Energy Storage and Distributed Energy Resources Phase 4 - Stakeholder Comments

Submitted by	Company	Date Submitted
Beverly Brereton beverly.a.brereton@sce.com	Southern California Edison	9/4/2019

Southern California Edison (SCE) offers the following comments on the California Independent System Operator's (CAISO) Energy Storage and Distributed Energy Resources Phase 4 (ESDER 4) Straw Proposal[1] presented on August 21, 2019.

SCE offers comments in relation to the following:

- Multiple Use Applications
  - Load forecast adjustment
  - Settlement for behind-the-meter (BTM) resources
- Energy Storage
  - Default Energy Bid Calculation and Cycle Aging Cost
- Variable Output Demand Response (DR)
  - Resource Adequacy (RA) counting and variable DR capability
  - Declaring variable DR operation capability

Multiple Use Applications

Load Forecasting Adjustment

Absent communication and data collection protocols and infrastructure between Load Serving Entities (LSEs) and operators of BTM resources, LSEs are unable to account for the activities of BTM resources in the development of their net load forecasts for the ISO. The communication and data collection protocols and infrastructure needed for the real-time operations of these resources require attention and development to support data collection and communication requirements necessary for better forecasting of net load and settlement of the activities of the BTM resources.

SCE notes that resolving this issue is not as simple as the provision of data and protocols to share that data. In order to effectuate the use of energy (both consumption and generation) from behind the meter devices that at times will be wholesale and at times retail resources will require coordination of multiple rule sets across multiple jurisdictions. In addition, it is no longer the simple accumulation of energy consumption or generation data itself but the intent to utilize part or all of that consumption or generation for retail or wholesale purposes. The introduction of this additional variable creates new challenges in the ability to forecast as well as settle. In addition, this variable is not something that can

[1] http://www.caiso.com/Documents/Presentation-EnergyStorage-DistributedEnergyResourcesPhase4WorkingGroup-Aug21-2019.pdf

simply be read off of a meter as it is a choice about the service that the meter is providing at any given moment in time. Once one moves off of the use of a behind the meter battery as being always a retail or always a wholesale device, the complexity of forecasting and settling expands significantly.

Based upon this, SCE believes that this stakeholder activity must be coordinated closely with the CPUC and other local regulatory authorities to ensure that any tariff changes presented to the FERC can be accommodated not only by the CAISO and the market participant but also within the local jurisdiction, the LSE for the load, and the scheduling coordinator for the resource within both the wholesale and retail environment.

The coordination of all of these elements is critical to the success of a multiple use application.

Settlement Process for BTM Resources

Customers connected to the distribution grid are not usually equipped with settlement quality meters that the ISO requires of market participants in the wholesale market. Further, although pumped storage resources are equipped with meters that account for the injection and withdrawal of power from the transmission grid, the activities of BTM storage resources are anticipated to be quite different. BTM resources expect access to the wholesale and retail markets in a way that no other resource participates today.

As a result, current metering arrangements in the wholesale and retail markets do not facilitate independent accounting for wholesale and retail transactions by BTM resources. As operators of BTM resources make the decision to participate in the wholesale and retail markets, there are jurisdictional issues that require attention by the Local Regulatory Authority. These are:

- Should there be a demarcation of the hours when BTM resources can or cannot operate in specific modes within the wholesale and retail market? Can simultaneous provision of services in the wholesale and retail markets be accommodated?
- Is there any energy management system that can separate wholesale from retail operations in real-time? If yes, what protocols can be developed to ensure independent operations and settlement?
- Who owns and controls the meter and meter data from which wholesale and retail transaction data will be collected?
- How does the CAISO and the retail provider account for the use in both wholesale and retail space when such participation is a choice variable rather than metered data?

At the federal level, there are some issues that still require resolution:

- If simultaneous provision of wholesale and retail services is possible for BTM resources, how will FERC ensure that any decisions made about market participation will not restrict resource participation in the retail market?
- If a common meter is used for wholesale and retail transactions, can independent decision-making by the regulatory bodies preserve or improve the level of participation in wholesale and/or retail markets?

These are examples of questions for which answers must be sought albeit challenging at this nascent state of BTM resource participation in wholesale and retail markets. These challenges are likely made

even more difficult if BTM resources are allowed to participate in both the wholesale and retail environment in the same interval. For such situations, there would need to be procedures to handle deviations in order to allocate such deviations to the appropriate wholesale or retail function.

SCE looks forward to continued discussion in this area and recognizes that the answers will not be easy and will not likely be instantaneous either. None-the-less, SCE will continue working with the CAISO and all stakeholders to develop this important topic.

Energy Storage – Cycle Aging Cost and the Default Energy Bid Calculation

SCE commends the CAISO for proposing two approaches to the calculation of cycle depth for energy storage resources. The approaches seek to incorporate the latest academic research in this area through the Xu et al paper[2]. SCE notes that the CAISO's assumptions seem largely consistent with the paper and observes that the CAISO's assumption of discharge cost and cycle cost expressions seem reasonable. Thus, the driver being the resource's depth of discharge or state of charge is the determinant of cycle depth. However, SCE cautions the CAISO to test for robustness on the California fleet given that the paper produces results for a hypothetical battery within ISO-NE's energy market.

SCE recommends that the CAISO's proposed functional forms be examined in more detail such that the presence of individual constituent variables be justified. SCE also notes that no economic rationale was provided for the different values of the constant, ρ, which acts as a multiplier in the approaches the CAISO proposes. Further, there are some inconsistencies in the expressions provided for cycle depth. Typically, an energy storage resource's cycle depth is expressed as a percentage or as a value between 0 and 1. The expressions provided on pages 33 and 36 of the CAISO's presentation[3] do not yield such a result.

As a result, SCE proposes an alternative that resolves the defects of the approaches. Xu et al[4] provide a simplified approach to the calculation of an energy storage resource's cycle depth as follows:

$$cd_{i,t} = \left(\frac{1}{\pi_i C_i} \times P_{i,t}\right) + cd_{i,t-1} \qquad (1)$$

where

i - index for the resource

n – index for the dispatch interval within the hour

t – index for the hour

[2] https://arxiv.org/pdf/1707.04567.pdf

[3] http://www.caiso.com/Documents/Presentation-EnergyStorage-DistributedEnergyResourcesPhase4WorkingGroup-Aug21-2019.pdf

[4] Bolun Xu, Jinye Zhou, Tongxin Zheng, Eugene Litvinov, Daniel S. Kirschen (2018). Factoring the Cycle Aging Cost of Batteries Participating in Electricity Markets, IEEE *Transactions on Power Systems*, Volume 33, Issue 2, p.2248-2259.

cd – cycle depth (%)

π – discharge efficiency of the resource (%)

P – output of the resource (MW)

C – capacity of the resource (MW)

DOD – depth of discharge

SOC – state of charge

Equation (1) may be modified to reflect sub-hourly intervals as follows:

$$cd_{i,n,t} = \left(\frac{1}{\pi_i C_i} \times P_{i,n,t}\right) + \left(cd_{i,n,t-1} \times \frac{\Delta T}{T}\right) \quad (2)$$

where ΔT is the elapsed cumulative dispatch time within the operating hour and T is the duration of the operating hour. $\frac{\Delta T}{T}$ represents the proportion of total dispatch time within the hour.

SCE proposes a modification to Xu *et al.* for consideration by the CAISO:

$$cd_{i,n,t} = \left(\left(\frac{1}{\pi_i C_i} \times P_{i,n,t}\right) + cd_{i,n,t-1} \times \left(\frac{\Delta T}{T}\right)\right) \times \left(1 + \left(SOC_{i,n,t} \times \frac{DR_i}{C_i}\right)\right) \quad (3)$$

or

$$cd_{i,n,t} = \left(\left(\frac{1}{\pi_i C_i} \times P_{i,n,t}\right) + cd_{i,n,t-1} \times \left(\frac{\Delta T}{T}\right)\right) \times \left(1 + \left(\left(1 - DOD_{i,n,t}\right) \times \frac{DR_i}{C_i}\right)\right) \quad (3a)$$

$SOC_{i,n,t} \times \frac{DR_i}{C_i}$ represents the proportion of available charge that was used in the relative dispatch range (i.e., dispatch range relative to total capability which is the total capacity). Since the dispatch range may be less than or equal to the installed capacity of the resource, the state of charge is used as a scaling factor that provides the incentive for charging the resource during periods when the incremental compensation provided for cycle aging is lower than the increment to marginal revenue to be earned from another discharge or the incremental cost saving derived from increasing the resource's state of charge.

As a result, the structure of this calculation provides incentives for operators to manage the resource's state of charge or depth of discharge while constructing offers that reflect the physical performance and operating cost of the resource when equation (3) is incorporated within the calculation of a default energy bid for the energy storage resource.

Variable Output Demand Response

RA counting and variable DR capability

While SCE appreciates the ISO's interest in performing a Loss of Load Expectation (LOLE) study for variable-output DR with the intent of establishing the Effective Load-Carrying Capability (ELCC) value for the resource, this could be a challenging task. The ELCC methodology needs to account for the seasonal variation as well as intra-seasonal variation in resource output, and, also appropriately value the inherent high correlation between high DR availability and high load (high need) conditions (i.e. demand response resources can be very effective contributors to reliability when it matters the most). Furthermore, the contribution of different resources to reliability (LOLE reduction) needs to be calculated with care to avoid under or over-counting each individual resource's contribution (e.g. accounting for diversity benefits, etc.). The ELCC methodology developed for wind and solar resources should not be superimposed on variable-output DR without accounting for the unique characteristics of these resources.

Declaring variable DR operation capability

Operators of variable-output DR resources prefer the resource adequacy counting approach that reflects the true capability of their resource and their contribution to system reliability rather than an approach that partially accounts for their capability while exposing the resource to RAAIM penalties. Bounding resource performance by a must offer obligation should hinge on appropriate accounting for resource performance and capability.

The CAISO asked in its August 21, 2019 presentation (p. 45) if a variable DR resource's capability could "be provided to the CAISO through an automated, real-time process" and whether it is "cost prohibitive"? SCE believes it is feasible for scheduling coordinators to provide updated capabilities. For example, in its March 18, 2019 comments[5], SCE referred to the ISO-NE market where demand response resources with weather-sensitive characteristics are allowed to re-declare their capacity after the publication of the day-ahead market results but prior to the real-time market (the "re-offer period"). Additionally, automation of providing this information to CAISO is feasible.

Essentially, if a scheduling coordinator is allowed to update the capability of a variable DR resource while still being considered following the must offer obligation, it could use updated inputs that drive the variability as better information is available (i.e. prior to submitting day-ahead market bids, and prior to the real-time market). Weather-sensitive demand response programs that have a high degree of variability tied to temperature provide an example where updated temperature forecasts can be used to update the capability of the resource.

SCE does not see a data or analytics-based method as referenced above as cost prohibitive (i.e. where for example temperature forecast data is used to update the demand response resource capability up through real-time, assuming weather forecasting data can be collected from reasonably representative sources). Any other method that requires installation of equipment or instrumentation at a single end

[5] http://www.caiso.com/Documents/SCEComments-EnergyStorage-DistributedEnergyResourcesPhase4WorkingGroup-Mar18-2019.pdf

user location that is part of the demand response resource aggregation may be, and likely is cost prohibitive.

Specifically addressing SCE's variable DR resources such as the Summer Discount Program (SDP), which can deliver over 200 MW of load reduction, SCE could provide the CAISO with an estimation equation, which calculates the expected MW availability based on the temperature data.

SCE notes that CAISO refers to the RAAIM exposure in their ESDER4 proposal for variable DR, while RAAIM is under consideration for removal per the RA Enhancement stakeholder process. Should the latter remain under consideration, it is prudent to consider alternative approaches.