BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

In the Matter of the Application of DCR TRANSMISSION, LLC for a Certificate of Public Convenience and Necessity for the Ten West Link Project.	Application 16-10-012 Filed October 12, 2016

OPENING BRIEF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

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The California Independent System Operator Corporation (CAISO) submits this opening brief pursuant to the *Email Ruling Setting Procedural Schedule* (Ruling) issued on January 25, 2021. The CAISO recommends the Commission approve DCR Transmission, L.L.C.'s (DCRT's) application for a certificate of public convenience and necessity (CPCN) to construct the Ten West Link Transmission Project (Proposed Project). The Proposed Project serves the public convenience and necessity by providing economic benefits to CAISO ratepayers well in excess of project costs. In addition, the Proposed Project provides important reliability benefits to the CAISO system by reinforcing high voltage transmission system connecting California to the desert southwest.

I. Introduction

The CAISO identified the need for the Proposed Project in its 2013-2014 Transmission Plan to provide economic benefits for California ratepayers. Specifically, the CAISO found the Proposed Project provided sufficient economic benefits relative to its estimated cost. The CAISO Board of Governors approved the Proposed Project at its June 16, 2014 Meeting.[1]

In this proceeding, the CAISO re-studied the Proposed Project's economic benefits based on updated study assumptions, base cases, and Commission-developed renewable generation portfolios prepared for the 2019-2020 transmission planning process studies.[2] The CAISO re-

[1] Exhibit CAISO-03 (Millar), p. 8:9-13.
[2] *Id*. at 12:23-27.

assessed both the production cost and capacity cost benefits of the Proposed Project. To assess production cost benefits, the CAISO conducted two analyses—a baseline analysis and a sensitivity analysis with a higher natural gas price forecast. To establish the capacity benefits, the CAISO determined the incremental resource adequacy capacity the Proposed Project would allow CAISO load serving entities to access. The CAISO then assessed capacity benefits based on the avoided capacity costs of battery storage and the locational renewable capacity cost savings provided by the Proposed Project.

In addition, the CAISO provided a supplemental capacity benefits assessment based on the cost savings associated with locating hybrid solar/storage resources in Arizona versus California. This analysis shows that the Proposed Project could provide approximately $160 million in capacity benefits by taking advantage of such locational cost savings for hybrid solar/storage resources.[3] This means the Proposed Project's capacity benefits could be greater than the CAISO estimated in its benefit-to-cost analysis, to the extent load serving entities procure hybrid solar/storage resources made deliverable by the Proposed Project.

The CAISO's analysis shows the Proposed Project will produce combined production and capacity costs well in excess of project costs. The CAISO's studies show a project benefit-to-cost ratio that ranges from 1.16 to 1.54 in the baseline analysis using the avoided cost of battery storage to quantify capacity benefits.[4] In the higher gas price sensitivity, the range of benefit-to-cost ratios increases from 1.48 to 1.89 using the same avoided cost of battery storage to quantify capacity benefits.[5] Project benefit-to-cost ratios using the locational renewable cost savings to calculate capacity benefits range from 1.00 to 1.56.[6] Overall, the CAISO's results demonstrate the Proposed Project consistently produces positive benefit-to-cost ratios, even after heavily discounting the potential capacity benefits.

In addition, the Proposed Project will provide significant reliability benefits by strengthening existing transmission Path 46, the path connecting the CAISO grid to the desert southwest. The Proposed Project parallels the existing Palo Verde-Colorado River 500 kV line and mitigates an overlapping contingency of that line and the Imperial Valley–North Gila 500

[3] Exhibit CAISO-05 (Yimer), p. 22:1-9.
[4] Exhibit CAISO-01 (Zhang), p. 10, Table 4.
[5] *Id.* at p. 11, Table 5.
[6] *Id.* at pp. 12-13, Tables 6 and 7.

kV line. Currently, such an overlapping contingency could lead to a violation of the Path 46 Interconnection Reliability Operating Limit, potentially resulting in widespread instability, uncontrolled separation, or cascading outages. The Proposed Project mitigates the reliability impacts of potential loss of the Palo Verde-Colorado River 500 kV transmission line.[7]

Because the Proposed Project serves the public convenience and necessity by reducing overall costs to CAISO ratepayers and increase system reliability, the Commission should approve DCRT's CPCN application to construct the Proposed Project.

II. Background

A. The CAISO Approved the Proposed Project in its 2013-2014 Transmission Planning Process as an Economically-Driven Transmission Solution.

The CAISO followed its FERC-approved transmission planning process to review and approve the Proposed Project in its 2013-2014 transmission planning process.[8] In each annual transmission planning process, the CAISO conducts high priority economic studies to determine whether economically-driven transmission solutions are necessary to reduce electric-industry related costs for CAISO ratepayers. The economic planning studies complement the reliability and policy driven analyses in each annual transmission plan by exploring economically driven transmission solutions that create opportunities to reduce CAISO ratepayer costs.[9]

The CAISO's economic study process uses production cost simulation as the primary tool to identify potential study areas, prioritize study efforts, and assess project benefits. The production cost simulation identifies grid congestion and assesses economic benefits created by congestion mitigation measures. This type of economic benefit is normally categorized as an energy or production cost benefit. The production cost modeling simulation is a computationally intensive application based on the CAISO's security-constrained unit commitment and security-constrained economic dispatch algorithms. The CAISO conducts the production cost simulation for all hours in a study year.[10]

[7] Exhibit CAISO-05 (Yimer), pp. 27:11-31:12.
[8] Exhibit CAISO-03 (Millar), p. 8:17-18.
[9] *Id.* at p. 4:5-22.
[10] *Id.* at pp. 4:24-5:2.

The CAISO quantifies potential economic benefits in terms of reductions in ratepayer costs based on the CAISO Transmission Economic Analysis Methodology (TEAM).[11] The Commission thoroughly reviewed the CAISO's TEAM approach in Investigation (I.) 05-06-041.[12] In that proceeding, the Commission adopted a "rebuttable presumption with regard to economic evaluations in a CPCN proceeding in favor of a CAISO Board-approved economic evaluation" under certain circumstances.[13] Though the TEAM approach has evolved since the Commission's decision, the CAISO's assessment of production cost benefits remains fundamentally consistent. As a result, the Commission should afford the CAISO's analyses significant weight in determining Proposed Project benefits in this case.

The CAISO's tariff and the related TEAM documentation set out the considerations for seeking approval of a transmission project in the CAISO transmission planning process. The CAISO followed these TEAM processes in re-assessing the economic benefits of the Proposed Project in this proceeding.[14] In determining whether to approve economic transmission solutions, the TEAM approach considers the degree to which the benefits of the transmission solution outweigh the costs.

In the 2013-2014 annual transmission plan, the CAISO studied the Proposed Project considering production cost modeling benefits and forecast transmission line loss savings developed through powerflow analysis. The CAISO also derived system capacity benefits based on then-current forecast capacity requirements in California and Arizona and the comparative costs of new gas-fired generation construction. The quantified benefits exceeded estimated costs and, as a result, the CAISO Board of Governors approved the project.[15]

B. The CAISO Updated its Economic Assessment of the Proposed Project for this Proceeding.

The CAISO initially approved the Proposed Project based on the parameters and considerations outlined in the 2013-2014 transmission planning process and the CAISO tariff. In this proceeding, the CAISO updated its economic analyses to consider the need for the Proposed

[11] *Id.* at p. 6:1-8.
[12] *In Re Order Instituting Rulemaking on Commission's Own Motion into Methodology for Econ. Assessment of Transmission Projects*, No. D-06-11-018, 2006 WL 3328154 (Nov. 9, 2006).
[13] *Id*. at p. 2.
[14] Exhibit CAISO-01 (Zhang), p. 2:19-26.
[15] Exhibit CAISO-03 (Millar), pp. 8:23-9:5.

Project given current conditions on the electric transmission system.[16] The CAISO's updated analysis considers the following changed circumstances since the CAISO initially approved the Proposed Project:

- Continued growth of grid-connected solar in excess of the level anticipated in the 2013 time frame;
- Rapid deployment of distributed energy resources—rooftop solar PV in particular—far exceeding industry expectations;
- Decreasing battery storage costs;
- Actual and forecast reductions in the out-of-state thermal fleet, including out-of-state coal resources;
- Legislation requiring load-serving entities to acquire 60% of their energy from renewable resources by 2030 and 100% of energy from non-GHG-emitting generation by 2045;
- Broader acceptance that existing natural gas resources will be critical to ensure reliability well into the future—with those resources providing a key source of dispatchable capacity but far less overall energy production; and
- Advancement of generation and transmission planning and development processes. In particular, the Proposed Project has been part of the planning landscape over the last five years, and its impact is demonstrated by the significant generation development activity in the western Arizona area and generation projects seeking direct connection to the CAISO-controlled grid through points of interconnection in Arizona.[17]

The CAISO's updated economic analysis identified capacity benefits associated with the Proposed Project by enabling 969 MW of additional deliverable capacity from solar resources in Arizona.[18] The Proposed Project can also support delivery of an equivalent amount of other types of resources from the desert southwest identified as able to meet the state's current and future greenhouse gas emissions, renewable energy, and reliability targets. The CAISO calculated the economic benefit of this additional deliverable capacity using several methodologies to ensure reasonableness. The CAISO calculated the forecast production cost

[16] Exhibit CAISO-03 (Millar), p. 12:21-27.
[17] *Id.* at pp. 15:28-16:17.
[18] Exhibit CAISO-02 (Yimer), p. 12:15-17.

savings consistent with the TEAM approach discussed above. The CAISO combined the production cost savings and capacity benefits to establish benefit-to-cost ratios for the Proposed Project under a baseline analysis and a sensitivity that includes a higher natural gas costs. The CAISO's analysis shows the Proposed Project produces CAISO ratepayer benefits exceeding the most up-to-date project cost estimates in both sensitivities, even after significantly discounting potential capacity benefits.

C. The CAISO's Updated Analysis Is Consistent with State Electric Resource Planning Processes.

The CAISO's updated analysis uses resource assumptions and demand forecasts consistent with the state's electric resource planning processes. Specifically, the CAISO uses Commission-developed renewable generation portfolios for information regarding the location and volume of future renewable energy development to meet the state's public policy goals. The CAISO uses these renewable generation portfolios in all of its transmission planning studies, including the analyses conducted for this proceeding.[19]

The Commission and the CAISO have acknowledged the importance of agency coordination in developing and studying the renewable energy portfolios to identify transmission projects. The Commission recently reiterated this commitment to agency coordination in Decision 19-04-040 in the Integrated Resource Planning (IRP) proceeding, which recommended that the CAISO use the IRP-developed Preferred System Plan in the 2019-2020 Transmission Planning Process.[20] Most recently, the Commission's Decision transmitting resource portfolios for the 2021-2022 transmission planning process explicitly notes that the adopted base case portfolio "aligns with the direction given to the LSEs for planning in D.20-03-028, and one of the key objections of this process is to maintain close alignment between planning and resource development, including transmission development."[21]

Both the Commission and the CAISO have previously highlighted the development community's need for planning consistency and certainty. Reconsidering portfolios that alter

[19] Exhibit CAISO-03 (Millar), p. 6:13-18.
[20] Decision (D.) 19-04-040, p. 3.
[21] *See* Decision Transferring Electric Resource Portfolios to California Independent System Operator for 2021-2022 Transmission Planning Purposes, p. 17 (The Commission approved the proposed decision, with revisions, on February 11, 2021. As a result, the Decision has not been assigned a formal number at this point. The Agenda Decision approved by the Commission is accessible at the following link: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M364/K581/364581537.PDF).

past generation development activities and transmission plans—after the CAISO develops transmission plans and project proponents begin development based on those portfolios—would create an untenable framework for generation developers to site projects and contract with load-serving entities.[22] To encourage cost-efficient renewable procurement, the Commission's annual portfolio development should build on previous years' efforts. In the 2016-2017 transmission planning process, Commission and California Energy Commission (CEC) leaders acknowledged the need for consistency by noting that "[i]t is undesirable to use a renewable portfolio in the [transmission planning process] base case that might require reexamination of previously approved transmission investment decisions."[23] The CAISO's analysis avoids such unnecessary reexamination by using the most up-to-date resource portfolio, specifically, the resource portfolios used for the 2019-2020 transmission planning cycle, to conduct its economic studies for this proceeding.

As noted in testimony, the CAISO corrected an error in the Commission-developed resource portfolio to enable Arizona solar as a candidate resource. This correction was necessary to optimize the portfolio and allow for economic resource selection. The CAISO's correction was appropriate, as borne out by the Commission's Decision (D.) 20-03-028, which adopted resource portfolios for the 2020-2021 transmission planning process and corrected the error, enabling Arizona solar resources to be considered.[24] Correcting this error led to a shift in resources resulting in a portfolio with $977 million in cost savings in terms of present value of revenue requirements.[25] Though these cost savings are not directly attributable to the Proposed Project, the CAISO quantifies the capacity benefits the Proposed Project provides based on the locational renewable cost savings.[26]

The CAISO highlights the importance of using a consistent resource portfolio to assess transmission needs. The CAISO, the Commission, and the CEC have established coordinated processes to ensure that there is a common understanding of expectations regarding the

[22] Exhibit CAISO-03 (Millar), p. 7:8-19.
[23] Exhibit CAISO-03 (Millar), p. 7:8-19, citing Letter from Commission President Michael Picker and CEC Chair Robert Weisenmiller to CAISO President and Chief Executive Officer Steve Berberich.
[24] No. D. 20-03-028, 2020 WL 1888792 (Mar. 26, 2020), p. 38. ("Arizona solar was previously considered outside of the CAISO, but has now been added to the resources balanced by the CAISO, removing the previously-associated transmission wheeling cost.")
[25] Exhibit CAISO-02 (Yimer), pp. 9-10.
[26] Discussed in more detail in Section III.A.2, herein.

development of renewable generation portfolios feeding into the annual transmission planning cycle. Because the Commission develops its resource portfolios based on least cost RESOLVE optimization, a resource portfolio that is inconsistent with the Commission-developed portfolio would be uneconomic from the outset. An uneconomic resource portfolio would be an invalid starting point for transmission planning analysis because it would increase total resource costs and inaccurately quantify project benefits due to the changes in the underlying resources.[27]

The CAISO and DCRT benefit analyses appropriately use the Commission-developed portfolios as the starting point to assess the Proposed Project benefits. As a result, the benefits the CAISO and DCRT identify are reliable and consistent with Commission's IRP process.

III. Discussion

A. The Proposed Project's Economic Benefits Exceed Project Costs.

1. The Proposed Project Provides Significant Capacity Benefits Under Multiple Valuation Methodologies.

The CAISO used a deliverability assessment to determine the amount of Arizona solar capacity that could be deliverable—and therefore eligible as resource adequacy capacity—with the Proposed Project in place.[28] The CAISO performed the deliverability assessment with and without the Proposed Project. Based on these assessments, the CAISO determined the Proposed Project provides an increase of 969 MW of deliverable Arizona Solar capacity.[29] Table 1 shows the total amount of economically-selected Arizona solar capacity[30] and deliverable Arizona solar capacity with and without the Proposed Project:

[27] CAISO testimony explained how Cal Advocates created an alternative portfolio to assess the Proposed Project's economic benefits by modifying the RESOLVE optimized portfolio, thereby increasing portfolio costs by approximately $273 million. *See* Exhibit CAISO-05 (Yimer), p. 23:21-27.
[28] Exhibit CAISO-02 (Yimer), p. 11:7-10.
[29] *Id.* at p. 12, Table 7.
[30] The economically-selected Arizona solar capacity is based on the Commission's RESOLVE resource optimization tool. *See* Exhibit CAISO-02 (Yimer), p. 11:13-15.

Table 1 : Deliverable Arizona Solar Capacity[31]

	With TWL	Without TWL
Total Economically Selected Arizona Solar	3262 MW	3262 MW
Deliverable Capacity	2149 MW	1180 MW
Incremental deliverable capacity due to the Proposed Project	969 MW (29.7% of total)	

The CAISO used two separate approaches to quantify the economic benefits of this incremental deliverable capacity. First, the CAISO quantified the economic benefits of the incremental deliverable capacity based on the avoided cost of battery storage equivalent to the net qualifying capacity of the incremental deliverable Arizona solar. This approach determined the quantity and the cost of battery resources that would be required to replace the incremental resource adequacy capacity from the Arizona solar enabled by the Proposed Project.

Second, the CAISO quantified the economic value of the 969 MW of incremental deliverable Arizona solar by calculating the capacity benefit based on the local renewable costs savings from the Commission's RESOLVE modeling. Specifically, the CAISO calculated the cost differential between the incremental 969 MW of deliverable Arizona solar resources versus the equivalent amount of resources replaced. The CAISO discusses these methodologies, and their results, in detail below.

2. Capacity Benefits of Incremental Deliverable Arizona Solar Resources Based on Avoided Cost of Battery Capacity

To establish a capacity value for the 969 MW of incremental deliverable solar capacity based on the avoided cost of batteries, the CAISO first calculated the resource adequacy capacity value of the 969 MW of Arizona solar. The Commission uses an effective load carrying capability (ELCC) methodology to determine the resource adequacy value for solar resources. Based on the Commission's ELCC values adopted in D.19-06-026, 969 MW of incremental Arizona solar is equivalent to 136 MW of effective resource adequacy capacity in the peak month (September). Thus, the Proposed Project will allow 969 MW of Arizona solar to count

[31] *Id.* at p. 12.

for 136 MW of resource adequacy capacity that would otherwise need to be procured from other resources.[32]

The CAISO then used battery energy storage cost projections to determine the economic value of the 136 MW of resource adequacy capacity enabled by the Proposed Project. Battery storage resources are the typical marginal resources procured to meet new resource adequacy needs, therefore avoided cost of battery capacity provides an appropriate monetization of the 136 MW of resource adequacy capacity provided by the Proposed Project. This approach is consistent with the RESOLVE optimization because the increase in deliverable renewable capacity provided by the Proposed Project will result in a decrease in the amount of battery storage necessary to meet system reliability requirements. Industry data show the levelized cost of battery storage to be $268/kW-year. Using this data, the levelized cost of 136 MW of battery storage is approximately $36.3 million per year.[33] This represents the avoided cost of batteries provided by the incremental 969 MW of deliverable Arizona solar capacity enabled by the Proposed Project.

3. Capacity Benefits based on Locational Renewable Cost Savings

Under the second approach, the CAISO estimated the capacity benefit of 969 MW of deliverable Arizona solar assuming that without the Proposed Project the equivalent 969 MW, *i.e.*, 29.7% of the economically selected Arizona solar resources in the portfolio,[34] would have to come from renewables located in less economic locations subject to deliverability constraints. The CAISO calculated the capacity benefit attributable to the Proposed Project as the percentage of the Arizona solar made deliverable by the Proposed Project, *i.e.,* 29.7% of the 3,262 MW of economically selected Arizona solar,[35] multiplied by the total resource cost savings realized by enabling the RESOLVE model to include Arizona solar in the resource optimization ($977.3 million in present value of revenue requirement). Table 2, below, provides a summary of this calculation.

[32] *Id.* at pp. 13:12-14:6.
[33] *Id.* at p. 14, Table 8.
[34] *Id.* at p. 14, Table 9.
[35] *See* Table 1, above.

Table 2 : Capacity Benefit of TWL Based on Locational Renewables Cost Savings[36]

	Total Resource Cost Saving from RESOLVE due to AZ Solar (2016$, $MM)	Capacity Benefit @ 29.7% of Total (2016$, $MM)
Present Value of Revenue Requirement	$977.3	**$290.3**
Levelized Revenue Requirement	$58.2	**$17.3**

Under this approach, the Proposed Project produced a levelized annual capacity benefit of $17.3 million.

4. Discounting Capacity Benefits Due to Future Declines in Solar ELCC Values

The CAISO's capacity benefit calculations recognize the ELCC-based capacity value for solar resources will likely continue to decline in the future as more solar is added to the system, and post-sunset energy needs become more predominant. To account for this reduction in capacity value and future uncertainty, the CAISO discounted the capacity benefits calculated in Sections III.A.1 and III.A.2 by one-third, one-half, and two-thirds as the basis for its benefit-to-cost ratio calculations. Thus, the CAISO used ELCC values for solar of 9.3%, 7% and 4.7% in its benefit calculation based on the avoided cost of energy storage.[37]

These capacity benefit discounts are consistent with, and even conservative, compared to the Commission's solar ELCC assumptions that currently guide load serving entity procurement. In D.20-03-028, the Commission delegated to Commission staff the task of maintaining a Resource Data Template to assist individual load serving entities in preparing their individual integrated resource plans.[38] The Resource Data Template includes future year solar ELCC assumptions for load serving entities to use to estimate capacity contributions for their 2020 IRP filings. The solar ELCC values from the Resource Data Template for September are shown in

[36] Exhibit CAISO-02 (Yimer), p. 14, Table 9.
[37] *Id*. at p. 15:7-14. For supporting calculations, *see* Exhibit CAISO-01 (Zhang), pp. 10-13, Tables 4-7.
[38] D.20-03-028, p. 67.

Table 3, below. They show the ELCC values range from 14% in 2020 to 9% in 2030, which are generally higher than the discounted numbers the CAISO used.[39]

Table 3 : Solar ELCC Assumptions for September 46 MMT RSP Portfolio 2019 IRP Resource Data Template[40]

Year	Month	ELCC
2020	9	14%
2021	9	14%
2022	9	14%
2023	9	14%
2024	9	12%
2025	9	11%
2026	9	9%
2027	9	9%
2028	9	9%
2029	9	9%
2030	9	9%

By discounting the solar capacity values by one-third, one-half, and two-thirds, the CAISO's estimated solar capacity value are more conservative than those reflected in the Resource Data Template. After discounting, the CAISO's effective solar ELCC values range from 4.7% to 9.3%. Under these circumstances, the CAISO's capacity benefit calculations likely understate the economic value of the 969 MW of incremental deliverable Arizona solar capacity enabled by the Proposed Project.

In addition, the CAISO provided a supplemental capacity benefits assessment based on the cost savings associated with locating hybrid solar/storage resources in Arizona versus California. In that case, there was no need to discount the capacity benefit because it is based on locational cost difference and, unlike solar resources, the capacity value of hybrid solar/storage resources are not likely to decline as much over time.[41] This analysis shows that the Proposed Project could provide approximately $160 million in capacity benefits by taking advantage of

[39] Exhibit CAISO-02 (Yimer), p. 17:3-12.
[40] *Id.* at p. 12, Table 3.
[41] Exhibit CAISO-05 (Yimer, p. 22:3-7).

such locational cost savings for hybrid solar/storage resources.[42] This means the Proposed Project's capacity benefits could be greater than the CAISO estimated in its benefit-to-cost analysis, to the extent load serving entities procure hybrid solar/storage resources made deliverable by the Proposed Project. The capacity benefit of the Proposed Project calculated based on hybrid solar/storage resources would be far greater than the $75-$150 million range that the CAISO used in its benefit-to-cost calculations below.[43]

5. The Proposed Project Provides Substantial Production Cost Benefits Under Multiple Sensitivities.

The CAISO performed production cost modeling analysis consistent with the TEAM approach to quantify the production cost benefits associated with the Proposed Project under a baseline case and a high natural gas cost sensitivity. The CAISO's production cost simulation shows the Proposed Project helps to reduce congestion on lines or corridors supplying Southern California. Specifically, the Proposed Project reduces congestion on lines that parallel the Proposed Project. For example, the Proposed Project reduces congestion on the San Luis Rey to San Onofre 230 kV lines, an inter-tie between the San Diego Gas and Electric Company-owned system and the Southern California Edison Company-owned system, in the south to north direction. It also reduces congestion on Path 42 from the Imperial Irrigation District to the CAISO's Southern California Edison-owned system and on lines in the corridor between the desert southwest and California systems, in the east to west direction. Reducing congestion on these lines and corridors indicates the system dispatch will be more economic with the Proposed Project than without.[44]

The CAISO calculated the Proposed Project's production cost benefits from the CAISO ratepayer perspective, as required by TEAM. The ratepayer perspective focuses on the benefits that would accrue to the entities funding the upgrade, in this case, CAISO ratepayers.[45] The focus on CAISO ratepayer production cost benefits is appropriate and consistent with D.06-11-018, in which the Commission stated "[w]e agree that the perspective of CAISO ratepayers is of primary importance in the Commission's evaluation of a proposed transmission project, since it

[42] *Id.* at pp. 21-22, Table 3.
[43] *Id.* at p. 22:7-9.
[44] Exhibit CAISO-01 (Zhang), p. 4:3-16.
[45] *Id*. at p. 5:6-19.

reflects the effects on customers of the utilities within our jurisdiction."[46] The CAISO calculated ratepayer production cost benefits based the difference in net load payment (*i.e.*, net production costs payable by CAISO ratepayers) with and without the Proposed Project.

In conducting this analysis, the production cost model considers transmission and generator ownership to properly attribute costs and benefits to CAISO ratepayers. Certain transmission revenues and generator profits are counted as an offset to ratepayer net load payments because the underlying resources are owned (or contracted for) and operated on behalf of ratepayers *(i.e.*, utility-owned generation). Again, this calculation is consistent with the Commission's direction in D.06-11-018.[47]

Table 4, below, provides the CAISO's annual production cost benefits for the baseline study:

Table 4 : Baseline Study Annual Production Cost Benefits[48]

	Without Ten West ($M)	**With Ten West ($M)**	**Production Cost Benefits ($M)**
CAISO Load Payment	7,886.5	7,877.2	9.4
CAISO generator net revenue benefitting ratepayers	3,598.9	3,630.0	31.1
CAISO transmission revenue benefitting ratepayers	170.4	163.6	-6.9
CAISO Net payment	4,117.2	4,083.6	33.6

The baseline analysis shows annualized production cost savings to CAISO ratepayers of $33.6 million.

The CAISO conducted a separate production cost simulation using the preliminary California Energy Commission (CEC) natural gas price forecast in the 2019 Integrated Energy Policy Report (IEPR).[49] This preliminary forecast included higher natural gas prices in

[46] D.06-11-018, p. 35.
[47] D.06-11-018, p. 38. ("The energy benefits due to a transmission project consist of the net changes in consumer costs (consumer surplus), producer net income (producer surplus), and congestion revenues flowing to transmission owners or holders of transmission rights (transmission surplus). The sum of the changes in consumer surplus, producer surplus, and transmission surplus equals the change in energy production costs.")
[48] Exhibit CAISO-01, p. 6, Table 1.
[49] *Id.* at pp. 6:17-7:9.

California and decreased natural gas prices in other states, especially Arizona, compared to the 2018 IEPR forecast. Table 5, below, provides the annual production cost benefits for the sensitivity study:

Table 5 : 2019 IEPR Preliminary Forecast Sensitivity Annual Production Cost Benefits[50]

	Without Ten West ($M)	With Ten West ($M)	Production Cost Benefits ($M)
CAISO Load Payment	7,753.7	7,748.3	5.3
CAISO generator net revenue benefitting ratepayers	3,522.2	3,574.0	51.8
CAISO transmission revenue benefitting ratepayers	200.4	189.9	-10.5
CAISO Net payment	4,031.1	3,984.5	46.6

This sensitivity analysis shows increased annualized production cost savings to CAISO ratepayers compared to the baseline study, with $46.6 million in annualized benefits.

In summary, the CAISO's production cost modeling demonstrated significant reductions in congestion both within the CAISO and on transmission lines connecting the CAISO and the desert southwest. The annualized production cost savings ranged from $33.6 to $46.6. The CAISO then added these production cost savings to the capacity benefits calculated above to establish total project benefits.

6. The Proposed Project Benefits Exceed Estimated Project Costs.

The CAISO calculated Proposed Project benefit-to-cost ratios by adding the capacity benefits and the production cost savings detailed above and comparing them against updated project costs. The CAISO's updated cost estimate for the Proposed Project was based on information provided by DCRT. For the benefit-to-cost ratio calculation, the CAISO converted the DCRT-provided capital cost values into a present value of revenue requirement in 2018

[50] *Id.* at p. 7, Table 2.

dollars.[51] Table 6, below, shows the CAISO's calculation of project costs in 2018 dollars using a seven and five percent discount rate.

Table 6 : Updated Cost Estimates for the Proposed Project[52]

	Capital Cost ($M)	Present value based on 7% discount rate ($M)	Present value based on 5% discount rate ($M)
DCRT Provided Values (2021 dollars)	389	622	766
CAISO Benefit-to-Cost Ratio Values (2018 dollars)	365	584	720

The CAISO then converted the annualized capacity benefits and the production cost savings into present value of revenue requirements based on 2018 dollars. Table 7 provides the present value of production cost benefits using a seven and five percent discount rate.

Table 7 : Present Value of Production Costs Benefits[53]

	Present Value (in $M) 7% Discount Rate	Present Value (in $M) 5% Discount Rate
Baseline Study	496	644
2019 IEPR Gas Forecast Sensitivity	688	893

This table demonstrates the production cost benefits alone, without considering any capacity benefits, almost exceed total project costs in the baseline study, and the sensitivity study production cost benefits exceed total project costs before considering any capacity benefits.

The CAISO used the annualized capacity benefits from both the avoided cost of battery capacity methodology and the locational benefit savings approach discussed above to calculate the present value of capacity benefits. Table 8 provides a summary of the present value of capacity benefits under each approach.

[51] *Id*. at p. 8:5-7.
[52] *Id.* at p. 8, Table 3.
[53] *Id.* at pp. 10-11, data extracted from Tables 4 & 5.

Table 8: Total Present Value of Capacity Benefits[54]

	Present Value (in $M) 7% Discount Rate	Present Value (in $M) 5% Discount Rate
Avoided Cost of Battery Storage	536	696
Locational Renewable Cost Savings	266	346

The CAISO further discounted the capacity values to account for future uncertainty regarding the ELCC values for solar resources. To discount the capacity values appropriately, the CAISO multiplied the total present value of capacity benefits from Table 8 (above) by one-third, one-half, and two-thirds.

Table 9: Discounted Present Value of Capacity Benefits[55]

	Present Value (in $M) 7% Discount Rate			Present Value (in $M) 5% Discount Rate		
Capacity Discount for Solar ELCC Uncertainty	**33%**	**50%**	**66%**	**33%**	**50%**	**66%**
Avoided Cost of Battery Storage	179	268	357	232	348	464
Locational Renewable Cost Savings	89	133	178	115	173	230

The production cost savings from Table 8 together with the discounted capacity benefits from Table 9 must be combined to establish the total present value of benefits for the Proposed Project. Those total benefits are then compared with the total present value of project costs (from Table 8) to determine benefit-cost-ratios. Tables 10 through 11 below provide summaries of the total project benefits compared with project costs and the resulting benefit-to-cost ratios.

[54] *Id*. at pp. 10-13, data extracted from Tables 4 & 6.
[55] *Id*.

Table 10 : Benefit-to-Cost Ratios -- Avoided Costs of Battery Storage[56]

	Baseline Study Present Value (in $M) 7% Discount Rate			**Baseline Study Present Value (in $M) 5% Discount Rate**			**Sensitivity Study Present Value (in $M) 7% Discount Rate**			**Sensitivity Study Present Value (in $M) 5% Discount Rate**		
Production Savings	496			644			688			893		
Capacity Benefit (Discounted per table X)	179	268	357	232	348	464	179	268	357	232	348	464
Total Project Benefit	675	764	854	876	992	1,108	867	956	1,045	1,125	1,241	1,357
Total Project Cost	584			720			584			720		
Benefit-to-Cost Ratio	**1.16**	**1.31**	**1.46**	**1.22**	**1.38**	**1.54**	**1.48**	**1.64**	**1.79**	**1.56**	**1.72**	**1.89**

[56] *Id*. at pp. 10-13, data extracted from Tables 4 & 5.

Table 11: Benefit to Cost Ratios – Locational Capacity Savings[57]

	Baseline Study Present Value (in $M) 7% Discount Rate			Baseline Study Present Value (in $M) 5% Discount Rate			Sensitivity Study Present Value (in $M) 7% Discount Rate			Sensitivity Study Present Value (in $M) 5% Discount Rate		
Production Savings	496			644			688			893		
Capacity Benefit (Discounted per table X)	89	133	178	115	173	203	89	133	178	115	173	230
Total Project Benefit	585	629	674	759	817	874	777	821	866	1,008	1,066	1,124
Total Project Cost	584			720			584			720		
Benefit-to-Cost Ratio	**1.00**	**1.08**	**1.15**	**1.05**	**1.13**	**1.21**	**1.33**	**1.41**	**1.48**	**1.40**	**1.48**	**1.56**

The CAISO's analysis demonstrates the Proposed Project has a positive benefit-to-cost ratio using either the CAISO's baseline study or its 2019 IEPR natural gas sensitivity combined with any of the alternative capacity benefit calculations. The consistently positive benefit-to-cost ratios over a broad variety of potential scenarios is clear and strong evidence the Proposed Project will provide economic benefits to CAISO ratepayers. The Commission should approve the Proposed Project because it serves public convenience and necessity by providing ratepayers with sufficient and significant economic benefits.

B. The Proposed Project Provides Significant Reliability Benefits.

Although the CAISO initially approved the Proposed Project as an economic project with benefits exceeding its costs, it also provides significant reliability benefits. The CAISO identified reliability benefits in its initial documentation to its Board of Governors requesting

[57] *Id*. at pp. 10-13, data extracted from Tables 6 & 7.

approval of the Proposed Project. One of the Proposed Project's major reliability benefits is mitigating the existing Path 46 System Operating Limit, which qualifies as an Interconnection Reliability Operating Limit.[58] NERC reliability standards require the CAISO, as a registered Planning Authority, to have a documented methodology for developing System Operating Limits, including those that qualify as Interconnection Reliability Operating Limits.[59] The reliability standards also require CAISO to establish System Operating Limits, including Interconnection Reliability Operating Limits, for its Planning Authority Area that are consistent with its System Operating Limit Methodology.[60]

The CAISO identified only two multiple contingencies across its entire system that qualify as an Interconnection Reliability Operating Limit. These contingencies could lead to widespread instability, uncontrolled separation, or cascading outages that adversely impact the reliability of the Bulk Electric System. One of the multiple contingencies is the overlapping loss of Palo Verde–Colorado River and North Gila–Imperial Valley 500 kV transmission lines. These critical overlapping outages cause the existing Path 46 System Operating Limit (11,200 MW) to qualify as an Interconnection Reliability Operating Limit. If these contingencies occur while Path 46 is operating close to its System Operating Limit, the contingencies could lead to widespread instability, uncontrolled separation, or cascading outages that adversely impact the reliability of the Bulk Electric System unless transfers are reduced quickly enough after the initial contingency.[61]

Figures A and B, below, provide projected transfers on Path 46 in 2029 based on the CAISO's production cost modeling results without the Proposed Project for the CAISO baseline and sensitivity cases. The figures show there are a significant number of hours during which Path 46 is loaded close to or above its existing 11,200 MW System Operating Limit. If the Proposed Project does not proceed, overlapping contingencies during these periods could cause widespread reliability impacts arising from violation of an Interconnection Reliability Operating Limit.

[58] Exhibit CAISO-05, p. 28:4-6.
[59] *Id*. at p. 28:7-9.
[60] *Id*. at p. 28:9-12.
[61] *Id*. at pp. 28:16-29:9.

Figure A : Projected Path 46 Transfers without Ten West Link in the Baseline Case[62]

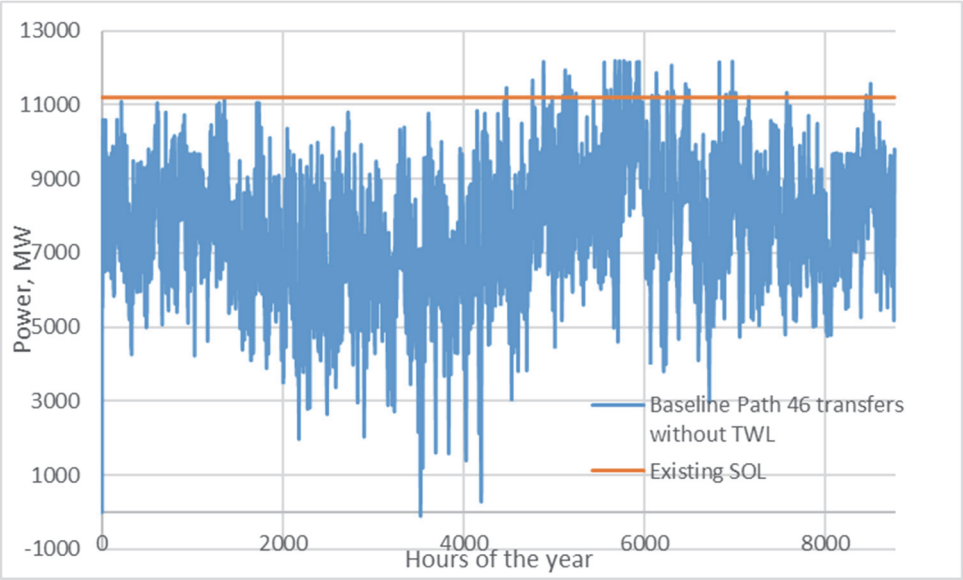
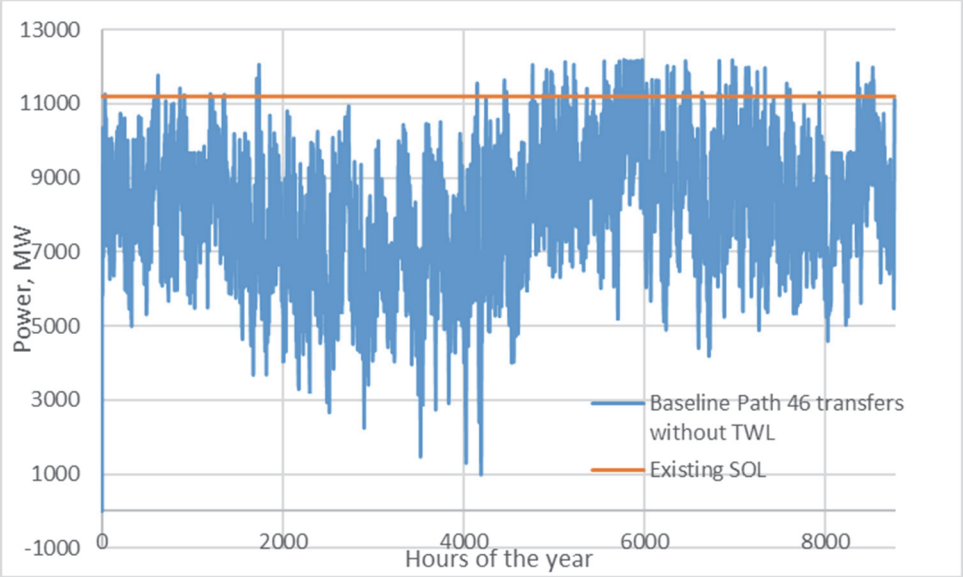


Figure B : Projected Path 46 Transfers without Ten West Link in the Sensitivity Case[63]



The Proposed Project creates a new 500 kV line that parallels the Palo Verde–Colorado River 500 kV line. As a result, it mitigates the reliability impacts of the loss of the Palo Verde–Colorado River 500 kV line, which is one of the most critical transmission lines in southern

[62] *Id*. at p. 30, Figure 3.
[63] *Id*. at p. 31, Figure 4.

California. As a result, the Proposed Project mitigates one of the Interconnection Reliability Operating Limits in the CAISO system that, if violated, could lead to widespread instability, uncontrolled separation, or cascading outages adversely affecting the reliability of the Bulk Electric System.[64]

IV. Conclusion

The Commission should approve DCRT's CPCN application to construct the Proposed Project as it will provide significant economic and reliability benefits to the CAISO grid and California ratepayers.

Respectfully submitted

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[64] *Id*. at p. 31:4-12.