Application No.: 13-10-020
Exhibit No.:
Witness: Songzhe Zhu

In the Matter of the Application of SOUTHERN CALIFORNIA EDISON COMPANY (U338E) for a Certificate of Public Convenience and Necessity for the West of Devers Upgrade Project and for an Interim Decision Approving the Proposed Transaction between Southern California Edison and Morongo Transmission LLC.	Application 13-10-020

TESTIMONY OF SONGZHE ZHU
ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

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BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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TESTIMONY OF SONGZHE ZHU ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

I. INTRODUCTION

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

A. My name is Songzhe Zhu. I am employed by the California Independent System Operator Corporation (CAISO), 250 Outcropping Way, Folsom, California as a Lead Regional Transmission Engineer for Southern California.

Q. Please describe your educational and professional background.

A. I received a PhD in electrical engineering from Iowa State University in 2000. Previously, I received an MSEE (Master of Science in Electrical Engineering) from Nanjing Automation Research Institute in China in 1996 and a BSEE (Bachelor of Science in Electrical Engineering) from Xian Jiaotong University in China in 1993.

After graduating from Iowa State University in 2000, I worked for Perot Systems as an Application Specialist from March 2000 to August 2000. While at Perot Systems, I developed various software applications to facilitate trading and settlement of the hour-ahead and day-ahead energy market for the California Power Exchange. Thereafter, from August 2000 to May 2006, I worked as a software engineer and then as a senior software engineer at Siemens PT&D, in San Jose, California. As a software engineer, my job

function was to design, develop, integrate, and implement advanced power applications software for use in energy management systems (EMS). In May 2006, I joined the CAISO, working in the EMS Information Technology division as an EMS Engineering Specialist. In September 2006, I transferred to my current position as Senior Regional Transmission Engineer.

Q. What are your job responsibilities?

A. I am a Lead Regional Transmission Engineer at the CAISO from February 2012 to the present time. Prior to that, I was a Senior Regional Transmission Engineer at the CAISO from September 2006 to February 2012. My job responsibilities in this position include (1) performing complex engineering studies to anticipate, identify, and resolve problems or potential problems with the southern California power grid, (2) conducting planning studies and overseeing and approving transmission projects proposed for the CAISO Controlled Grid, and (3) leading and performing interconnection studies for generation interconnection projects.

Q. What is the purpose of your testimony?

A. My testimony provides detailed information regarding the need for the West of Devers Upgrade Project (Proposed Project). Specifically, my testimony provides information regarding:

(1) the CAISO's initial assessment of need based on the Generator Interconnection Process in place at the time the Proposed Project was approved;

(2) the CAISO's subsequent confirmation of need for the Proposed Project based on the policy-driven analysis conducted in the CAISO's transmission planning process; and

(3) the ability of the Phased Build Alternative presented in the Draft Environmental Impact Report (DEIR) to meet the needs identified by the CAISO.

II. INITIAL CAISO IDENTIFICATION OF NEED FOR THE PROPOSED PROJECT

Q. Please explain how the CAISO identified the need for the Proposed Project.

A. The CAISO identified the Proposed Project as necessary to provide deliverability for certain generation interconnection requests as a part of its 2010 Generator Interconnection Process. The CAISO subsequently identified the Proposed Project as necessary to support the deliverability of renewable energy resources identified in the Commission's renewable portfolios submitted in the CAISO's transmission planning process.

Q. Please explain the concept of deliverability.

A. Deliverability from the perspective of individual generator resources, ensures that, under normal transmission system conditions, if capacity resources are available and called on, their ability to provide energy to the system at peak load will not be limited by the dispatch of other capacity resources in the vicinity. The purpose is to demonstrate that the installed capacity in any electrical area can run simultaneously, at peak load, and the excess energy above load in that electrical area can be exported to the remainder of the control area, subject to contingency testing. In short, the test ensures that bottleneck capacity conditions will not exist at peak load, limiting the availability and usefulness of capacity resources for meeting resource adequacy requirements. The CAISO's deliverability study methodology for resource adequacy purposes was discussed extensively in the Commission's 2004 Resource Adequacy Proceeding, and it was generally adopted in that proceeding. The Federal Energy Regulatory Commission (FERC) also accepted the CAISO's deliverability study methodology as a reasonable implementation of the large generator interconnection connection process during the FERC Order 2003 compliance filing process.

Q. Please explain how the CAISO initially identified the need for the Proposed Project.

A. In the 2010 generator interconnection process studies, the CAISO performed a deliverability assessment analyzing all generation interconnection requests seeking Full Capacity Deliverability Status in the eastern bulk transmission area of Southern California Edison (SCE). The assessment modeled generation projects both in the Serial Group (*i.e.*, those projects that requested deliverability prior to CAISO's institution of a cluster study process) and those projects in the 2010 Transition Cluster. Transition Cluster Phase II generator interconnection requests are included in Table 1 below while Serial Group projects that affected the need for the Proposed Project are listed in Table 2.

Table 1: Transition Cluster Phase II Projects in SCE Eastern Bulk Area

Queue #	Point of Interconnection	MW	Fuel Type
193	Colorado River 220kV	500	Solar
365	Red Bluff 220kV	500	Solar
421	Eagle Mountain 161kV	49.5	Solar
431	Colorado River 220kV	150	Solar
294	Colorado River 220kV	1000	Solar
	Total	*2199.5*	

Table 2: Serial Group Projects Impacting the Proposed Project Assumed in the Transition Cluster Phase II Study

Queue #	Point of Interconnection	Type	Project Size (MW)	Current Status
1	Devers 115kV	Wind	16.5	Withdrawn
3	Devers 220kV	N-Gas	850	Operational
17	Colorado River 500kV	N-Gas	520	GIA Executed; COD 1/2/2018
49	Devers 115kV	Wind	100.5	Converted to WDT1056;
138	Devers - Vista 230kV #1	Wind	150	GIA Executed; COD 9/30/2020
146	Red Bluff 220kV	Solar	150	Operational
147	Red Bluff 220kV	Solar	400	Operational
219	Colorado River 500kV	N-Gas	50	GIA Executed; COD 1/2/2018
		Total	*3,037*	

The deliverability assessment concluded that there was insufficient transmission capacity to support the requested Full Capacity Deliverability Status for these projects. The assessment identified significant overloads on the four West of Devers 220kV lines, as detailed in Table 3 below.

Table 3: West of Devers Overloads Identified in 2010 Large Generator Interconnection Process

Contingency	Overloaded Facilities	Max Flow
Devers – Valley 500kV No. 1 and No. 2	Devers – TOT185HS 220kV (part of Devers – Vista 220kV No. 1)	109%
	Devers – El Casco 220kV	147%
	Devers – Vista 220kV No. 2	120%
	Devers – San Bernardino 220kV	162%

Based on these findings, the CAISO concluded that reconductoring the West of Devers 220kV lines (*i.e*. the Proposed Project) was required for the projects listed in Table 1 to achieve Full Capacity Deliverability Status.

Since the completion of this deliverability assessment, only 16.5 megawatts (MW) of the 3,037 MW of generation in the Serial Group projects have withdrawn. The remainder of the Serial Group projects have either achieved commercial operation or executed a generation interconnection agreement. The cluster project generation associated with the Proposed Project varies as some projects drop out of the queue and others enter. However, currently there are projects totaling 1534.5 MW of generating capacity from the initial Transition Cluster and an additional 4,554.9 MW of generating capacity from subsequent clusters in the queue requesting Full Capacity Deliverability Status. Table 4 below details the projects in the queue dependent on the Proposed Project for Full Capacity Deliverability Status.

Table 4: CAISO Controlled Grid Interconnection Requests Dependent on Proposed Project for Full Capacity Deliverability Status

Queue #	Cluster	POI	MW	Fuel Type	Project Status	COD
193	TC	Colorado River 220kV	500	Solar	GIA Executed	250 MW operational; 250 MW on 11/30/2016
294	TC	Colorado River 220kV	485	Solar	GIA Executed	11/30/2106
365	TC	Red Bluff 220kV	500	Solar	GIA Executed	6/1/2019
421	TC	Red Bluff 220kV	49.5	Solar	GIA In Progress	12/31/2016
576	C2	Colorado River 220kV	224	Solar	GIA Executed	9/30/2018
643AE	C3	Red Bluff 220kV	150	Solar	GIA Executed	9/1/2019
970	C6	Colorado River 220kV	150	Solar	Parked	12/31/2016
1070	C7	Red Bluff 220kV	250	Solar	Phase II	12/1/2018
1071	C7	Colorado River 220kV	150	Solar	Phase II	5/1/2019
1192	C8	Colorado River 220kV	463	Solar & Battery	Phase I	12/31/2020
1193	C8	Red Bluff 500kV	1408	Water	Phase I	1/1/2022
1194	C8	Colorado River 220kV	600	Gas	Phase I	6/1/2020
1196	C8	Colorado River 220kV	409.9	Solar	Phase I	4/30/2022
1197	C8	Red Bluff 220kV	400	Battery	Phase I	9/1/2018
1198	C8	Colorado River 220kV	150	Solar	Phase I	12/1/2020
1200	C8	Red Bluff 220kV	200	Solar	Phase I	12/31/2018
		Total	*6089.4*			

In addition, there are generators interconnecting to SCE's distribution systems that are seeking full capacity deliverability status and are dependent on the Proposed Project.

Table 5: SCE Wholesale Distribution Interconnection Requests Dependent on Proposed Project for Full Capacity Deliverability Status

Queue Position	Cluster	MW	POD to CAISO Controlled Grid	Fuel Type	In-Service Date
WDT786	C4	14.64	Valley 500kV	Solar	online
WDT1033	C6	13	Valley 500kV	Solar	11/1/2016
WDT1177	C7	20	Valley 500kV	Solar	11/01/2016
WDT1186	C7	20	Devers 220kV	Battery	03/01/2019
	Total	*67.64*			

III. CAISO TRANSMISSION PLANNING PROCESS IDENTIFICATION OF NEED FOR THE PROPOSED PROJECT

Q. Has the CAISO reviewed the need for the Proposed Project in its transmission planning process?

A. Yes, in the 2010-2011 transmission planning process, the CAISO studied the need for the Proposed Project to support renewable generation development to meet California's environmental policy goals. The transmission planning analysis conducted by the CAISO identifies transmission projects necessary to support Commission developed renewable portfolios. In this instance, the CAISO's transmission planning analysis found the Proposed Project also to be necessary to achieve state policy goals.

Q. Please explain the CAISO's review of the Proposed Project through its transmission planning process.

A. In the 2010-2011 transmission planning process, the CAISO conducted power flow studies that identified significant overloads on the West of Devers 220kV transmission lines under (1) normal conditions, (2) the single line outage of Alberhill–Valley 500kV, and (3) the Devers–Valley 500kV double line outage.

Table 5.5-14 from the 2010-2011 transmission plan, which identifies the specific overloads and contingency events, is reproduced below. Comparing the proposed emergency rating of the Phased Build Alternative (2037 Amps) to the flows in the table, the Phased Build Alternative would not have been sufficient to meet all the identified overloads.

Table 5.5-14 Power Flow Summary without West of Devers Upgrades

Overloaded Facility	Worst Contingency	Rating (A)	Portfolio 4 Peak Case	Portfolio 4 Off-Peak Case	Portfolio 1 Peak Case	Portfolio 1 Off-Peak Case	Portfolio 2 Peak Case
DEVERS – EL CASCO 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	1150	186%	138%	193%	105%	141%
DEVERS – EL CASCO 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	1150	162%	124%	166%	115%	117%
DEVERS – EL CASCO 230kV line No.1	Base Case	1150	104%	<100%	112%	<100%	<100%
DEVERS – VSTA 230kV line No.2	DEVERS–VALLEY 500kV No.1 & No. 2	1240	170%	132%	175%	108%	125%
DEVERS – VSTA 230kV line No.2	ALBERHIL – VALLEYSC 500kV line No. 1	1240	146%	118%	150%	118%	102%
SANBRDNO –DEVERS 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	796	221%	174%	228%	128%	159%
SANBRDNO –DEVERS 230kV line No.1	Base Case	796	111%	<100%	106%	<100%	<100%
SANBRDNO –DEVERS 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	796	188%	155%	193%	141%	128%
TOT185HS –DEVERS 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	1150	164%	125%	172%	103%	116%
TOT185HS –DEVERS 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	1150	139%	111%	146%	114%	<100%

Table 5.5-14 Power Flow Summary without West of Devers Upgrades

Overloaded Facility	Worst Contingency	Rating (A)	Portfolio 4 Peak Case	Portfolio 4 Off-Peak Case	Portfolio 1 Peak Case	Portfolio 1 Off-Peak Case	Portfolio 2 Peak Case
DEVERS – EL CASCO 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	1150	186%	138%	193%	105%	141%
DEVERS – EL CASCO 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	1150	162%	124%	166%	115%	117%
DEVERS – EL CASCO 230kV line No.1	Base Case	1150	104%	<100%	112%	<100%	<100%
DEVERS – VSTA 230kV line No.2	DEVERS–VALLEY 500kV No.1 & No. 2	1240	170%	132%	175%	108%	125%
DEVERS – VSTA 230kV line No.2	ALBERHIL – VALLEYSC 500kV line No. 1	1240	146%	118%	150%	118%	102%
SANBRDNO –DEVERS 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	796	221%	174%	228%	128%	159%
SANBRDNO –DEVERS 230kV line No.1	Base Case	796	111%	<100%	106%	<100%	<100%
SANBRDNO –DEVERS 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	796	188%	155%	193%	141%	128%
TOT185HS –DEVERS 230kV line No.1	DEVERS–VALLEY 500kV No.1 & No. 2	1150	164%	125%	172%	103%	116%
TOT185HS –DEVERS 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	1150	139%	111%	146%	114%	<100%

TOT185HS –VSTA 230kV line No.1	DEVERS– VALLEY 500kV No.1 & No. 2	1150	185%	125%	190%	117%	136%
TOT185HS –VSTA 230kV line No.1	ALBERHIL – VALLEYSC 500kV line No. 1	1150	159%	129%	162%	128%	112%
EL CASCO– SANBRDNO 230kV line No. 1	DEVERS– VALLEY 500kV No.1 & No. 2	1150	124%	111%	127%	<100%	<100%

The CAISO's renewable generation deliverability review indicated that the Proposed Project was needed for two of the renewable portfolios: P4 – Hybrid Portfolio (the base portfolio) and P1 – High Transmission Utilization Scenario.

	Renewable Deliverability without upgrade	Renewable capacity in CREZs that need the upgrades to be deliverable for resource				Deliverability concerns in portfolios without upgrade				Description of deliverability concerns without upgrade
Transmission Upgrade	MW	P4	P1	P2	P3	P4	P1	P2	P3	
West of Devers Upgrade	1600	2822	3654	1477	1477	Yes	Yes	No	No	Thermal overload on the West of Devers 230 kV lines

The CAISO Board Approved 2010-2011 transmission plan identified the Proposed Project as a necessary element to support California's renewable portfolio standard (RPS) goals. In the subsequent transmission plans, the CAISO reviewed scenarios assuming both the existing transmission capability without the Proposed Project and the incremental transmission capability with the inclusion of the Proposed Project. Taking into account the estimated cost of the Proposed Project, the calculator selected the Proposed Project as the most cost effective way to achieve 33 percent renewable portfolio goal.

Q. What is the current status of generation interconnection projects relying on the Proposed Project for Full Capacity Deliverability Status?

A. The Proposed Project is required by all generation interconnection requests for Full Capacity Deliverability Status that occurred after the initial identification of the Proposed Project in the 2010 interconnection process. The status of these generation projects are shown in tables 4 and 5.

IV. CAISO COMPARATIVE ANALYSIS OF THE PROPOSED PROJECT AND PHASED BUILD ALTERNATIVE

Q. Did the CAISO perform an updated technical analysis of Proposed Project and the Phased Build Alternative?

A. Yes, the CAISO conducted updated analysis pursuant to its deliverability assessment methodology for both the Proposed Project and the Phased Build Alternative presented in the DEIR. The CAISO performed the deliverability assessment using the commercial interest portfolio for the 33% renewable base portfolio developed by the Commission staff and submitted to the CAISO for study in the 2015-2016 transmission planning process. In the portfolio, there are 3,017 MW of renewable generation in Riverside East and 1,750 MW of renewable generation in the Imperial area. The key assumptions of the deliverability assessment are described in Appendix A below.

To test the Proposed Project and the Phased Build Alternative, the CAISO developed and studied two cases:

- Case A modeled the Proposed Project
- Case B modeled the Phased Build Alternative

The CAISO found that the Phased Build Alternative would be at the emergency limit for the Devers–Vista 220 kV No. 1 & No. 2 lines, while these lines would be loaded at about 55% with the Proposed Project. For the Phased Build Alternative, minor variations in the

study assumptions might cause the loading to exceed the emergency limit. In addition, under dispatch conditions that are more stressed than evaluated under the CAISO's deliverability methodology, a special protection system (SPS) tripping generation would be required for the Phased Build Alternative.

In addition to the results above, the CAISO identified overloading on the Lugo–Victorville 500 kV line for both the Phased Build Alternative and the Proposed Project. The overload is higher for the Phased Build Alternative because of the higher impedance of the conductor used in the Phased Build Alternative. Separate mitigation measures would be necessary to resolve the Lugo-Victorville overload in both cases and are being evaluated in the current transmission plan, but if the West of Devers upgrades were in service before the mitigation upgrades for Lugo–Victorville overload, there would be lower interim deliverability with the Phased Build Alternative, limiting the capacity values of the generators in the desert area that includes Riverside East, Imperial and other renewable zones.

Detailed results of the CAISO's deliverability analysis are presented in Table 6 below:

Table 6: Base Portfolio Deliverability Study Results

Facility	Contingency	Flow	
		Case A (Proposed Project)	Case B (Phased Build Alternative)
Lugo - Victorville 500kV	Lugo - Eldorado 500kV with SPS	111.87%	113.07%
Devers - Vista 220kV No. 1 & 2	Devers - Valley 500kV No. 1 & 2	55.34%	99.87%

To test how much deliverability the Phased Build Alternative could provide, the CAISO modeled incremental generation in both the Riverside East and Imperial areas. The capacity of the

generators were increased gradually to identify deliverability constraints. The results are summarized in Table 7 below.

Table 7: Deliverability Constraints at Higher Generation Level

Scenario	Facility	Contingency	Flow	
			Case A (Proposed Project)	Case B (Phased Build Alternative)
+ 300 MW	Devers - Valley 500kV No. 1	Devers - Valley 500kV No. 2	96.86%	100.61%
	Devers - Vista 220kV No. 1 & 2	Devers - Valley 500kV No. 1 & 2	54.84%	diverged
		Devers - Valley 500kV No. 1 & 2 w/ SPS tripping Sentinel and gen @ Colorado River and Red Bluff	SPS not needed	diverged
+ 900 MW	Devers - Vista 220kV No. 1 & 2	Devers - Valley 500kV No. 1 & 2 w/ SPS tripping gen @ Colorado River and Red Bluff	SPS not needed	100.12%
		Devers - Valley 500kV No. 1 & 2	57.53%	diverged

For the Phased Build Alternative, an SPS would need to be installed to trip generation under the Devers–Valley 500kV No. 1 and No. 2 contingency to provide any increase in generation deliverability above the portfolio amounts. Furthermore, the CAISO identified voltage instability under the Devers–Valley 500kV No. 1 and No. 2 contingency due to high impedance of the ACCR-795 conductors. To avoid this voltage instability, the SPS must trip generation at Red Bluff or Colorado River, instead of the existing Sentinel plant, which is most effective reducing the flows on the West of Devers 220kV lines. Keeping Sentinel online provides necessary reactive support to the West of Devers 220kV area. The CAISO assumed this SPS design in the further analysis determining the additional deliverability provided by the Phased Build Alternative.

With 300 MW of additional generation in the area, the loading on Devers–Valley 500kV line under the outage of the parallel Devers–Valley 500kV line exceeds the emergency rating limit for the Phased Build Alternative. The SPS must trip generation under a single line outage.

However, with an additional 900 MW of generation in Riverside East and Imperial Valley area, the Phased Build Alternative cannot provide deliverability, even with the SPS.

In summary, the Phased Build Alternative can only meet the bare minimum deliverability need based on the 33% renewable generation portfolio provided by the Commission for the CAISO to study in its 2015-2016 transmission plan. The Phased Build Alternative may result in insufficient deliverability based on minor variations in study assumptions, such as transmission, loads, imports and generator addition or retirement. To provide reasonably certain deliverability to the portfolio, an SPS will be required to trip generation under the Devers–Valley 500kV No. 1 and No. 2 double line outage. The SPS will also need to trip generation in the event of the Devers–Valley 500kV single line outage to support 300 MW of deliverability in addition to the generation included in the

2015-2016 renewable portfolio. The Phased Build Alternative combined with the SPS could provide only an incremental 900 MW of deliverability in addition to the base portfolio. If the total generation exceeds 3,917 MW, further upgrades west of Devers substation will be needed provide full deliverability.

In contrast, the Proposed Project does not require an SPS in the event of a double line outage contingency. Combined with an SPS, the Proposed Project would accommodate incremental deliverability of 1,700 MW of renewable generation in Riverside East and Imperial areas in excess of the amounts identified in the Commission's 2015-2016 renewable portfolios.

Q. Did the CAISO identify any other performance differences between Proposed Project and the Phased Build Alternative?

A. The CAISO compared the transmission losses on the west of Devers transmission lines in the deliverability study initial dispatch between Case A and Case B. The Phased Build Alternative has 35 MW more transmission losses, making it less efficient for the system to serve the loads. The details are shown in Table 8.

Table 8: Comparison of Transmission Line Active Power Losses

	Proposed Project		Phased Build Alterative	
	Flow (MW)	P-Loss (MW)	Flow (MW)	P-Loss (MW)
Devers - San Bernardino No.1	371.4	3.99	328.1	11.56
Devers - El Casco No. 1	418.3	3.04	395.8	10.98
El Casco - San Bernardino No. 1	215.1	1.58	185	1.23
Devers - Vista No. 1	454.2	6.11	390.7	16.04
Devers - Vista No. 2	454.2	6.11	390.7	16.04
Total	1913.2	20.83	1690.3	55.85
			Increased MW Losses	35.02

Increased transmission losses result in economic costs and negative environmental impacts, as discussed in Mr. Millar's testimony.

V. CONCLUSION

Q. Please summarize your conclusions.

A. The Proposed Project was initially identified by the CAISO in order to ensure that renewable projects in the generator interconnection queue could achieve Full Capacity Deliverability Status. Subsequently, the CAISO reaffirmed the need for the project in the transmission planning process based on deliverability assessments of Commission submitted portfolios for renewable generation projects. The CAISO's updated analysis indicates that the Phased Build Project would not be best suited to meet long-term deliverability needs of a robust renewable portfolio.

Q. Does this conclude your testimony?

A. Yes, it does.

APPENDIX A

The key study assumptions used in the CAISO's deliverability assessment are provided below.

Transmission

The study included all existing transmission in service and the expected future projects that have been approved by the CAISO but are not yet in service. To test the Proposed Project and the Phased Build Alternative, two cases were developed and studied:

- Case A modeled the Proposed Project
- Case B modeled the Phased Build Alternative

Load Modeling

A coincident 1-in-5 year heat wave for the CAISO balancing authority area load in 2025 was modeled in the base case. Non-pump load was the 1-in-5 peak load level. Pump load was dispatched within expected range for summer peak load hours.

Generation Capacity (Pmax) in the Base Case

The most recent summer peak NQC was used as Pmax for existing thermal generating units. For new thermal generating units, Pmax was the installed capacity. Wind and solar generation Pmax data were set to 20 percent or 50 percent exceedance production level during summer peak load hours. For predominantly solar resource areas, if the study identified 20 or more non-solar generation units contributing to a deliverability constraint, solar generation was assessed for maximum output of 50 percent exceedance production level for the deliverability constraint, otherwise up to a 20 percent exceedance production level was assessed.

Table AppA-1: Wind and solar generation exceedance production levels (percentage of installed capacity) in deliverability assessment

Type	Area	20% Exceedance Level	50% Exceedance Level
Wind	SCE Northern & NOL	61%	38%
	SCE Eastern	73%	47%
	SDGE	51%	37%
	PG&E NorCal	58%	37%
	PG&E Bay Area (Solano)	71%	47%
	PG&E Bay Area (Altamont)	63%	32%
Solar	SCE Northern	99%	92%
	SCE/VEA others	100%	93%
	SDGE	96%	87%
	PG&E	99%	92%

Generation Retirement

Generators that will be retired by 2025 are turned off in the initial base case. If there are definite repowering plans, the repower generators are modeled. If the repower plan is pending, the retired generators are available for dispatch while creating stressed dispatch conditions.

Import Levels

Imports are modeled at the maximum simultaneous historical level, during the summer peak load period, by branch group. The historically unused existing transmission contracts (ETCs) crossing control area boundaries were modeled as zero MW injections at the tie point, but available to be turned on at remaining contract amounts. For any intertie that requires expanded MIC, the import is the target expanded MIC value. Table below shows the import megawatt amount modeled on the given branch groups.

Table AppA-2: 2015-2016 Base Portfolio deliverability assessment import target

Branch Group Name	Direction	Net Import MW	Import Unused ETC & TOR MW
Lugo-Victorville_BG	N-S	981	16
COI_BG	N-S	3770	631
BLYTHE_BG	E-W	72	0
CASCADE_BG	N-S	80	0
CFE_BG	S-N	-42	0
ELDORADO_MSL	E-W	405	0
IID-SCE_BG	E-W	702	0
IID-SDGE_BG	E-W		0
LAUGHLIN_BG	E-W	-42	0
MCCULLGH_MSL	E-W	0	316
MEAD_MSL	E-W	897	506
NGILABK4_BG	E-W	-137	168
NOB_BG	N-S	1544	0
PALOVRDE_MSL	E-W	2588	128
PARKER_BG	E-W	86	17
SILVERPK_BG	E-W	-3	0
SUMMIT_BG	E-W	13	0
SYLMAR-AC_MSL	E-W	340	311
Total		11254	2093