SDG&E Comments on the CAISO 2018-2019 Transmission Plan

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Submitted by	Organization	Date Submitted
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San Diego Gas & Electric Co. ("SDG&E")[1] appreciates the extensive amount of work undertaken by the California ISO ("CAISO") to develop the Plan (CAISO 2018-2019 TPP) which includes evaluation of various reliability and economic proposals provided by stakeholders. CAISO's transmission planning process is comprehensive, open, and competitive and should continue to maintain reliability and generate savings for California ratepayers. SDG&E offers the following comments and recommendations for incorporation into the Plan and in future transmission planning cycles.

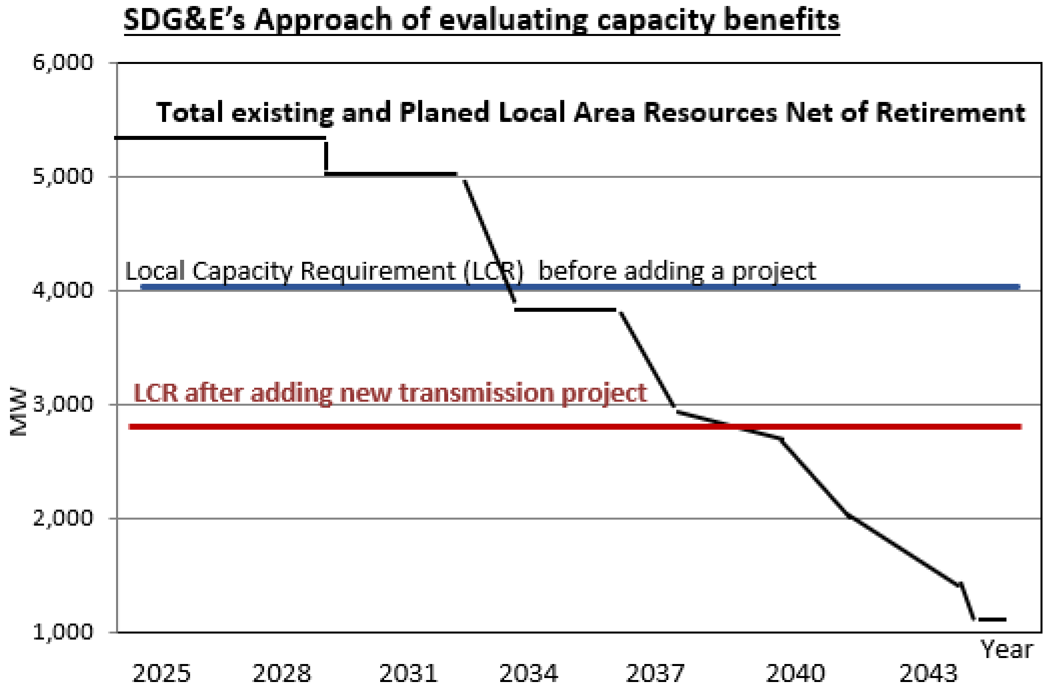
1. **Develop long-term Resource Adequacy (RA) prices that correspond with long asset lives when evaluating the cost-effectiveness of reducing Local Capacity Requirements (LCR) with transmission infrastructure additions.**

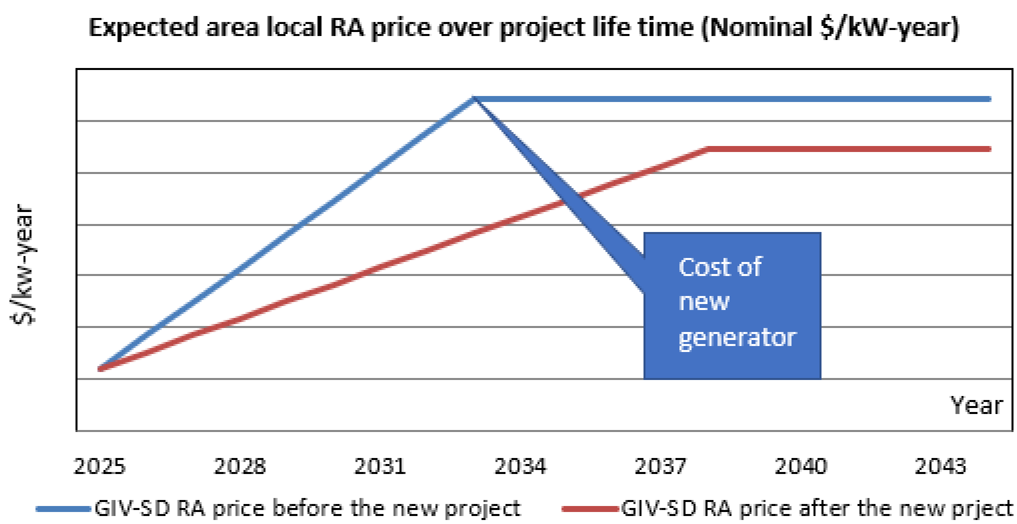
SDG&E notes that in the 2018-2019 planning cycle, the CAISO used the difference between ***near-term local*** capacity prices and ***near-term system*** capacity prices to assess the economic benefits of transmission projects that are proposed to reduce LCRs. The near-term capacity prices used by the CAISO were based on the CPUC's most recent 2017 Resource Adequacy Report.

SDG&E has some concerns regarding the CAISO's new RA price forecasting approach. The CPUC's 2017 Resource Adequacy Report reflects only near-term (less than 5 years) system and local RA capacity prices. Near-term price forecasts are not an accurate representation of capacity prices for time periods in the future when a potential transmission project could be placed in-service and operational. Long-term price forecasts which account for forecast LCR, projections of existing and committed amounts of RA capacity within the LCR area, and estimates for the Cost of New Entry (CONE) when projections of existing and committed amounts of RA capacity are less than the forecast LCR, are needed to evaluate the cost-effectiveness of potential transmission projects. By doing so, consideration of project construction timeframes, which may take as long as seven years, and appropriate asset economic life can be accounted for.

Specifically, SDG&E's proposed approach is to forecast longer term (corresponding to asset lives of 50 or more years) capacity prices by considering resource scarcities over time, the cost of building new generators that will comply with California's policies (e.g. SB100) including the replacement of such generation when their useful economic lives end, and the impact of future technology improvements on zero-carbon resources' costs (e.g. storage). The graph below illustrates such a methodology:

[1] SDG&E's assessment and comments on the Plan were supported by additional technical expertise from Quanta Technology, including Dr. Henry Chao, to develop these comments.





SDG&E notes that important studies by the CAISO have been previously conducted using the approach proposed by SDG&E in these comments. SDG&E is unclear why, in the current transmission planning cycle, the CAISO has chosen to use a different approach for forecasting long-term RA capacity prices. Frequent changes to the LCR reduction benefit methodology creates uncertainties and difficulties for stakeholders working on potential LCR reduction projects.

SDG&E encourages the CAISO to consider launching a stakeholder initiative that would enable stakeholders to collaboratively develop a more robust and more permanent LCR reduction benefit methodology. Because the short-term RA prices used by the CAISO to evaluate long-lived transmission projects are significantly lower than the Cost of New Entry (CONE), SDG&E believes the 2018-2019 transmission plan presented to the CAISO Board for approval, should include the following caveat:

"Long-term RA prices were derived from near-term local RA price data, and from near-term system-wide RA price data. This use of near-term RA prices to determine cost-effectiveness for projects with long asset lives (e.g., more than 50 years for transmission projects that would reduce LCR) creates a temporal disconnect. Further study and refinement is necessary before the Plan reaches determinative findings on cost-effectiveness."

2. <u>Anomalies in production cost results need to be addressed before reaching definitive conclusions on the cost-effectiveness of proposed transmission projects.</u>

The CAISO's economic assessment of most transmission projects show negative WECC-wide production cost savings. While the application of the Transmission Economic Assessment Methodology (TEAM) could result in negative energy cost savings for consumers *within* the CAISO Balancing Authority Area, it is difficult to understand how the addition of transmission capacity (which reduces overall grid impedance) could result in higher production costs for the WECC as a whole. If the production cost model objective function is to minimize total system wide production cost in order to meet system load plus losses, an improved/expanded transmission system should allow more efficient use of more economic generation resources in the system through the economic dispatch. These anomalous results (Tables 4.9-2, 4.9-5,4.9-7,4.9-8,4.9-11, 4.9-26, etc.) suggest that refinements of input data and/or changes to modeling techniques may be needed.

For instance, the Plan stated that the proposed 230 kV transmission project intended to mitigate congestion for high San Onofre north-bound flow resulted in increased thermal and renewable generation in the San Diego and Imperial Valley area, reduced thermal and renewable generation in the SCE area, and increased Path 26 north-bound congestion. If the optimization model is correct, the generation in the SCE area prior to the addition of the 230 kV transmission project should be more expensive than generation in the SCE area after the addition of the 230 kV transmission project. Similarly, prior to the addition of the 230 kV transmission project, generation north of Path 26 should be more expensive than the generation south of Path 26 and this price difference should be eliminated or moderated subsequent to adding the new 230 kV transmission project. Overall, the new generation pattern effectuated by the economic dispatch model with the addition of the new 230 kV transmission project, will reduce or eliminate north-bound congestion and necessarily result in a lower WECC wide production cost.

We note that since the rest of the WECC often acts as a "sink" for a significant amount of California's renewable energy, a schedulable HVDC can further improve the efficiency of this "sink," resulting in reduced WECC wide production costs.

Unless CAISO can demonstrate the negative WECC production cost savings are reasonable, SDG&E believes the 2018-2019 transmission plan presented to the CAISO Board for approval, should include the following caveat:

"Further study and refinement is necessary before the Plan reaches determinative findings on project cost-effectiveness in the cases where WECC production cost savings are negative."

3. **<u>Improve the production cost modeling for HVDC and Phase Shifters to better reflect these devices' capabilities.</u>**

It is SDG&E's opinion that the current economic results in many cases do not reflect the full economic benefits of projects that have power flow control capabilities such as HVDC or phase shifting transformer projects. It is SDG&E's recommendation, because of current model limitations in the tools used by the CAISO, that the CAISO should consider not including these results in the current iteration of the Plan, or at a minimum indicate they are preliminary in nature and subject to future refinement when the tools are improved.

In real-time systems, generation and transmission flexibilities are fully deployed to achieve the least cost dispatch to serve the load while meeting transmission security and generation ramping and regulation requirements. The same is expected for the models used in system planning. If there are modeling limitations, the planners should try to work with the model vendors to improve the tools. If engineering judgement is selected instead, the CAISO should ensure that all stakeholders agree with the workarounds used to overcome limitations in the models. Further detailed comments and recommendations are also listed below:

No.	Document Reference	Issues & Comments
1	P.327 of the Plan – T*he SWPL HVDC project "increased congestion along the IV to San Diego corridor, mainly on the Suncrest to Sycamore corridor, and on Path 26, although SDG&E Bay Blvd-Silvergate and San Luis Rey to S. Onofre congestions were reduced, as shown in Figure 4.9-18. Renewable curtailment was reduced in the IV area, but increased in most of the other areas in Southern California, as shown in Figure 4.9-19*."	**<u>Need for an improved HVDC model to fully access the economic benefits of the SWPL HVDC project:</u>** Most production cost simulation models greatly simplify the capability and flexibility of an HVDC. For example, the GridView software models a two-terminal HVDC link with an open circuit and a pair of a generator-load for respective ends of the two-terminal HVDC. When the CAISO system needs emergency generation injection into a certain area under contingency conditions, the model is unable to schedule that power movement during the simulations. The model causes the controllable HVDC to appear no different than a plain AC line. The current production cost simulation software should be enhanced to properly model the operation of the three-terminal HVDC. Additionally, the SWPL HVDC has many other features or flexibilities that are clearly beyond the capability of currently available production cost models. Namely: 1) The SWPL HVDC has a metallic return coupled with VSC technology-based terminals, making it a truly bipolar HVDC system. This technology and configuration enable the HVDC to operate with one pole if the other pole is out or faulted (an N-1 contingency per NERC/WECC standards). It is important to note the technology differences between the SWPL HVDC and the other two existing HVDC links in CAISO - PDCI and IPPDC. PDCI and IPPDC both use earth return and are LCC technology

		based, which means when one pole is out, the other pole has to be turned off. That is, the N-1 contingency for PDCI or IPPDC is the outage of the entire HVDC link. This difference needs to be factored into the economic analysis. 2) The production cost model's solution routine should be enhanced with a "balance equation" to ensure the proper optimization of internal DC flows in three-terminal DC lines. In the meantime, the model should allow the three terminals to participate in the minimization of the system wide production cost. 3) An HVDC project can transfer 50% higher than the rated power over an extended period of time following an N-1 contingency. For example, if one pole is lost, the other pole can carry 2250 MW. That is, an N-1 contingency of the SWPL HVDC would only reduce the power transfer capability from 3000 MW to 2250 MW. If the pre-contingency loading is at 2250 MW or lower, the post contingency flow can be maintained at the same or even higher level depending on the system needs. The Plan should be enhanced to fully capture this favorable feature for grid operations.
2	P.327 of the Plan – "*It was observed in the simulation results that modeling the HVDC Conversion project increased congestion along the IV to San Diego corridor, mainly on the Suncrest to Sycamore corridor, and on Path 26, although SDG&E Bay Blvd-Silvergate and San Luis Rey to S. Onofre congestions were reduced, as shown in Figure 4.9-18. Renewable curtailment was reduced in the IV area, but increased in most of the other areas in Southern California, as shown in Figure 4.9-19.*"	**<u>Unaccounted for HVDC operational and reliability benefits:</u>** It is conceivable that with the SWPL still an AC line and not controllable, the described congestion can happen. However, it is not clear in the Plan if the controllability feature of the SWPL HVDC was activated to alleviate any post contingency overloads, which should thereby reduce congestion. Since the SWPL HVDC can be controlled by the grid operators, it offers flexibility under different system conditions and provides various forms of relief. For instance, during a fire event, grid operators can adjust loading on critical facilities in rapid and granular increments to avoid more significant subsequent interruptions in flow or can reduce the HVDC voltage to prevent arcing or force outages due to heavy smoke. Additionally, an HVDC's ability to ramp up and down flow almost instantaneously further helps to mitigate overloads or meet system frequency regulation requirements. These operational and reliability benefits should be captured by the TEAM method as "Benefits from Increased Operational Flexibility" (see page 2-20 of the TEAM Process document). Additionally, the HVDC will become part of the WOR Path and it is expected to provide a significant increase in transmission capacity on Path 46 between Arizona and southern California. This potential Path rating increase should also be considered in the Plan.

3	P.241 and 247 of the Plan – Table 4.7-1, 4.7-3, and "*Path 26 south to north congestion increased from previous planning cycles, and was mostly caused by the large amount of renewable generation in Southern CA identified in the CPUC portfolio.*"	**Path 26 congestion and the need to coordinate the operation of all HVDC lines in the CAISO system to ensure optimal results:** In addition to the large amount of renewable generation in Southern California, it seems that a high northwest hydro flow (into CA through COI and PDCI) looping through Southern California was one of the possible reasons why Path 26 has over 1000 hours of northbound congestion. Path 26 congestion is the second highest in the Plan, only lower than the COI in the production cost simulations. It is not clear from the Plan that these northwest flows that are causing additional congestion on Path 26 are a result of predefined inputs such as "fixed schedules" over COI and PDCI, or optimal economic behavior computed by the production cost software. If these flows are caused by predefined inputs, they should be fine-tuned to more realistic schedules to reduce some of the congestion seen on Path 26. Furthermore, A true controllable SWPL HVDC can help direct low-cost northwest energy into the thermally-dominated southwest WECC region. Absent such control, the production cost model may be pushing the energy northward across Path 26 and increasing transmission losses. Therefore, it is recommended that the flow patterns of all DC lines should be modeled flexibly, in amount and direction, and are a result of an economic optimization.

4. Planning standards and methodologies should be applied clearly and consistently

It appears that the CAISO may not be consistently applying the standard limiting generation tripping for a single SPS. It has become a good industry practice to reduce the impact of special protection scheme ("SPS") in light of NERC standard compliance. For example, major transmission projects and SPS retirements have been planned and implemented for this purpose in the NPCC region. CAISO has a planning policy for this as well, but it appears the CAISO may not be implementing this policy consistently.

The CAISO mentioned in response to stakeholder questions that one of the criteria to evaluate the need for a reliability project is the need to limit generation tripping by existing or planned SPS's to within the limits imposed by the CAISO planning standards. Currently, the standard ISO SPS3 limits the amount of generation tripping under a single contingency to 1100 MW and 1400 MW under double contingencies. It is worth noting that the current SPS in service at the Imperial Valley substation near El Centro would trip generation in excess of these limits, on the order of 2900 MW depending on system conditions. This raises concerns in both planning and operations, and control area balancing and consequential load shedding.

SDG&E has long held that SPS are operational tools, not appropriate as long-term planning solutions. A similar view is shared by the industry. For example, major transmission projects and SPS retirements have been planned and implemented for this purpose in the NPCC region. An SPS, such as the Imperial Valley SPS, that trips large amounts of generation is especially concerning, as it indicates the network may not be capable of handling the amount of connected generation in some circumstances. Projects have been proposed that would effectively reduce the amount of generation tripping to the limits of the CAISO standard. To date, the CAISO has not approved any of these projects. In light of the increasing dependence on SPS, SDG&E recommends the CAISO reconsider projects which would allow this dependence to be reduced.

5. Improve LCR studies

Specific comments and recommendations are listed below:

No.	Document Reference	Issues & Comments
1	P.184 of the Plan – "*The 30-minute emergency ratings…, and adjusting the phase shifting transformers at Imperial Valley substation*." P.319 of the Plan "*It was determined that a southbound flow schedule of 40 MW on the Mission phase shifters would be sufficient to mitigate the potential overloading concern on the El Centro 230/92 kV transformer. Therefore, there is no impact to the local capacity requirement for the San Diego –Imperial Valley LCR area*". P.329 of the Plan – "*The HVDC Conversion project potentially could reduce local capacity need in the San Diego-Imperial Valley by about 690 MW*".	**Limited use of the flow control capabilities of phase shifters and HVDC lines when evaluating LCRs:** It seems that the Plan has taken into consideration the flow control capability of the Imperial Valley phase shifter. However, in calculating the benefits of a phase shifter that would reduce LCR for the San Diego – Greater Imperial Valley area, the plan appears to not fully utilize the Mission phase shifter flow control capabilities, such as bidirectional and multiple control mode. The LCR benefits were only evaluated assuming the Mission phase shifter was set to push a fixed flow from San Diego into the western LA basin sub-area. In other words, the study could have shown different benefits if the full capability and flexibility of the proposed Mission phase shifter was modeled in the study. The SWPL HVDC project may provide the same, if not more, capability as the Imperial Valley phase shifting transformer. This capability can be used to control power flows in a way that would mitigate potential overload concerns such as the overloads on the El Centro 230/92 kV transformer which drives the San Diego-Imperial Valley LCR needs. However, because the SWPL HVDC was fixed pre-contingency at a 1650 MW flow, due to potential constraints caused by the Miguel-Mission 230 N-2 contingency without considering the post contingency flexibility of the HVDC project, the LCR benefit of the project might have been underestimated to only 690 MW. SDG&E recommends that LCR studies considers the full capabilities of the HVDC project and phase shifters.
2	P. 188 of the Plan - *Border Sub-Area LCR Reduction* P. 191 of the Plan – *Otay-Otay Lake Tap 69 kV Reconductor Project*	**Cost and duration of generator contracts should be used to evaluate LCR reduction projects:** Neither of these proposed projects in the San Ysidro area were approved by the CAISO. The main mitigation stated for both is to redispatch available generation in the area. The CAISO in its analysis should consider the cost and duration of generator contracts to evaluate LCR reduction projects in sub-areas.

6. Storage as a transmission asset determination

Several proposed storage projects in this cycle were studied at different locations with the production cost modeling software to assess whether they were providing a transmission function to "improve access to cost-efficient resources" per 24.4.6.7 of the tariff. If a specific project showed the same benefits at two different locations (e.g. SDG&E vs. SCE), the CAISO concluded the project was mainly providing a system benefit instead of a local benefit needed to consider the project as a transmission asset. It is however unclear from the Plan, the required difference in benefits between locations that could have made storage projects qualify as transmission assets. SDG&E would appreciate if the CAISO could provide more information on how much benefit difference (e.g. percentage or amount) is needed between two locations, for the same storage project, to qualify as providing a transmission function.

7. Conclusion

Given the above comments and concerns, SDG&E considers the currently drafted transmission plan to be one data point in a process, and not the final word on the true benefits of SDG&E's proposed projects. SDG&E requests that CAISO consider these comments and recommendations for incorporation in the Plan and future cycles. With CAISO's strong track-record of leadership and collaboration, SDG&E is confident CAISO will continue their planning process improvement to enhance the robustness and effectiveness of the transmission planning process. SDG&E looks forward to working with CAISO on next steps.