

Application No.: 16-10-012
Exhibit No.: _____
Witness: Yi Zhang
ALJ: MacDonald
Commissioner: Randolph

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

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1 costs.¹ I use this alternative capacity benefit calculation to provide an additional benefit-
2 to-cost ratio analysis for the Proposed Project. This analysis shows that even with the
3 alternative capacity benefit calculation using 2019 IRP battery storage costs the Proposed
4 Project maintains a benefit-to-cost ratio greater than 1.0.

5
6 **II. THE CAISO’S PCM PROVIDES A ROBUST ANALYSIS OF PROPOSED**
7 **PROJECT BENEFITS.**

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

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

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

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

25
26 Studying a case beyond ten years is also impractical because WECC only provides a ten-
27 year ADS PCM. There is not a consistent starting point for doing such longer term study.

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)

² CAISO Board Approved 2019-2020 Transmission Plan, p. 237.

<http://www.caiso.com/Documents/ISOBoardApproved-2019-2020TransmissionPlan.pdf>

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1 **Q5. Do you agree with Cal Advocates’ assertion that using the CEC’s IEPR forecast**
2 **natural gas prices results in overstating the economic benefits of the Proposed**
3 **Project?**

4 A5. No. Cal Advocates’ testimony states that the 2019 IEPR forecast for earlier years has
5 larger differential in natural gas prices between Arizona and Southern California Gas hub
6 than the forecast for later years. Cal Advocates’ testimony specifically compared the
7 projected natural gas prices of Arizona Phoenix hub and Southern California hub. The
8 projected natural gas price differential between Arizona Phoenix hub and Southern
9 California in 2028 is \$1.13/MMBtu (= \$4.01 - \$2.88), which would drop to \$0.58/MMBtu
10 (= \$4.33 - \$3.74) in 2055³. Because of that, Cal Advocates’ testimony claims that using the
11 2019 IEPR natural gas price forecast from earlier years overstated the value of the
12 Proposed Project⁴.

13
14 As explained in opening testimony,⁵ the CAISO used the CEC 2018 IEPR natural gas
15 price forecast for its baseline PCM analysis. The CAISO also presented a sensitivity
16 PCM analysis using the CEC 2019 preliminary IEPR natural gas price forecast. Table 1
17 below shows the natural gas price differentials in the CAISO baseline PCM.
18 Specifically, Table 1 shows baseline PCM monthly natural gas prices for Arizona
19 South—which represents the Arizona Phoenix natural gas hub—and Southern California
20 in the CAISO’s baseline PCM.

21

³ *Opening Testimony for the Application of DCR Transmission, LLC for a Certificate of Public Convenience and Necessity for the Ten West Link Project*, A.16-10-012, May 13, 2020, p. 2-29, lines 1-3. (Cal Advocates Opening Testimony)

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

⁵ *Testimony of Yi Zhang on Behalf of the California Independent System Operator Corporation*, A.16-10-012, December 20, 2019, pp. 6-7. (CAISO – Zhang Opening Testimony)

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**Table 1
Natural Gas prices modeled in the CAISO’s PCM**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NG_CA SoCalGas	4.6798	4.675	4.1418	4.1256	4.2288	4.4975	4.5689	4.4194	4.4302	4.2693	4.2314	4.6015
NG_AZ South	4.0821	4.0775	3.5603	3.5446	3.6447	3.9053	3.9746	3.8296	3.84	3.6839	3.6472	4.0062
Diff	0.5977	0.5975	0.5815	0.581	0.5841	0.5922	0.5943	0.5898	0.5902	0.5854	0.5842	0.5953

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.⁶ 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.⁷

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

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.

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**Table 2:
Cal Advocates' Comparison of the Proposed Project's Benefit Categories⁸**

Benefit Category	CAISO	Applicant
Separate Accounting of Renewable Curtailments Benefit	No	Yes
Separate Calculation of Transmission Energy Losses Reduction Benefit	No	Yes
Separate Calculation of RPS Procurement Benefit	No	Yes
Capacity Benefit Attributed to Proposed Project	Yes	No

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 below⁹

$$\text{Net load payment} = \text{ISO's Gross load payment} - \text{ISO's Generator profit} - \text{ISO's Transmission revenue}$$

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

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

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

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

⁸ Cal Advocates Opening Testimony, Table 5, p. 2-21.

⁹ CAISO TEAM document Nov. 2, 2017, p. 20.

http://www.caiso.com/Documents/TransmissionEconomicAssessmentMethodology-Nov2_2017.pdf

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

9
10 Further, unlike the Applicant's study, the CAISO's study does not require a separate
11 calculation of renewable curtailment benefit separately. ABB GridView provides the
12 generator net revenue including renewables, which is the generation revenue minus the
13 generation cost. The CAISO's model uses the GridView results to calculate the changes
14 of generator net revenue benefiting ratepayers, which is a part of the ratepayer's benefit
15 in the benefit calculation.¹⁰

16
17 **Q7. Does the CAISO believe the production benefits of the Proposed Project will**
18 **drastically change with the new RSP as Cal Advocates claims?**

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

21
22 The new RSP includes a similar amount of renewable resources delivered at the Arizona-
23 California border and along the Sunrise/SWPL corridor. In addition to the 2,352 MW of
24 Arizona Solar, the current RSP includes 606 MW of New Mexico Wind delivered at Palo
25 Verde, which brings the total resource amount delivered at the Arizona-California border
26 to 2,958 MW. Compared with the resource assumption in the CAISO's PCM, the new
27 RSP also includes incremental resources delivered at the Imperial Valley/Ocotillo (548
28 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/>

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1 Sunrise/SWPL corridor and its downstream system is similar to the generators at Hoodoo
2 Wash. The total amount of renewable resources in these areas discussed above are about
3 4512 MW, which is even higher than the 3,364 MW of renewable resources delivered at
4 Arizona-California border in the CAISO’s PCM analysis.

5
6 As a result, the CAISO expects the production benefits of the Proposed Project will not
7 drastically change as claimed in Cal Advocates’ testimony.

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

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

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

19
20 To further assess the robustness of the CAISO’s benefit-to-cost ratio results, I used the
21 alternative capacity benefit in Mr. Yimer’s rebuttal testimony to re-calculate the Proposed
22 Project’s benefit-to-cost ratio. Table 3 and Table 4 show this re-calculated benefit-to-
23 cost ratio based on CAISO’s baseline and 2019 IEPR preliminary forecast sensitivity
24 scenarios. All benefit and cost values are in 2018 real dollars, which is consistent with
25 the CAISO’s opening testimony.¹³ To consider potential future reductions in solar
26 resource adequacy capacity, Table 3 and Table 4 provide benefit-to-cost ratios with

¹² CAISO – Yimer Rebuttal Testimony, Table 4, p. 20.

¹³ CAISO – Zhang Opening Testimony, p. 9, line 16

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1 discounted capacity benefits that are consistent with the CAISO’s opening testimony.
2 The CAISO reduced capacity benefits by two-thirds, one-half, and one-third.¹⁴

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

Capital cost (\$M)	365					
Production cost benefit (\$M/year)	34					
Capacity benefit (\$M/year)	24					
	7% discount rate			5% discount rate		
Total cost (Revenue requirement) (\$M)	584			720		
Present Value of Production cost benefit (\$M)	496			644		
Present Value of Capacity benefit (\$M)	348			452		
Capacity benefit discount level	33%	50%	66%	33%	50%	66%
Discounted Present Value of Capacity benefit (\$M)	116	174	232	151	226	301
Total benefit (\$M)	612	670	728	795	870	945
Benefit-to-cost ratio	1.05	1.15	1.25	1.10	1.21	1.31

**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**

Capital cost (\$M)	365					
Production cost benefit (\$M/year)	47					
Capacity benefit (\$M/year)	24					
	7% discount rate			5% discount rate		
Total cost (Revenue requirement) (\$M)	584			720		
Present Value of Production cost benefit (\$M)	688			893		
Present Value of Capacity benefit (\$M)	348			452		
Capacity benefit discount level	33%	50%	66%	33%	50%	66%
Discounted Present Value of Capacity benefit (\$M)	116	174	232	151	226	301
Total benefit (\$M)	804	862	920	1,044	1,119	1,194
Benefit-to-cost ratio	1.38	1.48	1.58	1.45	1.55	1.66

¹⁴ *Id.*, p. 9, lines 1-4

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1 Table 3 and Table 4 show that the benefit-to-cost ratios remain higher than 1.0 for all
2 scenarios even with the lower capacity benefits. This confirms that any potential
3 variation of the battery storage cost does not change the CAISO's conclusion that the
4 Proposed Project's total benefits outweigh its costs.

5
6 **IV. CONCLUSION**

7 **Q9. Please summarize your recommendations.**

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

11
12 **Q10. Does this conclude your testimony?**

13 **A10.** Yes, it does.