MW in the southeast) AND install 650 MVAR of SVC/SC support at SONGS and Talega; (2) Replace or add new 965 MW generation in the northwest San Diego AND install total of 1460 MVAR of SVC/SC support at SONGS, Talega, Penasquitos, San Luis Rey and Mission	

	LA Basin	W. LA	Ellis	San Diego	SD/IV
LCR Area's Total Required Generation	(1) Total 10,846 MW (included 251 MW DG) - Option 1 (2) Total 10,846 MW - Option 2	Total 4,931 MW (included 251 MW D.G.)	48 MW	(1) 3,255 MW (=2,135 + 820 + 300) (2) 3,100 MW (=2,135 + 965)	See notes above
Deficiency (MW)	(1) None - Option 1 (2) None - Option 2	None	None	If there is no mitigation measure, the local area would be subject to a deficiency of (1,835) MW (1) None if mitigating 1,120 MW generation deficiency (820 MW northwest and 300 MW southeast) (2) None if mitigating 965 MW generation deficiency (northwest S/D generation)	See notes above

Table 4: Identified thermal loading concerns for 2018 base case study and evaluation of mitigation measures

	From	kV	To	kV	ck	2018 Loading Concerns (absence of S/D northwest generation and SONGS)	2018 with San Diego northwest generation on-line	2018 with San Diego northwest generation and SONGS generation on-line	2018 with absence of S/D northwest generation and SONGS - Construct Sycamore-Penasquitos 230kV line	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 520 MW S/D northwest generation	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 820 MW S/D northwest generation	Column at immediate left with IID renewable related upgrades	Outage description
1	B	69	SILVERGT	69	2	1.010	0.973	0.935	0.954				Line B 69.0 to SILVERGT _Line SILVERGT 69.0 to URBAN
2	BAY BLVD	230	MIGUEL	230	1	1.198	1.089	0.945	0.994	0.947			Base system (n-0)
3	BAY BLVD	230	MIGUEL	230	1	1.003	0.907	0.774	0.783				Line PEN 230.0 to SYCAMORE 230.0 Circuit 1
4	CHCARITA	138	SHADOWR	138	1	1.167	0.690	0.774	1.077	0.398			Line BATIQTP 138.0 to PENSQTOS _Tran ENCINA 230.00 to ENCINA
5	ESCNDIDO	69	SANMRCOS	69	1	1.166	1.057	0.918	0.896				Line BERNDOTP 69.0 to R.SNTAFE _Line PEN

	From	kV	To	kV	ck	2018 Loading Concerns (absence of S/D northwest generation and SONGS)	2018 with San Diego northwest generation on-line	2018 with San Diego northwest generation and SONGS generation on-line	2018 with absence of S/D northwest generation and SONGS - Construct Sycamore-Penasquitos 230kV line	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 520 MW S/D northwest generation	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 820 MW S/D northwest generation	Column at immediate left with IID renewable related upgrades	Outage description
6	IMPRLVLY	230	ELCENTRO	230	1	1.295	1.052	0.727	1.311	1.176	1.101	0.556	230.0 to ENCINATP Line LRP-U1-A 230.0 to INTB _Line N.GILA 500.0 to IMPRLVLY
7	MIGUEL	230	MIGUEL	500	2	1.067	0.957	0.797	1.042	0.965			Line BORDER 69.0 to LRKSP_BD _Tran MIGUEL 230.00 to MIGUELMP
8	MIGUEL	230	MIGUEL60	138	1	1.060	0.989	0.927	1.009	0.976			Line BERNDOTP 69.0 to R.SNTAFE _Line PRCTRVLY 138.0 to MIGUEL
9	MIGUEL	500	MIGUELMP	500	1	1.078	0.964	0.800	1.053	0.974			Tran MIGUEL 230.00 to MIGUEL 500.00 Circuit 2

	From	kV	To	kV	ck	2018 Loading Concerns (absence of S/D northwest generation and SONGS)	2018 with San Diego northwest generation on-line	2018 with San Diego northwest generation and SONGS generation on-line	2018 with absence of S/D northwest generation and SONGS - Construct Sycamore-Penasquitos 230kV line	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 520 MW S/D northwest generation	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 820 MW S/D northwest generation	Column at immediate left with IID renewable related upgrades	Outage description
10	MIGUEL	230	MISSION	230	1	1.030	0.928	0.790	0.805				Line BORDER 69.0 to BORDERTP _Line BAY BLVD 230.0 to MIGUEL
11	MIGUEL	230	MISSION	230	2	1.024	0.922	0.786	0.800				Line BORDER 69.0 to BORDERTP _Line BAY BLVD 230.0 to MIGUEL
12	OLD TOWN	230	MISSION	230	1	1.086	0.948	0.844	0.608				Line BORDER 69.0 to BORDERTP _Line BAY BLVD 230.0 to MIGUEL
13	PENSQTOS	230	OLD TOWN	230	1	1.021	0.757	0.501	0.260				Base system (n-0)
14	POWAY	69	POMERADO	69	1	1.114	1.086	0.998	0.996	0.985			Line ARTESN 69.0 to SYCAMORE _Line SYCAMORE 69.0 to BERNARDO
15	POWAY	69	R. CARMEL	69	1	1.291	1.262	1.181	1.194	1.179			Line ARTESN 69.0 to SYCAMORE _Line

	From	kV	To	kV	ck	2018 Loading Concerns (absence of S/D northwest generation and SONGS)	2018 with San Diego northwest generation on-line	2018 with San Diego northwest generation and SONGS generation on-line	2018 with absence of S/D northwest generation and SONGS - Construct Sycamore-Penasquitos 230kV line	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 520 MW S/D northwest generation	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 820 MW S/D northwest generation	Column at immediate left with IID renewable related upgrades	Outage description
16	SWEETWTR	69	MONTGYTP	69	1	1.024	0.950	0.865	0.893				SYCAMORE 69.0 to BERNARDO Line BORDER 69.0 to SALT CREEK _Line SILVERGT 230.0 to BAY BLVD
17	SWEETWTR	69	SWTWTRTP	69	1	1.241	1.125	0.977	1.031	0.935			Line SILVERGT 230.0 to BAY BLVD 230.0 Circuit 1
18	SYCAMORE	230	PENASQUITOS	230	1	N/A	N/A	N/A	0.967				Base system (n-0)
19	SYCAMORE	69	BERNARDO	69	1	1.045	1.021	0.944	0.941				Line ARTESN 69.0 to SYCAMORE _Line POWAY 69.0 to POMERADO
20	SYCAMORE	138	CHCARITA	138	1	1.536	0.324	0.418	1.440	0.683			Line BATIQTP 138.0 to PENSQTOS _Tran

	From	kV	To	kV	ck	2018 Loading Concerns (absence of S/D northwest generation and SONGS)	2018 with San Diego northwest generation on-line	2018 with San Diego northwest generation and SONGS generation on-line	2018 with absence of S/D northwest generation and SONGS - Construct Sycamore-Penasquitos 230kV line	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 520 MW S/D northwest generation	2018 with absence of SONGS - Construct new Syc.-Penasq. 230kV line, Replaced or New 820 MW S/D northwest generation	Column at immediate left with IID renewable related upgrades	Outage description
													ENCINA 230.00 to ENCINA
21	SYCAMORE	69	SCRIPPS	69	1	1.195	1.067	0.965	0.739				Line BERNDOTP 69.0 to R.SNTAFE _Line BAY BLVD 230.0 to MIGUEL
22	SYCAMORE	230	SYCAMORE	69	3	1.002	0.970	0.932	0.800				Line BERNARDO 69.0 to FELCTATP _Tran SYCAMORE 230.00 to SYCAMORE

c. Long-Term (2022) Reliability Assessment

For the long-term reliability assessment of the LA Basin, San Diego/Imperial Valley and their LCR sub-areas, the mid-term (2018) mitigation plans were included in the long-term (2022) study cases prior to performing contingency studies. The following OTC plants in the LA Basin, in addition to the list in the mid-term assessment, were assumed to be off line in the starting 2022 study cases because of the compliance schedule as reflected in the state's OTC policy (the need for these plants would be characterized in the mitigation plans as the need for replacement generation without reference to specific names of the generating units):

Table 5: Capacity of OTC generating units in the LA Basin

Generating Plant	Total Plant Capacity (MW)	Individual Unit Capacity (MW)	LCR Area	SWRCB Compliance Date	Scheduled Retirement Date*
Alamitos	2011	Unit 1 (175) Unit 2 (175) Unit 3 (332) Unit 4 (336) Unit 5 (498) Unit 6 (495)	LA Basin	12/31/2020	
Huntington Beach	904	Unit 1 (226) Unit 2 (226) Unit 3 (225) Unit 4 (227)	LA Basin	12/31/2020	Unit 3 (11/2012)** Unit 4 (11/2012)**
Redondo Beach	1343	Unit 5 (179) Unit 6 (175)	LA Basin	12/31/2020	

Generating Plant	Total Plant Capacity (MW)	Individual Unit Capacity (MW)	LCR Area	SWRCB Compliance Date	Scheduled Retirement Date*
		Unit 7 (493) Unit 8 (496)			

Notes:

* Only publicly announced retirement is indicated in the table

**Huntington Beach Units 3 and 4 were retired in January 2012 to provide offsets for emission credits required by the new Walnut Creek Energy Center (500 MW), scheduled to be on-line in June 2013. However, these two units were brought back to service for the summer 2012 due to extended outage of SONGS.

Table 8 provides the results of the local reliability assessments. In summary, the following are identified reliability concerns:

- For the LA Basin LCR area, the most critical contingency is the same as in 2018 studies (i.e., Category C of overlapping outage of the Sunrise Powerlink, system readjusted, followed by the outage of the SWPL line). The constraint is post-transient voltage instability.

- For the Western LA sub-area, the most critical contingency continues to be Category C of overlapping outage of the Serrano-Lewis #1, followed by the Serrano-Villa Park #2 230 kV line. The constraint is thermal overloads on the Serrano-Villa Park #1 230 kV line.

- For the Ellis sub-area, the constraint is due to normal overloads on the Barre-Lewis 230 kV line (7 percent).

- For the San Diego sub-area, the most critical contingency is the same as of the LA Basin (i.e., N-1-1 of Sunrise, followed by SWPL line). The constraint is post-transient voltage instability.

- For the San Diego/Imperial Valley LCR area, the most critical contingency is the Category B outage of the overlapping G-1 of Otay Mesa, followed by an outage of the Imperial Valley-N.Gila 500kV line. The constraint is post-transient voltage deviation at various transmission buses in SCE area.

There are two major mitigation plans evaluated for the long-term, which include two generation alternatives and a combination of transmission and generation alternative. They are described in the following.

Long-Term Generation Alternatives

Two generation mitigation strategies were explored, as set out below.

Generation Alternative No. 1: Minimizing Generation in San Diego

This mitigation strategy explored minimizing generation in the San Diego area, and then determining generation requirements in the LA Basin.

For this option, Huntington Beach synchronous condensers are assumed not available because of AES Corp. repowering plan.

- Replace existing and add new generation, totaling 4,300 MW – 4,600 MW in the LA Basin to mitigate post-transient voltage instability following the Category C contingency in San Diego.

- To simultaneously mitigate thermal loading concerns in the Western LA sub-area, approximately 2,460 MW of the replaced and/or new generation would need to be sited in the southwestern part of the LA Basin to be most effective. It can be seen in Table 6 that this condition would be satisfied from this action.

- The maximum amount of generation requirements above can be reduced by about 300 MW if installing an additional 550 MVAR of SVC is feasible at the San Onofre 230 kV switchyard (or in an electrically equivalent location).

Generation Alternative No. 2: Minimizing Total Generation in LA Basin and San Diego

This mitigation strategy explored minimizing total generation requirements in the LA Basin due to potential air emission credit constraints.

For this option, Huntington Beach synchronous condensers are assumed to be available.

- Replace existing and add new generation with about 1,360 MW in the northwestern LA Basin and 2,460 MW in the southwestern LA Basin area. As in the above, to simultaneously mitigate thermal overloading concerns in the Western LA Basin sub-area, about 2,460 MW of this generation would need to be sited in the southwestern part of the LA Basin to be most effective, which appears to be satisfied based on the amount of generation need for the area.

- Continue to rely on the Huntington Beach synchronous condensers, which would reduce the total amount of generation repowering planned for Huntington Beach plant by half.

- Add about 920 MW of new or replaced generation in the San Diego area. The locations for these generation additions are indicated in table 3.5-8.

A summary table, Table 6, is provided below to show the generation need, as well as dynamic reactive support need by the sub-areas in LA Basin and San Diego LCR areas. This table provides a summary of generation and dynamic reactive support need for the Mid-Term (2018) and the incremental need for the Long-Term (2022) Generation alternatives. The left half of the table lists the amount of OTC generation replacement and new generation assumptions as well as dynamic reactive support need identified for the Mid-Term (2018) mitigation. The middle section of the table lists incremental generation need, as well as incremental dynamic support need, for the Long-Term (2022) mitigation. The total generation and dynamic reactive support need by 2022 is summarized in the far right of the table. The critical contingency that requires these mitigations is the Category C contingency (i.e., N-1-1 of Sunrise, followed by SWPL line out[3]), which causes post-transient voltage instability. The mitigations were tested by applying the mandated WECC post-transient study methodology, in which a positive margin must be

[3] Cross-tripping of the Otay Mesa – Tijuana 230kV line was also simulated as part of the existing SPS in response to the N-1-1 contingency to avoid overloading the CFE transmission system.

obtained successfully for the system modeled with 2.5 percent more loads under a Category C contingency.

It is noted that the new Sycamore – Penasquitos 230kV line is mitigation common to the Mid-Term and Long-Term mitigation identified in the following table.

Table 6 – Summary of Mid-Term and Long-Term (generation) options

Summary of Generation & Dynamic Reactive Support Need (No SONGS Analyses) - Mid-Term and Long-Term (Generation) Options

	2018 (Mid-Term)^			2022 (Long-Term) - Generation Options (Incremental Need)			Total Generation & Dynamic Support Need By 2022	
Area	**OTC Replacement Assumptions (MW)**	**New Generation* (MW)**	**Dynamic Reactive Support Need (MVAR)**	**OTC Replacement Assumptions (MW)**	**New Generation* (MW)**	**Dynamic Reactive Support Need (MVAR)**	**Total Dynamic Support Need (MVAR)**	**Total Generation Need (MW)**
Alternative #1								
Southwestern LA Basin	0	0	280 (HB)! + 400/500**	2900	1000 - 1200	550 #	500 - 1050 #	3915 - 4115
Northwestern LA Basin	0	0	0	0	300	0	0	300
Eastern LA Basin	0	0	0	0	100 - 200	0	0	100 - 200
Subtotal LA Basin			*280 (HB)! + 400/500 **	*4315 - 4615 ◊ #*		*550 #*	*500 - 1050*	*4315 - 4615 #*
Northwest San Diego	620/820 +	0	240 !!	++ ◊	0	240 !!	480	620/820 ++ ◊
Southwest San Diego	0	0	!!	0	0	2x240 !!	480	0
Southeast San Diego	0	300	0	0	0	0		300
Subtotal San Diego	*920/1120*		*240 !!*	*(Minimum 920 carried from 2018)*		*720 !!*	*960*	*920/1120 ◊*
Alternative #2								
Southwestern LA Basin	0	0	280 (HB)! + 500	2460	0	0	280 (HB)! + 500	2460
Northwestern LA Basin	0	0	0	1360	0	0	0	1360
Eastern LA Basin	0	0	0	0	0	0	0	0
Subtotal LA Basin	*0*		*280 (HB)! + 500*	*3820*			*280 (HB)! + 500*	*3820*
Northwest San Diego	965 $	0	2x240 (new)	520 $	0	0	480	1485
Southwest San Diego	0	0	2x240 (new)	0	0	0	480	0
Southeast San Diego	0	0	0	400 $	0	0	0	400
Subtotal San Diego	*965*		*960*	*920*			*960*	*1885*

Notes: ^ Common transmission line need: Sycamore-Penasquitos 230kV line

* New generation can replace OTC generation if in the same vicinity area

** Need: 400 MVAR with design provision for future expansion for additional 100 MVAR (may need to be upgraded to 500 MVAR between 2018 - 2022 time frame)

Generation need may be reduced by 300 MW by adding an additional 550 MVAR SVC at San Onofre switchyard

+ This can be accomplished by combining a minimum of 620 MW generation replacement/repowering; the remaining (200 MW) generation need is OTC-extended until further development in the long term

++ Need a minimum of 620 MW OTC permanent replacement or new geneneration in the N/W S/D vicinity area (this part is carried over from the larger 2018 mitigation)

! ISO assumes HB synchronous condensers to be available for 2018 (for 2022 if HB repowering occurs for one CCGT block only)

!! Reactive support need to be expanded with additional 720 MVAR in San Diego between 2018 - 2022 time frame for a total of 960 MVAR in San Diego in 2022

$ If total San Diego generation replacement and new generation is 1120 MW for mid-term (2018), then the additional need is 765 MW for 2022

◊ Approximately 200 MW of generation in the West LA Basin can be lowered if 200 MW if generation is developed in San Diego

Long-Term Combined Transmission and Generation Alternative

This mitigation strategy tested the effectiveness of adding a major 500 kV reinforcement in the area, and minimizing overall generation requirements.

Table 7 below provides a summary of generation and dynamic reactive support need for the Mid-Term (2018) and the incremental need for the Long-Term (2022) Combined Transmission and Generation alternatives. The left half of the table lists the amount of OTC generation replacement and new generation assumptions as well as dynamic reactive support need identified for the Mid-Term (2018) mitigation. The middle section of the table lists incremental generation need, as well as incremental dynamic support need, for the Long-Term (2022) mitigation. The total generation and dynamic reactive support need by 2022 is summarized in the far right of the table. The critical contingency that requires these mitigations is the Category C contingency (i.e., N-1-1 of Sunrise, followed by SWPL line out[4]), which causes post-transient voltage instability. The mitigations were tested by applying the WECC post-transient study methodology, in which a positive margin must be obtained for the system with 2.5 percent more loads under a Category C contingency.

The following transmission line was modeled as common mitigation for the combined transmission & generation alternatives:

- Construct a new 65-mile 500kV line between Alberhill and Suncrest Substation with 70 percent compensation to reduce reactive power losses contributing to voltage stability concerns during contingencies because of high flows from the SCE to the SDG&E electric system.

[4] Cross-tripping of the Otay Mesa – Tijuana 230kV line was also simulated as part of the SPS in response to the N-1-1 contingency to avoid overloading the CFE transmission system.

Table 7 – Summary of Mid-Term and Long-Term (combined transmission & generation) alternatives

Summary of Generation & Dynamic Reactive Support Need (No SONGS Analyses) - Combined Transmission & Generation Alternatives

	2018 (Mid-Term)^			2022 (Long-Term) - Combined Transmission Line and Generation Option (Incremental Need)			Total Generation & Dynamic Reactive Support Need by 2022	
Area	**OTC Replacement Assumptions (MW)**	**New Generation* (MW)**	**Dynamic Reactive Support Need (MVAR)**	**OTC Replacement Assumptions (MW)**	**New Generation* (MW)**	**Dynamic Reactive Support Need (MVAR)**	**Total Dynamic Support Need (MVAR)**	**Total Generation Need (MW)**
Alternative #1								
Southwestern LA Basin	0	0	280 (HB)! + 400/500 **	2915	0	0	500	2915
Northwestern LA Basin	0	0	0	0	0	0	0	0
Eastern LA Basin	0	0	0	0	0	0	0	0
Subtotal LA Basin	*0*		*280 (HB)! + 400/500 **	*2915*			*500*	*2915*
Northwest San Diego	820	0	240 !!	360	0	240 !!	480	1180
Southwest San Diego	0	0	!!	0	0	2x240 !!	480	0
Southeast San Diego	0	300	0	0	100	0	0	400
Subtotal San Diego	*1120*		*!!*	*460*		*720 !!*	*960*	*1580*
Alternative #2								
Southwestern LA Basin	0	0	280 (HB)! + 500 (new)	2915	0	0	500	2915
Northwestern LA Basin	0	0	0	0	0	0	0	0
Eastern LA Basin	0	0	0	0	0	0	0	0
Subtotal LA Basin			*280 (HB)! + 500 (new)*	*2915*			*500*	*2915*
Northwest San Diego	965	0	2x240	215	0	0	480	1180
Southwest San Diego	0	0	2x240	0	0	0	480	0
Southeast San Diego	0	0	0	0	400	0	0	400
Subtotal San Diego	*965*		*960*	*615*			*960*	*1580*

Notes: ^ Common transmission line need: Sycamore-Penasquitos 230kV line

* New generation can replace OTC generation if in the same vicinity area

** Need: 400 MVAR with design provision for future expansion for additional 100 MVAR (may need to be upgraded to 500 MVAR between 2018 - 2022 time frame)

+ Can be accomplished by combining a minimum of 620 MW replacement/repowering and the remaining generation need is OTC-extended until further generation development in the long term (2022)

++ Need a minimum of 620 MW OTC replacement or new geneneration in the N/W S/D vicinity area (this part is carried over from the larger 2018 mitigation),(see notes + above for residual need in 2018)

! ISO assumes HB synchronous condensers to be available for 2018 (for 2022, assumes that all HB units would be repowered)

!! Reactive support need to be expanded with additional 720 MVAR in San Diego between 2018 - 2022 time frame for a total of 960 MVAR in San Diego in 2022

◊ Approximately 100 MW of generation in the West LA Basin can be lowered if 100 MW if generation is developed in San Diego

The following two figures illustrate the generation and combined transmission and generation alternatives. Note that both assume the mid-term mitigations were put in place and remain in place.

Figure 2: Long-term generation alternatives

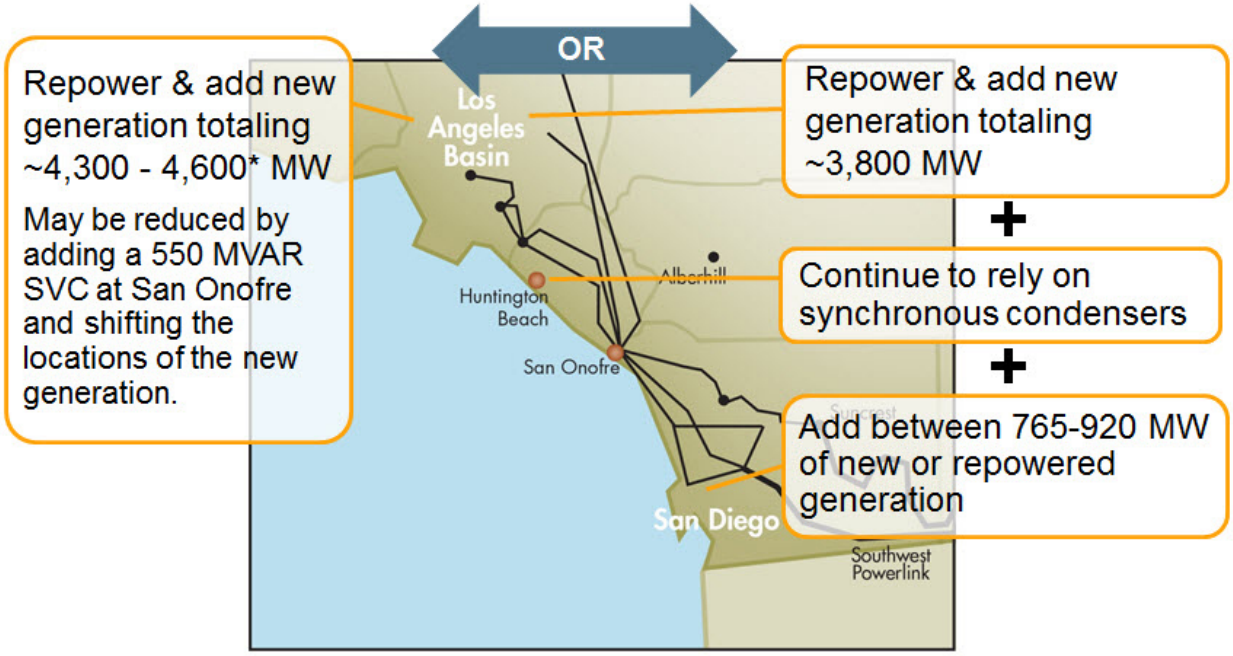
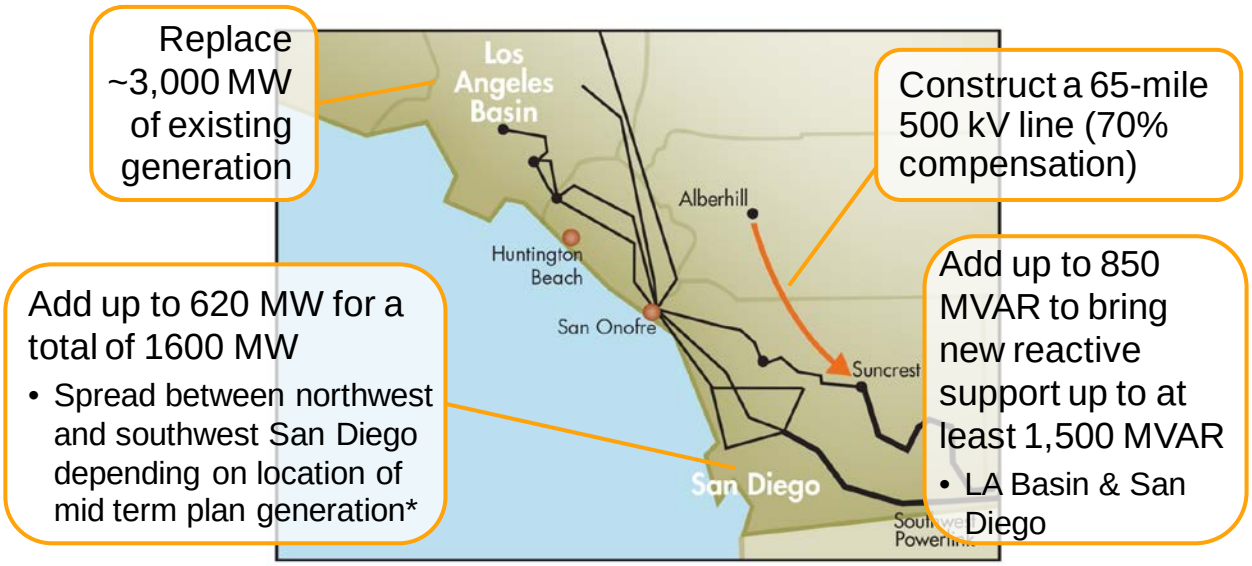


Figure 3: Long-term combined transmission and generation alternative



***Approximately 700 MW of generation in San Diego can be displaced by additional reactive support, transformer upgrades and 66 kV transmission upgrades in the LA Basin and upgrading line series capacitors and additional transformer upgrades.**

Table 8: 2022 Local reliability assessment of LA Basin and San Diego areas

	LA Basin	W. LA	Ellis	San Diego	SD/IV
Total Generation (MW)	7,112	2,734		3,100	4,361
Category A	N/A	N/A	One Category A – normal overloads	N/A Category C contingency is the overriding contingency for LCR need for this sub-area	N/A None other than the ones identified in the San Diego sub-area
Identified Reliability Concerns			Barre-Lewis 230kV line (7% overloads)		
Required Generation (MW)			543 MW (386 MW thermal/157 MW DG)		
Deficiency (MW)			(386)* *This is mitigated by any of the mitigation plans for Category C (N-1-1) for LA Basin and San Diego areas if this portion of generation addition is in the southwest area of LA Basin		
Category B	N/A Category C contingency is the overriding contingency	N/A Category C contingency is the overriding contingency	N/A	Same notes as above	G-1/N-1: Otay Mesa/IV-N.Gila 500kV

	LA Basin	W. LA	Ellis	San Diego	SD/IV
	for LCR need for this area	for LCR need for this sub-area			
Identified Reliability Concerns	Category C reliability concerns established LCR needs	Category C reliability concerns established LCR needs	Category A reliability concerns establish LCR needs	Same notes as above	Post-transient voltage deviation beyond 7% at SCE's Viejo 230kV
Required Generation	See notes above	See notes above	See notes above	N/A	5,304* *The deficiency of 943 MW (=4361-5304) would be mitigated by any of the mitigation plans for Category C (N-1-1) for LA Basin and San Diego areas
Category C	N-1-1: Sunrise, system adj., followed by SWPL	N-1-1: Serrano-Lewis #1, followed by Serrano-Villa Park #2 230kV	See notes above	N-1-1: Sunrise, system adj., followed by SWPL	Category B contingency is the overriding contingency for LCR need for this area
Identified Reliability Concerns	Post-transient voltage instability	Overloading concern on the Serrano-Villa Park #1 230kV line (36% overloads)	See notes above	Post-transient voltage instability	See notes above

	LA Basin	W. LA	Ellis	San Diego	SD/IV
Description of Mitigations – Generation Options	(1) Replace and add new generation totaling 4,300 – 4,600 MW* Notes: * the maximum generation level may be reduced by adding another 550 MVAR SVC at San Onofre 230kV bus (or in new substation in proximity of the existing switchyard) (2) Replace and add new generation totaling 3,800 MW, AND Continue to rely on HB synchronous condensers, AND Add between 765 – 920** MW of new or replaced generation in San Diego (**lower number corresponds to higher generation addition/replacement in 2018 in San Diego area and vice versa), AND Add 820 MVAR of additional dynamic	In association with LA Basin mitigation, if 2,460 MW of OTC generation is replaced or new generation is added in the southwestern part of the LA Basin, the thermal loading concern for Western LA sub-area would be mitigated.		Generation Options (see LA Basin for coordinated plan) (1) No new additional generation in San Diego area (2) Add between 765 – 920 MW of new or replaced generation	

	LA Basin	W. LA	Ellis	San Diego	SD/IV
	reactive support in LA Basin and San Diego areas if 2018 plan has minimum amount of voltage support				
LCR Area's Total Required Generation – for Generation Options	(1) Total 11,412 – 11,712 MW (included 251 MW DG) – lower number corresponds to scenario if additional 550 MVAR SVC can be installed at San Onofre 230kV bus (2) Total 10,912 MW in LA Basin	Total 5,099MW		(1) Total 3,100 MW (2) Total 3,865 – 4,020 MW (=3,100+765 or +920)	See notes above
Deficiency (MW)	Without additional new or replaced generation, the area would be subject to 3,800 – 4,600 MW of resource deficiency (1) With Gen. Option 1 - none (2) With Gen. Option 2 - none	(2,460)* *This deficiency is mitigated by new or replaced generation in the LA Basin, if 2,460 MW of new or replaced generation is sited in Southwestern LA area	None		See notes above
Description of Mitigations – Combined Transmission & Generation Option	3.2.1 Replace 3,000 MW of existing generation in the southwestern LA Basin,			Please see mitigation plan under LA Basin area for common plan between LA Basin and San Diego LCR	

	LA Basin	W. LA	Ellis	San Diego	SD/IV
	AND 3.2.2 Construct a 65-mile 500kV line (70% compensation) from Alberhill to Suncrest substations, AND 3.2.3 Add up to about 660 MW for a total of 1600 – 1700 MW of new or replaced generation in San Diego area, AND Add up to 850 MVAR to bring new reactive support up to at least 1,500 MVAR in LA Basin and San Diego areas			areas	

6. Conclusions - Grid Reliability Assessment of the Absence of SONGS Scenarios

Uncertainties in the Studies

In performing the reliability assessment without SONGS for the mid-term and long-term mitigation considerations, there is significant uncertainty inherent in the studies and conclusions as follows:

- Future status of SONGS;
- Status of future SDG&E generation procurement;
- Status of meeting flexible generation requirements;
- Increasing levels of energy efficiency on top of funded programs in the CEC-adopted demand forecast; and
- Potential successful deployment of improved demand response programs.

Least-Regret Considerations for the Mid-Term Needs

Because of the uncertainty factors listed above, ISO management's conclusions reflect the following least-regret considerations:

- The Sycamore – Penasquitos 230kV line provides mitigation for the absence of SONGS, as well as mitigation of policy-driven needs as set out in chapter 4; and
- A total of approximately 700 MVAR of dynamic reactive support in both LA Basin (at or near SONGS in particular) and San Diego areas provides mitigation for the absence of SONGS in a wide range of conditions.

Given the long lead time for the Sycamore to Penasquitos line and the need for this line in a reasonable range of possible alternative mitigation plans, the ISO is recommending proceeding with the development of this line. The ISO has identified that dynamic reactive support located in the vicinity of SONGS would provide much needed dynamic reactive support, and is recommending this upgrade as well as additional dynamic reactive support in the San Diego area (i.e., Talega Substation).

Further Study Works in the ISO 2013/2014 Transmission Planning Cycle for refinement of the Long-Term Needs

The following are ISO's preliminary considerations for additional studies in the upcoming transmission planning cycle:

- Work with the CEC to develop refined energy efficiency assumptions;
- Work to advance demand response programs that are suited for transmission mitigations;
- Consider the need for additional mitigation; and
- Work with the Participating Transmission Owners to find common ground in the long-term transmission mitigation needs.

Combined Diablo Canyon and SONGS Absence Grid Reliability Studies

To address concerns whether there are any transient stability issues for the scenario without Diablo Canyon and SONGS as base-load generation, additional transient stability studies were performed for some of the most critical contingencies in the Western Interconnection system. The CPUC Commercial Interest (i.e., base case) portfolio was evaluated for the 2022 Summer Peak load conditions. In addition, a sensitivity evaluation with the 2022 Off-Peak load conditions was evaluated with the CPUC High Distributed Generation (High D.G.) portfolio. This sensitivity study was performed to check whether there would be adequate inertia in the system under the conditions studied in response to critical contingencies in the WECC system. As expected, the results for the 2022 Off-Peak load High D.G. study case indicated slower damping response, especially for some generating units in San Diego area, than in the summer peak case because of less generation inertia in the WECC system, but the results did not exhibit system wide transient stability concerns. The following tables provide summary of the transient study results.

Table 9: Summary of transient stability study results for the 2022 Commercial Interest Summer Peak Load study case (no nuclear generation scenario)

	Contingency	**Meeting WECC Criteria?**	
		Transient Voltage	Transient Frequency
1	IPPDC Bi-pole	√	√
2	Midway-Vincent double line outage (N-2)	√	√
3	PDCI Bi-pole	√	√
4	Palo Verde G-2	√	√
5	Red Bluff – Devers double line outage (N-2)	√	√
6	Overlapping Sunrise and SWPL line outage (N-1-1)	√ *	√ *

Note:

*Meets WECC transient stability voltage and frequency criteria with proposed least-regret 2018 transmission mitigation plan without SONGS (2013 mitigation is also assumed to be in service).

Table 10: Summary of transient stability study results for the 2022 High D.G. Off-Peak Load study case (no nuclear generation scenario)

	Contingency	**Meeting WECC Criteria?**	
		Transient Voltage	Transient Frequency
1	IPPDC Bi-pole	√	√

	Contingency	Meeting WECC Criteria?	
		Transient Voltage	Transient Frequency
2	Midway-Vincent double line outage (N-2)	√	√
3	PDCI Bi-pole	√	√
4	Palo Verde G-2	√	√
5	Red Bluff – Devers double line outage (N-2)	√	√
6	Overlapping Sunrise and SWPL line outage (N-1-1)	√ *	√ *

Note:

*Meets WECC transient stability voltage and frequency criteria with proposed least-regret 2018 transmission mitigation plan without SONGS (2013 mitigation is also assumed to be in service)

7. Sensitivity Analyses with CPUC High D.G. Portfolio for 2022 Summer Peak Load Conditions for LA Basin and San Diego LCR Areas

This section addresses the results of a sensitivity analyses based on the CPUC High D.G. portfolio for 2022 Summer Peak load conditions for the LA Basin and San Diego LCR areas. The ISO also has been requested by the state energy agencies (i.e., CEC and CPUC) as well as the California Air Resources Board (CARB) to perform additional sensitivity studies with incremental uncommitted energy efficiency (EE) beyond the committed portion that was included in the Commission's adopted demand forecast and potential incremental combined heat and power (CHP). These additional sensitivity analyses regarding uncommitted programs were requested by the state agencies in support of AB 1318 study-related works will be performed outside of this process and may be included in the final report, or addendum to the final report, depending on when it is available.

Sensitivity analyses were performed with the High D.G. portfolio for the 2022 Summer Peak power flow case to determine how much reduction of the thermal generation requirement, as identified for the CPUC Commercial Interest (base case) portfolio,

would be achieved with a higher level of distributed solar PV in the LA Basin and San Diego LCR areas.

Post-transient voltage stability evaluation for the Category C contingency in San Diego area (i.e., N-1-1 of the Sunrise, followed by SWPL) was performed for the generation alternative with the highest new and replaced generation in the LA Basin (i.e., the 4,600 MW generation addition and replacement alternative in the LA Basin).

The amount of D.G. for the CPUC Commercial Interest and High D.G. portfolios for the 2022 Summer Peak case is summarized below.

Table 11: Distributed generation in 2022 Commercial Interest and High D.G. Summer Peak Case

	Commercial Interest		**High D.G.**	
Area	**Dispatched Capacity (MW)**	**Installed Capacity (MW)**	**Dispatched Capacity (MW)**	**Installed Capacity (MW)**
LA Basin LCR Area	243	486	769*	1,538
San Diego Sub-LCR Area	202*	404	245*	490

Notes:

*Dispatched capacity was derived by applying a 50 percent NQC factor provided by the CPUC for small solar PV technology

The assessment with the High D.G. portfolio resulted in a total new generation addition and replacement requirements of 4,112 MW in the LA Basin, representing a reduction of about 488 MW compared with the Commercial Interest portfolio. When compared with the Commercial Interest's D.G. amount in the LA Basin and San Diego areas, the High D.G. portfolio represents an increase of 569 MW of production from D.G. capacity. With a reduction of 488 MW of thermal generation requirements with the High D.G. portfolio, the results appear to indicate that for every MW of production from D.G. capacity in the studied area, it would reduce the amount of thermal generation by about 0.85 MW. In terms of installed capacity, the comparison ratio would be 1 MW D.G. to 0.43 MW of thermal generation.

The above evaluation is greatly dependent on the net qualifying capacity (NQC) conversion factor from the CPUC. A high NQC conversion factor helps in this case. Observations from the utilities, particularly in the northern area seems to indicate that at the time of peak load (i.e., close to 5 p.m.) the solar PV output would appear to be about 35 percent of its installed capacity. Further observations and evaluations would be needed to improve the conversion factor from installed capacity to net dependable capacity at peak loads for the renewable generation.

8. Sensitivity Analyses with Incremental Uncommitted Demand Side Management Programs for LA Basin and San Diego LCR Areas

This report includes the study results for the LCR sensitivity analyses having incremental uncommitted demand side management (DSM) programs for the long-term (2022) generation mitigations conducted at the request of the state agencies (California Air Resources Board (CARB), CEC, and CPUC) for inclusion in the final AB 1318 report.

In the SONGS absence grid reliability studies as reported above in the ISO 2012-2013 Transmission Plan, *committed* energy efficiency (EE) was included in the CEC-adopted demand forecast that was modeled for the studies. For the sensitivity analysis, *incremental uncommitted* EE, combined heat and power (CHP) and demand response (DR) were included in the 2022 studies to determine OTC generation replacement, or new generation, requirements, along with dynamic reactive support requirements. These results are then compared with previously published results to estimate how much generation requirements would be reduced if these incremental uncommitted DSM programs were to materialize. Because local grid reliability assessment results are dependent on the locations where these uncommitted programs are assumed and modeled, the ISO considers these results as sensitivities due to uncertainty regarding these uncommitted programs actually developing at the assumed locations.

The ISO, in collaboration with the state energy agencies (CEC and CPUC), as well as the Load Serving Entities (LSEs), reviewed and discussed various levels of incremental uncommitted EE, CHP and DR assumptions to be used in the studies. The following assumptions were utilized to model the 2022 long-term power flow study cases. The total potential demand impact (i.e., demand reductions) assumptions for the sensitivity studies are about 1,582 MW.

Table 12: Input Assumptions for Incremental Uncommitted DSM for AB 1318 SONGS Absence Studies (2022)

	Major Category of Input Assumptions	**Data Inputs**
1	Study base case	Commercial Interest portfolio (CPUC/ISO RPS Base case)
2	Renewable Generation Assumptions	Same assumptions as in the Commercial Interest study case having no incremental uncommitted DSM (as reported in the ISO 2012/2013 Transmission Plan)
2	Starting Demand Forecast Level (before adjustment for incremental uncommitted EE)	(CEC unadjusted 2022 mid case load levels for LA Basin and San Diego LCR areas (1-in-10 heat wave loads), 2012 CEC-adopted forecast, updated August 2012)
3	Incremental uncommitted energy efficiency assumptions	Total for both SCE and SDG&E: 1,160 MW Break-downs: SCE (973 MW) SDG&E (187 MW)
4	Incremental Combined Heat and Power (CHP)	15.1 MW (SCE) 0 MW (SDG&E)
5	Demand Response (DR)	*Direct control programs that can respond within 30 minutes to mitigate transmission loading concerns and to prepare to mitigate voltage stability concerns for the next contingency* 382 MW (SCE) 25 MW (SDG&E)

The following table provides a summary of study results. The results of the studies without the incremental uncommitted DSM programs are also included in the same table for the purpose of comparison[5]. The studies were performed on the long-term generation alternatives to assess the impact to the OTC generation replacement and new generation need. The ISO did not perform sensitivity studies on the combined transmission and generation alternative because it is premature at this time to know whether Rights of Way are feasible for a potential new 500kV transmission line facility connecting SCE's southern 500 kV system with SDG&E's 500 kV system.

[5] ISO Board-Approved 2012/2013 Transmission Plan (http://www.caiso.com/Documents/BoardApproved2012-2013TransmissionPlan.pdf)

Table 13: SONGS Absence Studies – Comparison of Generation Replacement and New Generation Requirements With and Without Incremental Uncommitted DSM

2022 SONGS ABSENCE STUDIES - COMPARISON OF GENERATION REPLACEMENT REQUIREMENTS WITH AND WITHOUT INCREMENTAL UNCOMMITTED DSM

	2022 (Long-Term) - Generation Alternatives (No Incremental Uncommitted DSM)			2022 (Long-Term) - Sensitivity Study Results (With Incremental Uncommitted DSM)		
Area	**OTC Replacement Assumptions (MW)**	**New Generation (MW)**	**Dynamic Reactive Support Need (MVAR)**	**OTC Replacement Assumptions (MW)**	**New Generation (MW)**	**Dynamic Reactive Support Need (MVAR)**
Alternative #1						
Southwestern LA Basin	2900	1000 - 1200	1050 - 500#	2900	400 - 560	1000 - 500
Northwestern LA Basin	0	300	0	0	0	0
Eastern LA Basin	0	100 - 200	0	0	0	0
Subtotal LA Basin	*4300 - 4600 # %*		*1050 - 500 #*	*3300 - 3460*		*1000 - 500*
Northwest San Diego	620/820 +	0	2x240	520	0	2x240
Southwest San Diego	0	0	2x240	0	0	2x240
Southeast San Diego (inland area)	0	300	0	0	300	0
Subtotal San Diego Sub-Area	*920/1120 ◊*		*960*	*820*		*960*

Notes:

^ Common transmission line need: Sycamore-Penasquitos 230kV line

Generation need may be reduced by 300 MW by adding an additional 550 MVAR SVC at San Onofre switchyard

+ This can be accomplished by combining a minimum of 620 MW generation replacement/repowering; the remaining (200 MW) generation need is OTC-extended until further development in the long term

% Approximately 200 MW of generation in the West LA Basin can be lowered if 200 MW of generation is developed in San Diego

The most critical contingency that requires OTC generation replacement and new generation, as well as dynamic reactive support, is the overlapping Category C contingency of the Sunrise Powerlink line and the Southwest Powerlink line, with the cross trip of Otay Mesa – Tijuana 230kV line (to mitigate overloading of CFE 230kV lines). The constraint is post-transient voltage stability concern. Based on the above study results, with 1,582 MW of incremental uncommitted DSM modeled, the potential reduction in generation replacement and new generation requirements is about 1,000 - 1,100 MW in LA Basin. The lower generation need (3,300 MW) is associated with

having higher amount of dynamic reactive support (1,000 MVAR)[6] at or near San Onofre 230kV switchyard, if feasible. The higher generation need (3,460 MW) is associated with lower amount of dynamic reactive support (500 MVAR). The study results demonstrate non-linearity with the amount of generation addition and dynamic reactive support need for voltage stability related concerns. In the study cases that were performed without the incremental uncommitted DSM, as summarized in the table above, the amount of generation reduction as a result of adding almost the same amount of dynamic reactive support was noticeably higher (i.e., 300 MW reduction). This is because the original study cases without the incremental DSM had about 1,000 MW more local generation than the study cases with incremental uncommitted DSM. This extra amount of generation inherently provides available dynamic reactive support for further voltage support. In addition, the removal of an incremental amount of highly effective local generation tends to have more of an adverse impact as the remaining local generation amount diminishes, and is replaced with less effective demand side reduction locations.

For the sensitivity studies, San Diego's OTC generation replacement and new generation need are reduced by about 100 MW. It is assumed that there is the same amount of dynamic reactive support (960 MVAR) in San Diego for this sensitivity analysis.

Conclusions Related to Sensitivity Studies with Incremental Uncommitted DSM

If incremental uncommitted EE, CHP and DR are implemented at specific forecast substation locations, the OTC generation replacement, as well as new generation needs, could be reduced while maintaining local grid reliability for the LA Basin and San Diego areas for the SONGS absence condition. Further work is needed through the CEC Demand Analysis Working Group to improve forecasting of these incremental uncommitted DSM programs, particularly at the substation load locations. In addition, further work is underway to finalize the characteristics that demand response programs must have in order to be viable for transmission mitigation.

[6] A duplicate of the first 500 MVAR dynamic reactive support at or near SONGS was modeled for this sensitivity study. However, it is noted that site feasibility is not evaluated or confirmed at this time for the second 500 MVAR installation. The ISO Board approved the first 500 MVAR installation as part of the mid-term mitigation plan as described in the ISO 2012/2013 Transmission Plan.