Application No: R.12-03-014
Exhibit No:
Witness: John M. Jontry

PREPARED TRACK 4 DIRECT TESTIMONY OF

SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E)

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

August 26, 2013

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PREPARED DIRECT TESTIMONY

OF JOHN M. JONTRY

I. PURPOSE

The purpose of my testimony is as follows:

- Recommend a level of generation need for the San Diego Local Capacity Resource (LCR) sub-area.[1]
- Describe the technical studies underlying the recommendation for generation need.
- Describe the methodology and planning criteria used by San Diego Gas & Electric Company (SDG&E) and Southern California Edison (SCE) Transmission Planning personnel to determine the minimum generation resources required for the San Diego and Western Los Angeles Basin LCR areas for the year 2022 in the absence of generation at the San Onofre Nuclear Generating Station (SONGS) and the retirement of the coastal power plants that currently use "Once Through Cooling" (OTC) technologies.
- Compare the results of this analysis with the analysis presented by the California Independent System Operator (CAISO) in the testimony of Robert Sparks.
- Describe the transmission alternatives studied as a part of the minimum generation resource studies.
- Describe the results from using an N-1-1 contingency with no allowance for controlled load shedding, and using a G-1/N-1 contingency, with respect to determining requirements for the San Diego LCR area.

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[1] The terms "San Diego LCR sub-area" and "SDG&E service territory" are used interchangeably.

- Describe the results of the technical studies, including the minimum San Diego LCR generation requirements and how those requirements may be reduced by transmission upgrades.
- Describe the relative effectiveness of different generation siting options for serving load in the San Diego LCR area.

II. RECOMMENDATION FOR GENERATION PROCUREMENT FOR THE SAN DIEGO LCR SUB-AREA

A. Basis of Recommendation

The following recommendation for procurement of generation resources for the San Diego LCR sub-area was arrived at using powerflow modeling techniques similar to those used by the CAISO underlying the testimony of Robert Sparks. The technical details of these studies are described in Part III of this testimony.

The technical studies underlying the following recommendation were done with the best data and analytical techniques available at the time; however, further study work is required to determine the optimal combination of generation and transmission resources to meet the forecast load.

B. Recommendation for Generation Procurement for the San Diego LCR Sub-Area

SDG&E has identified a minimum generation need of between of 620 MW and 1470 MW of Net Qualifying Capacity (NQC) in the San Diego LCR sub-area. This need is in addition to the 300 MW identified in SDG&E's Pio Pico application.[2] The smaller figure of 620 MW represents the minimum amount of generation required to meet the forecasted LCR need for San Diego sub-area for 2022, assuming construction of the identified Imperial Valley-NCGen Direct Current (DC) Regional Transmission Project, as proposed by SDG&E and submitted to the

[2] Application 13-06-015.

CAISO for approval as a reliability project. The larger figure of 1470 MW represents the minimum amount of generation required to meet the forecasted LCR need for the San Diego LCR sub-area, assuming no major transmission projects are approved to increase import capability into the San Diego load center.

The system condition that determined the generation need is the overlapping outage (N-1-1) of the ECO-Miguel section of the Southwest Powerlink 500 kV line and the Ocotillo Express-Suncrest section of the Sunrise Powerlink 500 kV line. A discussion of the N-1-1 planning criteria and how it relates to the G-1/N-1 planning criteria is set forth in Part III of this testimony.

It is important to note that this recommendation assumes that the full amount of the generation identified as "Planned" in Section III of this testimony is fully realized; if any of the "Planned" generation fails to materialize, it will be necessary to add an equivalent amount to the recommendation in order to meet the reliability need.

III. DISCUSSION OF THE TECHNICAL STUDIES

A. Purpose of the Technical Studies

The purpose of the technical studies was twofold: One, to determine the amount of additional generation required in the San Diego and Western Los Angeles Basin LCR areas for the year 2022; and two, to determine the LCR benefits of several major transmission upgrades for the same study year of 2022.

B. Power Flow Case Selection and Development

The powerflow cases used in the analysis were developed jointly by transmission and resource planning personnel at SCE and SDG&E. SCE transmission and resource planning personnel were responsible for the load, resource, and topology assumptions in the representation of the SCE service territory. SDG&E transmission and resource planning personnel were responsible for the load, resource, and topology assumptions in the representation of the SDG&E service territory.

The load flow studies used a 2023 Western Electricity Coordinating Council (WECC) base case. The major assumptions underlying the case included the following:

1) Use of the most recent official California Energy Commission (CEC) forecast for the San Diego and Western L.A. Basin LCR area for 2023. The Western L.A. Basin load was modeled as 13,609 MW. The San Diego load was modeled at 5,483 MW. Please refer to SDG&E Witness Robert Anderson's testimony for specific information as to how preferred resources (energy efficiency, demand response, etc.) factored into the load level modeled for the San Diego LCR area.
2) The topology of the San Diego transmission system included all projects approved by the CAISO, including the following major projects:
   a) Sycamore-Penasquitos 230 kV line
   b) Bay Boulevard 230/69 kV substation
   c) Southern Orange County Reliability Enhancement project
   d) Talega +240/-120 MVAR 230 kV Synchronous Condenser
   e) SONGS Mesa +480/-120 MVAR 230 kV Static VAR Compensator (SVC)
   f) East County (ECO) 500/230 kV substation
3) The topology of the San Diego transmission system also included two conceptual dynamic reactive power installations. The purpose of the conceptual dynamic reactive power installations is to limit post-contingency voltage deviations. These installations also represent a portion of the voltage support that is currently provided by retiring generation

within the San Diego LCR sub-area. Reactive power (generally referred to in terms of megavolt-amperes, or MVARs) is necessary to support and control voltage on the transmission system, and can be provided by conventional generation or by specific transmission devices (shunt capacitors, etc.). Real power (*i.e.,* megawatts) can only be provided by generation. The purpose of the technical studies described in this testimony is to determine the real power resources necessary to reliably operate the transmission system. For this purpose, a sufficient level of theoretical reactive power transmission devices were included to mitigate load flow issues caused by insufficient reactive resources so that the minimum amount of real power resources could be more clearly determined.

a) Suncrest +/- 240 MVAR 230 kV synchronous condenser

b) Cannon/Encina +/- 240 MVAR 230 kV synchronous condenser

4) The major available resources modeled in the San Diego LCR area included the following:

a) Existing generation

i) Otay Mesa combined-cycle plant

ii) Palomar Energy Center combined-cycle plant

iii) Eleven gas-fired "peakers" at approximately 50 MW apiece, located at various sites in the San Diego area.

b) Planned generation

i) "Product 2" generation

(1) Pio Pico (300 MW)

(2) Wellhead Escondido (49 MW total, 14 MW incremental)

c) Theoretical generation

i) "Coastal" generation modeled at the Encina 230 kV bus

ii) "North County" generation modeled in northern San Diego County, approximately halfway between the Talega and Escondido substations.

iii) "Southwest San Diego" generation, modeled in the San Diego metro area in the vicinity of Sycamore Canyon substation.

5) The following existing generation resources in the San Diego LCR area were assumed retired:

a) SONGS

b) Encina steam units

c) Cabrillo II peaking units

The generation modeled at the "Coastal" , "North County", and "Southwest San Diego" sites are theoretical, for the purpose of determining the amount of additional generation required to meet reliability criteria, and do not represent specific generation projects. This generation was assumed to be of a conventional type (*i.e.*, gas-fired peaking or combined-cycle generation) for study purposes only; in practice, any type of generation with a NQC equivalent to the modeled theoretical generation and connected at the same location would meet the Local Capacity Requirement.

C. Discussion of the N-1-1 vs. G-1/N-1 Criteria for Determining the Minimum LCRGeneration Requirement for the San Diego Sub-Area

For the analysis that examined the N-1-1 of ECO-Miguel and Ocotillo Express-Suncrest 500 kV lines as the limiting contingency, a load-shedding Special Protection Scheme (SPS) was not assumed to be allowed. For the analysis that examined the worst G-1/N-1 contingency as the limiting contingency, a load-shedding SPS was assumed to be in place to mitigate the N-1-1 of the ECO-Miguel and Ocotillo Express-Suncrest 500 kV lines. SDG&E has a WECC-certified load shedding scheme in place to mitigate the N-1-1 of the Southwest Powerlink and the Sunrise Powerlink.

Both approaches allow the transmission system to meet applicable North American Electric Reliability Corporation (NERC), WECC, and CAISO reliability criteria. The critical difference between the two criteria is that the N-1-1 is a NERC Category C contingency. The applicable NERC planning standard (TPL-003-0a) permits non-consequential loss of load (load shedding) for Category C contingencies. The G-1/N-1 is defined by the CAISO's Planning Standards as equivalent to a NERC Category B contingency, for which non-consequential load is not permitted. Therefore, load shedding is allowable for the N-1-1 but not the G-1/N-1.

Planning analyses performed by the CAISO supporting the Final 2013 LCR Technical Study indicate that adherence to the N-1-1 criteria without the possibility of load shedding increases the LCR requirements for the San Diego LCR area by over 1000 MW, the equivalent of two combined cycle units.[3] The large performance gap between the N-1-1 and G-1/N-1 in the CAISO's 2013 LCR analysis is caused by the loss of reactive support due to the SONGS generation retirement. As reactive resources are added back into the system (such as the synchronous condensers at Talega and the SONGS Mesa SVC, both projects approved by the CAISO), the performance gap will narrow. The performance difference between the N-1-1 and G-1/N-1 criteria in the Final 2013 LCR Technical Study analysis with SONGS generation in place was about 400 MW.

[3] 2013 Local Capacity Technical Analysis, Addendum to the Final Study Report, p. 2, Table "2013 Local Capacity Requirement without SONGS".

Ultimately, the CAISO is the Transmission Planning Authority for the San Diego transmission system, and has the responsibility and authority to set and meet the planning criteria.

D. Generation and Transmission Scenarios

Six generation and transmission scenarios were examined in the joint SDG&E/SCE studies, three of them by SDG&E. The six scenarios are as follows:

1) Conventional generation case – In this case, all of the LCR need for the San Diego and Western L.A. basin LCR areas was met with conventional generation, both existing and theoretical.[4] This case was jointly developed and analyzed by both SCE and SDG&E.
2) L. A. Basin Transmission Project (Mesa Loop-in) – In this case, a 500/230 kV substation was modeled in SCE's territory. All of the remaining LCR need for the San Diego and Western L.A. basin LCR areas was met with conventional generation, both existing and theoretical. This case was developed and analyzed by SCE.
3) SCE Preferred Resources Scenario – In this case, a preferred resource scenario was modeled for SCE's territory. This case was developed and analyzed by SCE.
4) Regional Transmission (Valley-Alberhill-SONGS) - In this case, a 500 kV regional transmission project from Alberhill to SONGS Mesa was modeled. All of the remaining LCR need for the San Diego and Western L.A. basin LCR areas was met with conventional generation, both existing and theoretical. This case was developed and analyzed by SCE.
5) Regional Transmission (Imperial Valley-SONGS) - In this case, a 500 kV Direct Current (DC) regional transmission project from Imperial Valley to SONGS Mesa was modeled. All of the remaining LCR need for the San Diego and Western L.A. basin LCR areas was met

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[4] This assumption was used solely for modeling purposes and does not reflect SDG&E's procurement strategy for meeting LCR need.

with conventional generation, both existing and theoretical. This case was developed and analyzed by SDG&E. Note that the final project as submitted by SDG&E to the CAISO's Reliability Project Window for the 2013/2014 Transmission Planning Process may differ slightly, but will be electrically equivalent.

6) Regional Transmission (Devers-North County Generation (NCGen)) - In this case, a conventional 500 kV Alternating Current (AC) regional transmission project from Devers Substation to a new 230 kV substation in north San Diego County was modeled. All of the remaining LCR need for the San Diego and Western L.A. basin LCR areas was met with conventional generation, both existing and theoretical. This case was developed and analyzed by SDG&E. Note that the final project as submitted by SDG&E to the CAISO's Reliability Project Window for the 2013/2014 Transmission Planning Process may differ slightly, but will be electrically equivalent.

E. Results of the Technical Analysis

Table 1 summarizes the results of the cases developed and analyzed by SDG&E (Scenarios #1, #5, and #6) using the G-1/N-1 criteria. The LCR new generation requirement is broken out by scenario and identifies the reduction in the amount of new generation required to meet the required performance for each transmission alternative.

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Table 1: Results of Powerflow Analysis using the G-1/N-1 Reliability Criteria

Scen.	Description	Limiting Contingency	New Generation Requirement (MW)			Reduction in New Generation Requirement (MW)		
			Western L.A. Basin	San Diego	Total	Western L.A. Basin	San Diego	Total Red.
1	Conventional Generation	Otay Mesa CC & ECO-Miguel 500 kV (G-1/N-1)	2802	1320	4122	-	-	-
5	Regional Transmission Project (Imperial Valley - SONGS DC)	Otay Mesa CC & ECO-Miguel 500 kV (G-1/N-1)	2251	370	2621	551	950	1501
6	Regional Transmission Project (Devers-NCGen AC)	Otay Mesa CC & ECO-Miguel 500 kV (G-1/N-1)	2402	820	3222	400	500	900

Table 2 summarizes the results of the cases developed and analyzed by SDG&E (Scenarios #1, #5, and #6) using the N-1-1 reliability criteria with no allowable load shedding. The LCR new generation requirement is broken out by scenario and identifies the reduction in the amount of new generation required to meet the required performance for each transmission alternative.

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Table 2: Results of Powerflow Analysis using the N-1-1 Reliability Criteria with No Allowable Load Shedding

Scen.	Description	Limiting Contingency	New Generation Requirement (MW)			Reduction in New Generation Requirement (MW)		
			Western L.A. Basin	San Diego	Total	Western L.A. Basin	San Diego	Total Red.
1	Conventional Generation	ECO-Miguel & OCO-Suncrest 500 kV (N-1-1)	2802	1470	4272	-	-	-
5	Regional Transmission Project (Imperial Valley - SONGS DC)	ECO-Miguel & OCO-Suncrest 500 kV (N-1-1)	2251	620	2871	551	850	1401
6	Regional Transmission Project (Devers-NCGen AC)	ECO-Miguel & OCO-Suncrest 500 kV (N-1-1)	2402	820	3222	400	650	1050

Note that for Scenario 6, there is no difference in the generation need determined by the N-1-1 and G-1/N-1 planning criteria. In this scenario, the two contingencies are of approximately equal severity.

F. Discussion of the Conventional Generation Scenario (Scenario #1)

The analysis presented for Scenario #1 represents a scenario similar to that presented in the Track 4 testimony of CAISO witness Sparks. Generation was increased in the San Diego LCR sub-area and West L.A. Basin LCR area until all thermal and voltage stability issues were mitigated. The total amount of incremental LCR generation required for the San Diego sub-area was determined by adding up the amount of generation dispatched at the three "theoretical" sites – "Coastal", "North County", and "Southwest San Diego" – at the point all thermal and voltage stability issues were resolved. A similar methodology was also used for Scenarios #5 and 6. A comparison of the CAISO and SDG&E results for study year 2022 may be found in Table 3.

The assumptions in the CAISO studies differ somewhat from the SDG&E studies, mainly due to the CAISO assuming that the generation identified in the Pio Pico application was a solution to the generation need, whereas the SDG&E analysis assumed these units in the base case rather than treating it as a solution to LCR need. The results of the analysis are shown in Table 3.

Table 3: Comparison of CAISO and SDG&E Study Results

<table>
<tr><td colspan="2" rowspan="2">Table 2 – Comparison of SDG&E and CAISO results.</td><td colspan="3">N-1-1 w/o Load Shedding as the limiting contingency</td><td colspan="3">G-1/N-1 as the limiting contingency</td></tr>
<tr><td>West LA Basin</td><td>San Diego</td><td>Total</td><td>West LA Basin</td><td>San Diego</td><td>Total</td></tr>
<tr><td rowspan="2">CAISO</td><td>Tables 11, 13 (80/20 LA/SD split)</td><td>3722</td><td>920</td><td>4642</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Tables 12, 13 (67/33 LA/SD split)</td><td>3022</td><td>1485</td><td>4507</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">SDG&E</td><td>2802</td><td>1470</td><td>4272</td><td>2802</td><td>1320</td><td>4122</td></tr>
<tr><td colspan="2">SDG&E (including current need authorization)</td><td>2802</td><td>1770</td><td>4572</td><td>2802</td><td>1620</td><td>4422</td></tr>
</table>

As noted in Part II of this testimony, additional study work is required to determine the optimal combination of resources (generation and transmission) necessary to meet the forecast load. Both the results of this study work, and that performed by the CAISO, are most useful in that they provide an order of magnitude estimate of the aggregate generation need for Southern California. As the results in Table 3 show, while the results are slightly different, both sets of analysis show a similar generation need in both the Western L.A. Basin area and San Diego sub-area. The results also show that while the need varies according to the reliability criteria applied (N-1-1 versus G-1/N-1) the aggregate need is still in excess of 4000 MW under all studied generation-only scenarios.

G. Benefits of the Regional Transmission Project Modeled in Scenario #5

This is a conceptual DC tie line connecting the Imperial Valley 500 kV bus with the SONGS Mesa 230 kV bus. The conceptual DC line was assumed to have a nominal capability of 1500 MW. For the purposes of this analysis, conventional thyristor-controlled converter station technology was assumed.

The Imperial Valley-SONGS Mesa DC line modeled in Scenario #5 reduced the San Diego LCR generation requirement by 850 MW for the N-1-1 limiting contingency, and by 950 MW for the G-1/N-1 limiting contingency. The Imperial Valley-SONGS Mesa DC line also reduced the generation requirement for the Western L.A. Basin by 551 MW for the N-1-1 limiting contingency, and by 551 MW for the G-1/N-1 limiting contingency.

H. Benefits of the Regional Transmission Project Modeled in Scenario #6

This is a conceptual AC tie line connecting the Devers 500 kV bus with a new 500/230 kV NCGen substation in north San Diego County, located approximately halfway between Talega and Escondido substations and connected to the existing 230 kV Escondido-Talega 230 kV transmission line. For study purposes, a second Escondido-Talega line was included in the plan of service for this conceptual line.

The Devers-NCGen 500 kV DC line as modeled in Scenario #6 reduced the San Diego LCR generation requirement by 650 MW for the N-1-1 limiting contingency and by 500 MW for the G-1/N-1 limiting contingency. The Devers-NCGen 500 kV DC line also reduced the generation requirement for the Western L.A. Basin by 400 MW for the N-1-1 limiting contingency and by 400 MW for the G-1/N-1 limiting contingency.

I. Additional Discussion of the Regional Transmission Projects

The approximate linear distance is 120-150 miles for the Imperial Valley-SONGS Mesa DC line and 120-150 miles for the Devers-NCGen AC line, and these values were used to estimate the impedance of each line for modeling purposes only. A specific route or plan of service was not evaluated as a part of this analysis.

J. Discussion of the Effectiveness of Additional Dynamic Reactive Support Installations in the San Diego LCR Area to Significantly Reduce the Minimum LCR Generation Requirement

The analysis presented in my testimony already assumes +480/-240 MVAR of additional dynamic reactive capability on two critical San Diego import paths (Imperial Valley-Suncrest and South of SONGS) above and beyond what is currently approved by the CAISO. Additionally, the limiting condition for the worst G-1/N-1 contingency is a thermal limit, which cannot be significantly mitigated by the addition of reactive resources. Thus, additional dynamic reactive capability would not significantly reduce the minimum LCR generation requirement.

IV. DISCUSSION OF GENERATION EFFECTIVENESS BY LOCATION

A. The Location of Additional Conventional or Renewable Generation Affects its Ability to Serve Load in the San Diego LCR Sub-Area

Generally speaking, generation located within the San Diego import cut-plane is significantly more effective than generation located outside the import cut-plane, especially following severe contingencies on the 500 kV transmission system. Within the import cut-plane, generation located electrically close to the SONGS 230 kV bus is slightly more effective than generation located elsewhere within the cut-plane.

B. Results of Load-Flow Studies to Determine the Relative Effectiveness of Different Generation Sites Inside and Outside of the San Diego LCR Sub-Area

Transmission planners working under my direction performed a high-level screening study evaluating the effectiveness of 1000 MW of generation addition at six locations: SONGS Mesa 230 kV, North County 230 kV, Palomar Energy 230 kV, Encina 230 kV, Miguel 230 kV, and Imperial Valley 230 kV. For each of the six locations, 1000 MW of generation was modeled in the powerflow case as the appropriate electrical location. The load modeled for the San Diego load center was then increased and system contingencies applied until voltage collapse occurred. For the purposes of this analysis, load shedding for the severe N-1-1 overlapping outage of the Eco-Miguel and Ocotillo Express-Suncrest 500 kV lines was not assumed to be in place. The effectiveness ratio was determined by taking the San Diego load at the voltage collapse point for each scenario and dividing it by the scenario with the highest load. For the purposes of this analysis, thermal and voltage deviation limits were ignored.

The results of the study indicated that the most effective site was the SONGS Mesa 230 kV site. The results for all six sites are summarized in Table 4. The effectiveness for the other five sites is indicated by their ratio to the most effective site (SONGS Mesa 230 kV).

Table 4: Generation Effectiveness by Location

Table 4 - Generation Effectiveness By Location	Effectiveness	Limiting Contingency
SONGS Mesa 230 kV	1.00	Otay Mesa CC & ECO-Miguel 500 kV (G-1/N-1)
North County 230 kV	0.94	ECO-Miguel & OCO-SCR 500 kV (N-1-1)
Palomar Energy 230 kV	0.95	ECO-Miguel & OCO-SCR 500 kV (N-1-1)
Encina 230 kV	0.96	ECO-Miguel & OCO-SCR 500 kV (N-1-1)
Miguel 230 kV	0.97	ECO-Miguel & OCO-SCR 500 kV (N-1-1)
Imperial Valley 230 kV	0.87	ECO-Miguel & OCO-SCR 500 kV (N-1-1)

As noted above, thermal and voltage deviation limits were ignored. System upgrades, in the form of upgraded or additional transmission lines, system protection schemes, or other modifications, may be required to reliably connect this amount of generation at the studied locations. Any such upgrades would be determined as a part of the CAISO's generation interconnection study process.

This concludes my prepared testimony.

V. WITNESS QUALIFICATIONS OF JOHN JONTRY

My name is John M. Jontry. My business address is 5130 Century Park Court, San Diego, California 92123.

I am employed by San Diego Gas & Electric Company (SDG&E) as Manager of the Electric Grid Planning group within the Transmission Planning Department.

I have a bachelor's degree in electrical engineering from the University of Illinois at Urbana-Champaign and a master's degree in industrial technology from Eastern Illinois University. I am a registered Professional Electrical Engineer with approximately 23 years of experience in the electric utility industry. My work experience includes electric distribution and transmission planning, substation and control engineering, transmission, and transmission and distribution operations. I have worked for SDG&E for approximately eight years, in the Transmission Planning Department.

I have previously testified before the California Public Utilities Commission.