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

REBUTTAL TESTIMONY OF YI ZHANG
ON BEHALF OF THE CALIFORNIA INDEPENDENT SYSTEM OPERATOR CORPORATION

June 18, 2020
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I. INTRODUCTION

Q1. Have you previously provided testimony in this proceeding?
A1. Yes, on December 20, 2019, I provided opening testimony supporting the need for Delaney-Colorado River Transmission, LLC’s (DCRT’s) Ten West Link 500 kV transmission project (Proposed Project). My educational and professional background and job responsibilities are detailed in my opening testimony.

Q2. What is the purpose of your rebuttal testimony?
A2. The purpose of my rebuttal testimony is to respond to certain assertions made by the California Public Advocates Office (Cal Advocates) in its opening testimony. Specifically, I address the following issues:
   (1) The scope of the CAISO’s production cost modeling (PCM) analyses conducted to assess Proposed Project benefits; and
   (2) Whether the Proposed Project maintains a benefit-to-cost ratio greater than 1.0 given the alternative capacity benefits calculated in Mr. Yimer’s concurrently filed rebuttal testimony.

Q3: Please summarize your rebuttal testimony.
A3: The CAISO’s PCM provides a robust analysis that used conservative planning assumptions and assessed a reasonable range of sensitivities. The CAISO’s PCM conducted for this proceeding is consistent with recent practice in the transmission planning process and provides a sufficient record demonstrating the Proposed Project’s production cost benefits.

In addition, my testimony shows that the Proposed Project maintains a positive benefit-to-cost ratio given the alternative capacity benefit calculations in Mr. Yimer’s rebuttal testimony. Mr. Yimer’s rebuttal testimony provides an alternative capacity benefit for the Proposed Project using the 2019 Integrated Resource Plan (IRP) battery storage
costs.\textsuperscript{1} I use this alternative capacity benefit calculation to provide an additional benefit-to-cost ratio analysis for the Proposed Project. This analysis shows that even with the alternative capacity benefit calculation using 2019 IRP battery storage costs the Proposed Project maintains a benefit-to-cost ratio greater than 1.0.

II. THE CAISO’S PCM PROVIDES A ROBUST ANALYSIS OF PROPOSED PROJECT BENEFITS.

Q4. Please respond to Cal Advocates’ assertion that the CAISO’s production cost modeling should have considered additional study years.

A4. The CAISO’s Transmission Plan provides guidance regarding how to establish select study years for economic modeling purposes. The Transmission Plan provides that:

The [CAISO] normally develops a database for the 10-year case as the primary case for congestion analysis and benefit calculation. The ISO may also develop an optional 5-year case for providing a data point in validating the benefit calculation of transmission upgrades by assessing a five year period of benefits before the 10-year case becomes relevant.\textsuperscript{2}

In recent transmission planning cycles, the CAISO used only a ten-year case to conduct its economic assessment. The value of a five-year case has diminished, mainly because the highly dynamic resource and environmental policies across the Western Interconnection system, not only in California, makes it difficult to have a robust five-year WECC wide production cost model. The CAISO’s PCM uses the WECC wide Anchor Dataset (ADS) PCM as the starting point, which only has the ten-year case. The ADS PCM development is a WECC wide two-year process that involves all planning regions and utilities across WECC.

Studying a case beyond ten years is also impractical because WECC only provides a ten-year ADS PCM. There is not a consistent starting point for doing such longer term study.

\textsuperscript{1} Rebuttal Testimony of Nebiyu Yimer on Behalf of the California Independent System Operator Corporation, A.16-10-012, June 18, 2020, Table 4, p. 20. (CAISO – Yimer Rebuttal Testimony)

\textsuperscript{2} CAISO Board Approved 2019-2020 Transmission Plan, p. 237. 
Q5. Do you agree with Cal Advocates’ assertion that using the CEC’s IEPR forecast natural gas prices results in overstating the economic benefits of the Proposed Project?

A5. No. Cal Advocates’ testimony states that the 2019 IEPR forecast for earlier years has larger differential in natural gas prices between Arizona and Southern California Gas hub than the forecast for later years. Cal Advocates’ testimony specifically compared the projected natural gas prices of Arizona Phoenix hub and Southern California hub. The projected natural gas price differential between Arizona Phoenix hub and Southern California in 2028 is $1.13/MMBtu (=$4.01 - $2.88), which would drop to $0.58/MMBtu (=4.33-$3.74) in 2055. Because of that, Cal Advocates’ testimony claims that using the 2019 IEPR natural gas price forecast from earlier years overstated the value of the Proposed Project.

As explained in opening testimony, the CAISO used the CEC 2018 IEPR natural gas price forecast for its baseline PCM analysis. The CAISO also presented a sensitivity PCM analysis using the CEC 2019 preliminary IEPR natural gas price forecast. Table 1 below shows the natural gas price differentials in the CAISO baseline PCM. Specifically, Table 1 shows baseline PCM monthly natural gas prices for Arizona South—which represents the Arizona Phoenix natural gas hub—and Southern California in the CAISO’s baseline PCM.

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4 Cal Advocates Opening Testimony, p. 2-29, line 6.

Table 1 shows a price differential between Arizona South and Southern California between $0.581 to 0.597, which is very similar to the lower end of the price differential referenced in the Cal Advocates’ testimony. Therefore, the CAISO’s baseline PCM assessed the scenario with a relatively small natural gas price differential, consistent with Cal Advocates’ recommendation. The CAISO also presented a sensitivity PCM analysis with a relatively large natural gas price differential between Arizona and Southern California, which was consistent with the CEC 2019 IEPR natural gas forecast. That scenario represents a reasonable upper bound for natural gas price differentials between Southern California and Arizona.

Together, the CAISO’s baseline and sensitivity PCM studies covered a wide and reasonable range of natural gas price differentials between Arizona and Southern California, and both demonstrated benefit of the Proposed Project greater than its total cost.

Q6. Please address Cal Advocates’ argument economic analyses presented by the Applicant and the CAISO are inconsistent.

A6. Cal Advocates state benefit analyses conducted by DCR Transmission, LLC (Applicant) and CAISO are inconsistent. Specifically, Cal Advocates provides the following comparison of benefit categories in Table 2

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6 Cal Advocates testimony shows a $0.58 price differential in 2055. See Cal Advocates Opening Testimony, p. 2-29, lines 1-3.
7 CAISO – Zhang Opening Testimony, Table 3 - Table 7, pp. 8-13.
Table 2:
Cal Advocates’ Comparison of the Proposed Project’s Benefit Categories

<table>
<thead>
<tr>
<th>Benefit Category</th>
<th>CAISO</th>
<th>Applicant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate Accounting of Renewable Curtailments</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Benefit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate Calculation of Transmission Energy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Losses Reduction Benefit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separate Calculation of RPS Procurement Benefit</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Capacity Benefit Attributed to Proposed Project</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

The first two categories (i.e. the renewable curtailment benefit and transmission energy loss reduction benefit) are production cost modeling benefits. Generally speaking, the CAISO’s Transmission Economic Assessment Methodology (TEAM) provides a framework to assess production cost benefits. The full equation used to calculate these benefits is reproduced below.

\[
\text{Net load payment} = \text{ISO’s Gross load payment} - \text{ISO’s Generator profit} - \text{ISO’s Transmission revenue}
\]

\[
\text{Gross load payment} = \sum (\text{Load} \times \text{LMP})
\]

\[
\text{Generator profit} = \sum (\text{Generator revenue} - \text{Generator cost})
\]

\[
\text{Transmission revenue} = \sum (\text{Congestion cost} + \text{Export wheeling cost})
\]

The difference in the “net load payment” in cases with and without the Proposed Project represents the total production cost benefit in the CAISO’s analysis. Though the same general principles are followed in production cost modeling studies, individual studies may calculate production cost benefits differently based on the actual production cost.

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8 Cal Advocates Opening Testimony, Table 5, p. 2-21.
simulation tool used. For example, the transmission losses and the savings associated
with the reduction of transmission losses are calculated differently in the CAISO’s model
versus the Applicant’s model based on the actual production cost simulation software. In
the CAISO’s model, ABB GridView, software calculates transmission losses within the
simulation. In contrast, the Applicant’s modeling software requires a separate calculation
to fully capture transmission losses. Thus, in the CAISO’s study, transmission losses and
related energy saving benefits are inherent in the model run, and do not need to be
calculated separately.

Further, unlike the Applicant’s study, the CAISO’s study does not require a separate
calculation of renewable curtailment benefit separately. ABB Gridview provides the
generator net revenue including renewables, which is the generation revenue minus the
generation cost. The CAISO’s model uses the Gridview results to calculate the changes
of generator net revenue benefiting ratepayers, which is a part of the ratepayer’s benefit
in the benefit calculation.10

Q7. Does the CAISO believe the production benefits of the Proposed Project will
drastically change with the new RSP as Cal Advocates claims?

A7. The CAISO does not expect that the production benefits of the Proposed Project will
drastically change if the new RSP11 is used as the production cost modeling base case.

The new RSP includes a similar amount of renewable resources delivered at the Arizona-
California border and along the Sunrise/SWPL corridor. In addition to the 2,352 MW of
Arizona Solar, the current RSP includes 606 MW of New Mexico Wind delivered at Palo
Verde, which brings the total resource amount delivered at the Arizona-California border
to 2,958 MW. Compared with the resource assumption in the CAISO’s PCM, the new
RSP also includes incremental resources delivered at the Imperial Valley/Ocotillo (548
MW solar) and East County (600 MW wind), whose impact on congestion on

10 CAISO – Zhang Opening Testimony, Table 1 - Table 2, pp 6-7.
11 https://caenergy.databasin.org/documents/documents/b90faf47be4045a398171a5cfac51b87/
Sunrise/SWPL corridor and its downstream system is similar to the generators at Hoodoo Wash. The total amount of renewable resources in these areas discussed above are about 4512 MW, which is even higher than the 3,364 MW of renewable resources delivered at Arizona-California border in the CAISO’s PCM analysis.

As a result, the CAISO expects the production benefits of the Proposed Project will not drastically change as claimed in Cal Advocates’ testimony.

III. THE PROPOSED PROJECT MAINTAINS A BENEFIT-TO-COST RATIO GREATER THAN 1.0 EVEN CONSIDERING ALTERNATIVE BATTERY STORAGE COSTS TO CALCULATE CAPACITY BENEFITS.

Q8. Did the CAISO conduct any updated benefit-to-cost ratio analysis for this rebuttal testimony?

A8. Yes, the CAISO re-calculated benefit-to-cost ratios based on updated battery storage costs from the 2019 IRP. Mr. Yimer’s testimony addresses the CAISO’s treatment of battery storage costs and provides evidence that the CAISO’s opening testimony uses reasonable battery capacity cost to calculate the Proposed Project’s capacity benefits. However, Mr. Yimer also provides an alternative capacity benefit based on a thorough review of battery capacity cost estimates.12

To further assess the robustness of the CAISO’s benefit-to-cost ratio results, I used the alternative capacity benefit in Mr. Yimer’s rebuttal testimony to re-calculate the Proposed Project’s benefit-to-cost ratio. Table 3 and Table 4 show this re-calculated benefit-to-cost ratio based on CAISO’s baseline and 2019 IEPR preliminary forecast sensitivity scenarios. All benefit and cost values are in 2018 real dollars, which is consistent with the CAISO’s opening testimony.13 To consider potential future reductions in solar resource adequacy capacity, Table 3 and Table 4 provide benefit-to-cost ratios with

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12 CAISO – Yimer Rebuttal Testimony, Table 4, p. 20.
13 CAISO – Zhang Opening Testimony, p. 9, line 16
discounted capacity benefits that are consistent with the CAISO’s opening testimony. The CAISO reduced capacity benefits by two-thirds, one-half, and one-third.\footnote{Id, p. 9, lines 1-4}

Table 3
Baseline Study Benefit-to-Cost Ratio Calculation
Capacity Benefit Based on Avoided Battery Storage Costs – with lower battery storage cost

<table>
<thead>
<tr>
<th>Capital cost ($M)</th>
<th>365</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production cost benefit ($M/year)</td>
<td>34</td>
</tr>
<tr>
<td>Capacity benefit ($M/year)</td>
<td>24</td>
</tr>
<tr>
<td>Total cost (Revenue requirement) ($M)</td>
<td>584</td>
</tr>
<tr>
<td>Present Value of Production cost benefit ($M)</td>
<td>496</td>
</tr>
<tr>
<td>Present Value of Capacity benefit ($M)</td>
<td>348</td>
</tr>
<tr>
<td>Capacity benefit discount level</td>
<td>33%</td>
</tr>
<tr>
<td>Discounted Present Value of Capacity benefit ($M)</td>
<td>116</td>
</tr>
<tr>
<td>Total benefit ($M)</td>
<td>612</td>
</tr>
<tr>
<td>Benefit-to-cost ratio</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Table 4
2019 IEPR Preliminary Forecast Sensitivity Benefit-to-Cost Ratio Calculation
Capacity Benefit Based on Avoided Battery Storage Cost – with lower battery storage cost

<table>
<thead>
<tr>
<th>Capital cost ($M)</th>
<th>365</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production cost benefit ($M/year)</td>
<td>47</td>
</tr>
<tr>
<td>Capacity benefit ($M/year)</td>
<td>24</td>
</tr>
<tr>
<td>Total cost (Revenue requirement) ($M)</td>
<td>584</td>
</tr>
<tr>
<td>Present Value of Production cost benefit ($M)</td>
<td>688</td>
</tr>
<tr>
<td>Present Value of Capacity benefit ($M)</td>
<td>348</td>
</tr>
<tr>
<td>Capacity benefit discount level</td>
<td>33%</td>
</tr>
<tr>
<td>Discounted Present Value of Capacity benefit ($M)</td>
<td>116</td>
</tr>
<tr>
<td>Total benefit ($M)</td>
<td>804</td>
</tr>
<tr>
<td>Benefit-to-cost ratio</td>
<td>1.38</td>
</tr>
</tbody>
</table>
Table 3 and Table 4 show that the benefit-to-cost ratios remain higher than 1.0 for all scenarios even with the lower capacity benefits. This confirms that any potential variation of the battery storage cost does not change the CAISO’s conclusion that the Proposed Project’s total benefits outweigh its costs.

IV. CONCLUSION

Q9. Please summarize your recommendations.

A9. The CAISO’s recommendations remains the same. The CAISO’s analysis demonstrates the Proposed Project continues to show benefits in excess of project costs under a variety of different sensitivities and capacity valuation approaches.

Q10. Does this conclude your testimony?

A10. Yes, it does.