3/11/2021

California Independent System Operator

250 Outcropping Way, Folsom, CA 95630

CAISO Transmission Planning:

Vistra Corp. respectfully submits these comments on the CAISO's 2021-2022 Transmission Planning Process ("TPP") Draft Study Plan posted on February 18, 2021 and discussed at a stakeholder call on February 25, 2021.

Model Battery Energy Storage by Use Case

Vistra submitted comments to the CAISO's 2020-2021 Transmission Planning Process ("TPP") Preliminary Policy & Economic Assessment results raising areas for improvement in the production cost simulation (PCM) that would benefit from additional review and improvements by the CAISO. We raised that storage developers build energy storage resources to meet different use cases generally among three major types where the logic differs for when the resource would charge or discharge. We provide an explanation of co-located storage operations, use-limited stand-alone storage only providing ancillary services, and stand-alone storage performing energy arbitrage and ancillary service provision. The PCM should ideally adopt modeling parameters that are aligned with the expected business use. Please see our comments at http://www.caiso.com/Documents/VistraComments-2020-2021TransmissionPlanningProcess-Nov172020StakeholderCall.pdf.

Improvements to Battery Energy Storage Replacement Cost Estimate

Vistra analyzed the CAISO's approach for estimating storage replacement incremental costs currently in use and has several recommendations. In the 2019-2020 Transmission Planning Process Stakeholder Meeting in September 2019 the CAISO proposed to incorporate the flat average cost for each MWh in the PCM for storage. The CAISO acknowledged that "Further refinement to the approach and parameters of modeling these characteristics of batteries will be continued in future planning cycles".

Vistra requests the 2021-2022 TPP cycle revisit and adopt refinements to the approach as this is the appropriate, needed time do so with practical experience and improved information. Vistra proposes recommended changes to (1) update replacement cost estimate with 2020 study value highlighted below in yellow and (2) update Depth of Discharge input highlighted below in green, as described below.

CAISO Approach			
Average Cost Approach to Replacement Costs (Status Quo)			
Input	**Value**	**UOM**	**Source**
Replacement Cost	189,000	$/MWh	From HydroWires DOE 2019
Cycle Life	3,500	cycles	From HydroWires DOE 2019
DOD	80%	%	From HydroWires DOE 2019
Life	10	Year	From HydroWires DOE 2019
Denominator @ 2 input	2		CAISO
Status Quo	$ 33.75	$/MWh	

We submit the following recommendations.

1. *Use updated studies that go beyond 2025:* In the September 2019 meeting the CAISO raised that updates to the inputs used in this formula would be used if, for example, forecast for future years become available. One of the major authors of the HydroWires report that is used by the CAISO to calculate the $/MWh value is Pacific Northwest National Laboratory (PNNL). PNNL published an updated report, 2020 Grid Energy Storage Technology Cost and Performance Assessment[1], in December 2020 that expands the forecasts to 2030 and revises its analysis based on more recent and accurate information. In the PNNL 2020 study, for the year 2030 the 400 MWh storage block cost has been revised to $99,000/MWh, shown in the table below in yellow blocks. We request the CAISO explore more recent research and propose updated cost values that are applicable beyond 2025 for 2030. For example, we illustrate the change in flat average replacement costs using the PNNL's study installed cost estimate to more accurately estimate current expectations of replacement costs:

CAISO Approach updated for PNNL 2020 Values			
Average Cost Approach to Replacement Costs			
Input	**Value**	**UOM**	**Source**
Replacement Cost	99,000	$/MWh	From PNNL 2020
Cycle Life	3,500	cycles	From PNNL 2020
DOD	80%	%	From PNNL 2020
Life	10	Year	From PNNL 2020
Denominator @ 2 input	2		CAISO

	Replacement Costs	
Status Quo	$	33.75
W/ PNNL 2020 values	$	17.68

2. *Depth of Discharge should be 100%:* All the operating and cost parameters are interrelated to forecasting at what point in time the replacement cost is expected to be incurred. The CAISO 2019 presentation stated, "Dispatchable energy of batteries needs to be modeled to be less than the energy capacity due to the depth of discharge (DoD, or cycle depth)"[2]. In our experience, we do not agree that the Master File registered maximum capacity (Pmax) should be adjusted with Depth of Discharge below 100%. The ability to reliably deliver the Pmax is a function of how the battery asset as a whole is built. For instance, Vistra is bringing online a battery energy storage asset made up of three resources that together have 1200 MWh of capacity value at 100% DOD, we believe this technical ability is available to any project. We illustrate the improvement to replacement cost estimate below:

CAISO Approach updated for PNNL 2020 Values & 100% DOD			
Average Cost Approach to Replacement Costs			
Input	**Value**	**UOM**	**Source**
Replacement Cost	99,000	$/MWh	From PNNL 2020
Cycle Life	3,500	cycles	From PNNL 2020
DOD	100%	%	From PNNL 2020
Life	10	Year	From PNNL 2020
Denominator @ 2 input	2		CAISO

	Replacement Costs	
Status Quo	$	33.75
W/ PNNL 2020 values	$	17.68
W/ PNNL 2020 values & 100% DOD	$	14.14

[1] HydroWires, Department of Energy, July 2019, page viii, https://www.pnnl.gov/sites/default/files/media/file/Final%20-%20ESGC%20Cost%20Performance%20Report%2012-11-2020.pdf.
[2] Transmission Planning Process Meeting September 2019, CAISO, slide 20, http://www.caiso.com/Documents/Day1-Presentations-2019-2020TransmissionPlanningProcessMeeting-Sep25-26.pdf.

By adopting these two recommendations the CAISO can greatly improve the accuracy of what its current approach is intending to estimate – current expectations of replacement costs as function of expected operations. The updated cost estimate at ~$14/MWh is more in line with industry expectations than the existing approach. We respectfully urge the CAISO to update the replacement cost estimate accordingly to better represent battery economics in this TPP cycle.

Updating Variable O&M Parameters

Vistra understands that CAISO uses the operating parameters and Variable Operations and Maintenance adders from the PCM Anchor Data Set 2030 version 1.0 released by WECC on June 30, 2020. Vistra has observed that certain Variable Operations & Maintenance adders in the WECC Anchor Data Set are meaningfully different than Master File and CAISO default O&M values. We request the CAISO review the O&M adders by technology type to confirm the validity of these values. Using either the registered or as bid values would more accurately represent operational reality. If the CAISO modelling approach can only support the default O&M adders, we request the CAISO revise the values it is using for the O&M adders as shown in the Market Instruments BPM in Exhibit 4-2, Default O&M Cost Adders.

Exhibit 4-2: Default O&M Cost Adders effective April 1, 2012 ($/MWh)

Generation Technology	Recommended VOM Cost Adder ($/MWh)
Solar	$0.00
Nuclear	$1.00
Coal	$2.00
Wind	$2.00
Hydro	$2.50
Combined Cycle and Steam	$2.80
Geothermal	$3.00
Landfill Gas	$4.00
Combustion Turbine & Reciprocating Engine	$4.80
Biomass	$5.00

Resource Operating and Cost Parameter Improvements

Vistra has observed that there may be inconsistencies between a generation unit's actual operating characteristics as registered in Master File and the operating and cost parameters included in the WECC Anchor Data Set. For example, minimum operating capacity values, minimum on time, minimum off time, and proxy cost values appear to be disconnected from registered or as bid values. We request the CAISO review the source data and confirm the basis for the values used in the WECC Anchor Data Set. If CAISO also identifies these inconsistences, Vistra requests that the CAISO pursue updates to the data sets to improve accuracy of inputs driving model outcomes.

Modelling Line Rating Recommendations

Vistra has observed transmission line ratings in the Transmission Planning Process models where the line ratings are established at higher transmission line ratings than we frequently see in operations. In some cases, the dynamic line ratings observed for normal rating and emergency rating for operations are meaningfully short of the high-end values that we believe the CAISO is using to model the system. Vistra requests that the CAISO model line rating values that are consistent with seasonal dynamic line ratings used in operations. This will more accurately represent reality in the models and allow the CAISO to better identify needed transmission upgrades.

Sincerely,

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