California ISO

Stakeholder Comments Template

Hybrid Resources Initiative: Straw Proposal

This template has been created for submission of stakeholder comments on the **Hybrid Resources Initiative, Straw Proposal** that was held on October 3, 2019. The meeting material and other information related to this initiative may be found on the initiative webpage at:
http://www.caiso.com/informed/Pages/StakeholderProcesses/HybridResources.aspx

Upon completion of this template, please submit it to initiativecomments@caiso.com. Submissions are requested by close of business on October 21, 2019**.**

Submitted by	Organization	Date Submitted
William M. Conlon, P.E., Ph.D.	*Pintail Power LLC*	*21 October 2019*

Please provide your organization's comments on the following topics and indicate your organization's position on the topics below (Support, Support with caveats, Oppose, or Oppose with caveats). Please provide examples and support for your positions in your responses as applicable.

1. Hybrid Resource Definition

The proposed definition omits the essential component of a hybrid resource: the storage element. We propose the following definition instead:

Hybrid Resources can be a combination of generation and storage technologies that:

- Are physically and electronically controlled by a single owner/operator and Scheduling Coordinator.
- Are behind a single point of interconnection ("POI")
- Participate in the CAISO markets as a single resource with a single market resource ID.

Charging of the storage component of the hybrid resource may be from the associated generation resource, from the CAISO grid and/or as a load interconnection from a Participating Transmission Operator (PTO).

We believe that explicitly requiring a storage component in the definition is essential to distinguish from, for example multi-unit generators, and that identifying the charging sources is needed to understand the use of hybrid resources within the CAISO.

2. Hybrid Resources Business Drivers and Use Cases

We believe that CAISO will derive benefit from hybrid resources primarily by time shifting energy production in order to enhance renewable energy production, in other words storing renewable overgeneration for later dispatch to reduce carbon intensity.

The ability to move over-generation into storage is primarily driven by CAISO's markets, which will set the economic parameters for large-scale storage, and its transmission and generation constraints.

For hybrid resources to deliver this value, the storage function must interact with the CAISO grid, by time shifting energy subject to CAISO's schedule, or as a self-scheduled load that offers energy to CAISO.

We believe that long-duration storage resources will add disproportionate value by spanning market periods to remove constraints on charging or cost of charging. We urge CAISO to evaluate business cases that enable storage of over-generation on weekends (for example the 32 GWh of curtailed solar PV on 21 April 2019) for dispatch during a subsequent week.

While ITC capture is important to project developers, other than potentially reducing the Cost of New Entry (CONE) in the short term, we fail to see how CAISO benefits from structuring its market to facilitate or favor the profitability of individual entities, particularly when the ITC capture precludes the ability of CAISO to use the storage to benefit all CAISO participants. Accordingly, we believe that ITC capture should not be a CAISO business driver.

Likewise, while leveraging DC coupling may be of technical and economic interest to a few projects, we would point out that CAISO does not operate or manage low-voltage DC grids. These technologies accrue benefits to their developers, and unless there is a reduction of CONE, we fail to see how CAISO stakeholders at large benefit.

3. Forecasting

We agree that hybrid resources (with storage per our revised definition) should improve forecasting capability. Indeed, the storage element is analogous to securing a fuel supply for a fossil-fuel generator; once the fuel is secured, the resource can then be economically dispatched.

CAISO's proposals regarding zero-marginal cost Variable Energy Resources (VERs) seem sound, but forecasting needs to go beyond VERs with co-located storage.

Forecasting must include the availability of grid-charged storage to relieve over-generation constraints as well as provide dispatchable energy.

4. Markets and Systems

We believe that this section of the straw proposal needs to be expanded to support the business drivers of time shifting to enhance renewable energy production.

Owners, operators, and Scheduling Coordinators seek to maximize the profitable delivery of energy from the hybrid resource, which necessitates a positive *Park Spread*. Analogous to *Spark Spread*, Park Spread reflects the difference between the Locational Marginal Price (LMP) and the Marginal Cost of Energy (MCOE):

$$MCOE = Fuel\ Heat\ Rate * Fuel\ Cost + Electrical\ Rate * Power\ Cost$$

- There must be consideration of the cost of power placed into storage, which may be *de minimus* or even negative at times when charged from the grid
- Then there must be consideration of the *Electric Rate* -- MWh charged per MWh discharged, which is essentially the inverse of round-trip efficiency
    - The Electric Rate is a new term of art, first introduced in the American Society of Mechanical Engineers (ASME) Performance Test Code PTC-53 for Energy Storage Systems. The Electric Rate is analogous to the Heat Rate used for thermal generation.
- Likewise, there must be consideration of dispatchable hybrid resources that use stored energy to reduce the Fuel Heat Rate during discharge.
    - Compressed Air Energy Storage (CAES) and Liquid Air Energy Storage (LAES) technologies are provided by various companies.
    - The Energy Storage Combined Cycle (ESCC), available exclusively from Pintail Power, adds molten salt storage media to existing combustion turbine power plants to cut fuel consumption in half.

It will be important to assure that sufficient stored energy has been secured (like securing a fuel supply) to enable discharge awards to be scheduled.

For example, dispatchable hybrid resources (CAES, LAES, ESCC) cost-effectively provide long-duration storage of 24 hours or more. Such systems might be fully charged over a weekend with low or negative price power to enable economic discharged during weekdays. Such systems would also charge opportunistically during the week, just like short-duration batteries.

Accordingly, the market systems must have a long enough time horizon to optimize resources over multi-day or week-long periods.

Another factor is that the available of storage will increase system net load. This may potentially result in higher LMP during periods of over-generation while reduce the LMP and CO2 emissions during other hours.

Accordingly, the market optimization must accommodate the impact of storage or local minimization of LMP during each hour may NOT result in global minimization of system cost over periods of days, weeks, or years.

5. Ancillary Services

No comments at this time

6. Metering and Telemetry

No comments at this time

7. Resource Adequacy

We believe that QC must reflect the ability of the resource to dispatch when needed by the grid. The Effective Load Carrying Capability (ELCC) reflects the shifting of the need for capacity away from the availability of solar resources to provide such capacity, i.e., a measure of non-coincidence of supply and demand.

In the example of Table 5 the 100MW solar resource with 44% ELCC as 44 MW QC; the 100MW storage system with four-hour duration is shown as 100MW QC. In fact, the solar resource is not dispatchable, and cannot reliably contribute capacity when the sun is not shining. Although this provides a means for increasing the revenue of solar projects, the ELCC approach does not provide reliable capacity for CAISO.

When considering QC for storage resources, we believe it is essential to also consider the availability of the storage to dispatch capacity when needed.

For the example 4-hour duration storage, it would be necessary to immediately recharge the battery in order for it to continue to provide QC. The energy for charging will not be available at night from a co-located solar+storage resource, may not be available during a contingency, or may not be affordable, or may require charging from high carbon resources.

Charging from high-priced power would increase the resource's MCOE, and despite Must-Offer-Obligation (MOO), the resource might never be dispatched because its cost was too high.

We strongly recommend that CAISO consider the all reliability aspects in assigning QC value to hybrid resources.

Additional comments

In light of the recent Public Safety Power Shutoff (PSPS) events, we think that dispatchable hybrid resources (as we define them to include both generation and storage) are critical reliability components for both micro-grids and sectionalized grids.