

SB 350 Market Studies Preliminary Results

Submitted by	Company	Date Submitted
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San Diego Gas & Electric (“SDG&E”) offers the following comments on the California Independent System Operator’s (“CAISO”) *Clean Energy and Pollution Reduction Act Senate Bill 350 Study, Summary of Preliminary Results* dated May 24-25, 2016.

The CAISO’s SB 350 Study is Thoughtfully-Formed and Well-Executed

Based on presentations at the May 24-25, 2016 stakeholder meeting and other discussions with CAISO management and staff, SDG&E finds that the CAISO’s SB 350 study was put together with considerable forethought and, despite the compressed time frame, executed in a logical and sound manner. The results indicate that an expanded ISO will provide net benefits to California consumers. SDG&E believes this result is eminently reasonable – including a larger amount of generation and load in the CAISO’s centralized Locational Marginal Price (“LMP”)-based day-ahead unit commitment/scheduling market will necessarily result in more efficient use of both resources and transmission. Additionally, placing a wider geographic scope of transmission under the purview of the expanded ISO’s transmission planning process (“TPP”) provides the opportunity to identify transmission expansion options that confer benefits for a broader set of consumers.

Finally, and perhaps most importantly, an expanded ISO will allow realization of California’s Greenhouse Gas (“GHG”) reduction goals at a relatively low cost for California consumers. The fact that the CAISO’s studies indicate that expanding the ISO could result in a slight up-tick in California’s CO₂ emissions under certain assumptions (e.g., 0.47% in year 2020 assuming the ISO is expanded to include PacifiCorp)¹ is not troubling in that (i) California will be meeting its GHG reduction goals,² and (ii) California consumers will be receiving economic benefits while meeting GHG reduction goals.³

¹ Slide 112 of the CAISO’s May 24, 2016 presentation package.

² Slide 150 of the CAISO’s May 24, 2016 presentation package.

³ Slides 5 and 109 of the CAISO’s May 24, 2016 presentation package.

Estimated Benefits are Well-Within the Range of Uncertainty,⁴ But there are Unknowns that Should be Understood.

- Pursuant to the minimum requirements of SB 350, the SB 350 study, by design, did not evaluate the benefits (or disbenefits) to any consumers outside of California. Entities outside of California need to do their own due diligence as to the level of benefits that will accrue to such entities. While SDG&E believes that there will be benefits to all consumers within the expanded ISO, such benefits have yet to be demonstrated on a basis consistent with the CAISO's SB 350 study.
- The SB 350 study assumes that by year 2030, the expanded ISO will subsume all existing balancing authorities in the western U.S. except for Bonneville Power Authority ("BPA") and Western Area Power Authority ("WAPA"). While CAISO management has provided specific examples of other balancing authorities who have recently expressed interest in possibly joining an expanded ISO, there is a wide gulf between expressing interest and actual commitments. The Imperial Irrigation District (IID) for example, has been very clear that it opposes expansion of the ISO.

SDG&E agrees with the CAISO that if all existing balancing authorities within the western U.S. except BPA and WAPA join an expanded ISO, the benefits will be significant. What is not known, is what these benefits would be if fewer balancing authorities were to join and what these benefits would be if more balancing authorities join (e.g., BPA, WAPA, CENACE, BC Hydro).

- The CAISO's baseline estimate of California consumer benefits is \$55 million in year 2020 assuming the ISO is expanded to include PacifiCorp; and \$1.75 billion in year 2030 assuming the ISO is expanded to include the entire western U.S. except for BPA and WAPA. The \$55 million benefit of expanding the ISO to include PacifiCorp in year 2020 is low in proportion to the estimated current benefits from the EIM which are in the same neighborhood.

However, as CAISO management has pointed out, the production cost analysis used in the SB 350 study has limitations and is likely conservative. For example, the production cost model assumes perfect foresight of hourly wind and solar output. In reality there is a high level of uncertainty at the hourly level and a larger balancing authority would tend to mitigate the costs associated with managing this hour-to-hour uncertainty.

Also, while the "Current Practices" case contemplates simultaneous operation of (i) the CAISO's centralized LMP-based day-ahead unit commitment/scheduling market, with (ii) contract-path-based balancing authorities, the ability to accurately capture and model the essential differences between these two transmission access approaches does not exist. As a result, the Current Practices case necessarily models all balancing authorities as having an LMP-based day-ahead unit commitment/scheduling market. The Current Practices case therefore results in a level of optimization that exceeds that which can actually be realized, and accordingly produces a level of production costs that is lower than what would actually occur. If the production costs in the Current Practices case are lower than what will actually occur, then the savings associated with expanding the ISO's centralized LMP-based day-ahead unit commitment/scheduling market to more balancing authorities within the western U.S. are likely significantly under-stated.

⁴ SDG&E sees no benefit in undertaking a formal state-sponsored "independent review" of the CAISO's SB 350 study. Implementation should be the priority.

- The CAISO’s “Current Practices” case limits exports out of California to 2000 MW in any hour. This limit binds in about 10% of the hours (when California has high solar generation and low loads). There is no physical basis for this export limitation and SDG&E has consistently argued that it should not be included in production cost modeling.

CAISO management has responded to SDG&E’s concerns by suggesting that it is not reasonable to assume that California can effortlessly swing from a large net importing state to a large net exporting state. SDG&E agrees with the CAISO that there will be limits on the amount of surplus power that California can export to neighboring balancing authorities in the Current Practices case. However, the CAISO’s modeling in the Current Practices case already reflects both the operational constraints of neighboring balancing authorities (e.g., the impact of start-up times, minimum generation levels and ramping rates at coal and other power plants; the mix and quantity of “must take” renewable resources) and the economic constraints that will restrict the amount of surplus power neighboring balancing authorities will absorb (“hurdle rates” that reflect wheeling costs, administrative costs, and a minimum trading margin).

It is a fair question to ask whether the operational and economic constraints included in the CAISO’s modeling of the Current Practices case fully capture the constraints that would actually exist when California has a significant surplus of generation. SDG&E does not believe the CAISO has yet demonstrated that the operational and economic constraints it has modeled are, by themselves, inadequate.

Further, even if the CAISO were able to make such a demonstration, there is no basis for imposing an artificial export limit of 2000 MW. SDG&E believes it would be far preferable to increase the economic “hurdle rates” to reflect a higher level of “institutional friction” in the Current Practices case.

The bottom line is that costs of the “Current Practices” case (“1a”) are likely less than what the CAISO’s analysis indicates because, in fact, a higher level exports out of California are probably physically achievable and economically beneficial during periods of generation surplus. To its credit, the CAISO conducted a sensitivity analysis which increases the export limit in the Current Practices case to 8000 MW (“1b”). While there is no physical basis for this export limitation either; this limit binds less often so is a more realistic case. As expected, production costs in the Current Practices (“1b”) case are lower than in the Current Practices (“1a”) case which means that the benefits of expanding the ISO are less (though still significant⁵). SDG&E believes the CAISO’s SB 350 benefits assessment is more defensible if the Current Practices (“1b”) case is used as the basis of comparison.

- The SB 350 study assumes that in the Current Practices reference case, there is 5000 MW of existing out-of-state transmission available to wheel out-of-state renewables to California. This wheeling costs California consumers a total of \$211 million in year 2030.⁶ When the ISO is expanded to include all existing balancing authorities in the western U.S. except for BPA and WAPA, the SB 350 study assumes California consumers no longer have to pay any of these

⁵ Slide 109 of the May 24, 2106 presentation package estimates benefits in year 2030 to be between \$767 million and \$1.4 billion.

⁶ See slide 81 of the May 24, 2016 presentation package (\$39 million + \$72 million + \$34 million + \$66 million).

wheeling costs since all of the renewable resources are assumed to be located within the expanded ISO where there is no need for wheeling, i.e., the expanded ISO produces an avoided wheeling benefit of \$211 million.

Questions have been raised as to the reasonableness of the CAISO's assumption that in the Current Practices reference case there would be 5000 MW of available existing transmission on which to wheel renewable energy to California in year 2030. Some argue the amount of "available" existing transmission is closer to zero MW in which case the \$211 million benefit disappears. Removing this benefit would mean the overall year 2030 benefit of \$767 million for expanding the ISO to include all existing balancing authorities in the western U.S. except for BPA and WAPA, could be as low as \$556 million (\$767 million - \$211 million).

SDG&E believes the question of how much existing transfer capability will be available in year 2030 to access remote renewable resources in the Current Practices case deserves a deeper dive. On the one hand, economic grid simulations have consistently found that there is limited congestion on the Western Electric Coordinating Council ("WECC") grid, even with higher levels of renewables and without major new transmission. On the other hand, economic grid simulations tend to over-optimize the system given their perfect foresight of everything. Additionally, posted information as to the long-term availability of existing transfer capability across contract-path-based balancing authorities usually indicates very limited amounts. At this point, SDG&E places the avoided wheeling cost benefit in the "unknown" category.

- Some parties have suggested that the CAISO's estimate of wind capital costs in year 2030 are too high and that the out-of-state wind capacity factors are too low, especially as compared to the assumed significant decline in solar PV costs. Lower wind capital costs combined with higher annual capacity factors might shift the RPS mix in both the Current Practices reference case and in the case where the ISO is expanded to include all existing balancing authorities in the western U.S. except for BPA and WAPA. How the change in RPS portfolios would affect the overall benefit of expanding the ISO is unknown. However, lower wind capital costs would enhance the attractiveness of out-of-state wind compared to California solar. If out-of-state wind costs are low enough, there may be an economic basis for developing some of the large inter-regional transmission projects that have been proposed in the West, especially if the CAISO's assumptions as to the availability of existing transmission in these regions are overly optimistic.

Load Diversity Savings May be Under-Estimated

The CAISO's SB 350 study concludes, correctly, that expanding the ISO will reduce the cost of acquiring dependable capacity to meet applicable planning reserve requirements. This is because the coincident annual peak of the combined balancing authority will be less than the non-coincident annual peaks of the uncombined balancing authorities.⁷ However, the study assumes that the load diversity benefits in the expanded ISO are limited by transfer capability between different sub-regions of the expanded ISO.⁸ It is not clear why the transfer capability between sub-regions of the expanded ISO would necessarily act to limit the load diversity benefit. If the dependable capacity necessary to satisfy the planning reserve

⁷ See slide 98 of the May 24, 2016 presentation.

⁸ See slides 99 and 101 of the May 24, 2016 presentation.

requirements of the expanded ISO were located in the right places, transfer capability between sub-regions of the expanded ISO might never be binding. If this assumption were made, there would be a larger reduction in required dependable capacity with an expanded ISO and dependable cost savings would be increased as a result.

The SB 350 Study Confirms the Secondary, But Significant, Benefits of Reducing California's Electric Costs

When consumers have more money in their pockets, they spend it. Consumer spending drives economic activity. When economic activity increases, jobs are created. The CAISO's SB 350 study finds that because expanding the ISO will reduce California electric bills, there will be increased economic activity and therefore more jobs. The CAISO's SB 350 study estimates that electric bill savings for California consumers will result in can create 9,900 to 19,400 more new California jobs in year 2030. This is a common-sense result and its significance should not be overlooked: Economic efficiency leads to more, not fewer jobs.

The CAISO's SB 350 Results Point to the Need for More Realistic Modeling of Variable Operating Costs

An interesting and potentially useful result of the CAISO's SB 350 study is the conclusion that California consumers should be willing to pay other LSEs up to \$40/MWh to absorb California's surplus energy. At this LMP, California consumers are indifferent to (i) curtailing renewable resources and replacing the curtailed renewable energy at the marginal cost of new renewable resources, or (ii) paying other loads to absorb the surplus solar energy thereby avoiding the need to curtail.⁹

To date, most production cost models treat renewable resources as "must-take" generation, in effect treating this generation as having no variable cost. The CAISO's SB 350 study results demonstrate that renewable resources should be dispatched in the production cost model with a variable operating cost that approximates (i) the opportunity cost of curtailing those resources, plus (ii) any variable operating costs that could be avoided if the output of the resource were curtailed (operating and maintenance costs for wind machines, for example, vary with the amount the machines actually run). This will allow the production cost model to make the economic tradeoff, in every hour of the year, between (i) curtailing the renewable resource (i.e., not dispatching the resource) and dispatching a different resource (or increasing price-sensitive load), or (ii) dispatching the renewable resource and backing-down a different generator (or increasing price-sensitive load).

This modeling improvement may require software changes because most production cost models do not allow the maximum output of a dispatchable resource to vary every hour of the year (which would be required for wind and solar resources whose maximum output varies hourly in accordance with expected hourly weather conditions). Such improvements would allow for a more realistic projection of grid operations and LMPs during periods when the availability of renewable resources is high and loads are relatively low.

⁹ See slide 52 of the May 24, 2016 presentation package.