



Stakeholder Comments Template

Hybrid Resources

This template has been created for submission of stakeholder comments on the Hybrid Resources Issue Paper that was published on July 18, 2018. The paper, stakeholder meeting presentation, 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 **August 13, 2019**.

Submitted by	Organization	Date Submitted
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General Comments:

EDP Renewable North America LLC (“EDPR”) appreciates CAISO initiating the Hybrid Resources Stakeholder process and the opportunity to comment on the associated Issue Paper. EDPR is an active developer of renewable energy and storage projects in the CAISO and greatly supports the CAISO’s efforts to examine various policies and market rules to facilitate and optimize the increasing development of storage and hybrid resources in California.

Overall, EDPR encourages the ISO to pursue approaches to hybrid resources that allow for the greatest amount of system configuration flexibility. Multiple resource IDs for AC coupled configurations have obvious benefits and is most easily implemented, but the ISO should not create a design structure that discourages DC-coupled configurations or single resource ID configurations because developers must weigh various commercial considerations when selecting their optimal project configuration. Specifically, the ISO should strive to accommodate a hybrid resource’s ability to capture DC generation associated with oversized DC-AC inverter ratios and to manage the amount of yearly charging from the grid for the purpose of qualifying for the Investment Tax Credit. Accommodating all of these configurations and commercial considerations will result in the greatest number of hybrid resources being developed and will benefit the system in the long-run. EDPR respectfully requests that the following comments be considered by CAISO in the development of its Straw Proposal due in September.

1. Interconnection

EDPR would encourage CAISO to publish some best practices or standard approaches in generation limiting mechanisms that would be applicable for either or both AC and DC coupled systems. The implications of implementing different methods may warrant further discussion. For hybrid systems studied in the system impact study, the ability of the storage portion of the project to avoid hours or limits that would trigger more extensive/expensive upgrades is possible. EDPR would like to explore if this is something that could be taken into account in the study process and put as an operational constraint in the GIA.

2. Forecasting and Operations

Consistent with the general comments above, the ISO should strive to support equitable forecasting and operations services and rules for both AC and DC coupled configurations. For multiple resource IDs, EDPR supports CAISO in finding a way to limit the dispatch at the POI rather than at the resource ID level as to allow for a single generator to exceed the POI limit knowing the attached resource is charging the excess as provided in the example on page 16.

EDPR supports the utilization of multiple resource IDs for storage coupled with renewable resources as a means to maintaining PIR status (and to make the provision of ancillary services and RA easier). For AC coupled projects, adding the necessary metering and telemetry for multiple resource IDs is relatively straightforward and supported by EDPR.

However, EDPR is also interested in DC coupled hybrid resource projects and would like to further explore cost-effective options for maintain these VER scheduling benefits for DC configurations as well. Adding the necessary meters and telemetry to a DC coupled projects is not as practical or cost-effective as for AC because of large number of disaggregated blocks on a solar + DC coupled storage project. For both multiple resource ID configurations and single resource ID configurations with multiple resource meters for grid charging capabilities, EDPR would like to ensure that DC coupled solar + storage configurations are not overly burdened with additional metering. EDPR would appreciate if this stakeholder process could also include an exploration of workable options to better accommodate DC coupling.

EDPR supports exploring additional data sources to support accurate forecasting of the VER component of hybrid resource under single resource ID configuration as means to maintaining PIR status (and also to support accurate ancillary services assessments for hybrid resources and to allow single resource ID configurations to count for RA). While these data sources are likely not “revenue grade,” we believe there could be workable solutions. For example, DC coupled projects have other sources of the forecast and generation information that could be useful in providing the CAISO the same visibility necessary to support PIR.

Additional reporting through the plant’s energy management system controller based on the readings from the DC/DC converters is something EDPR suggests CAISO consider as that is a

communication network that is already installed and reporting the necessary information for accurate plant operation. Potentially this plant EMS data could be sufficient for providing data for the solar generation and battery state of charge forecasts needed. While these data sources are likely not “revenue grade,” we believe there could be workable solutions.

EDPR would appreciate if the requirements around having hybrid resources provide their own forecasts for the VER component could be spelled out for the industry to further comment on.

Under the multiple resource IDs configurations, EDPR supports the dispatch decisions being dictated by each resources corresponding bids, but also wants to ensure that CAISO is prioritizing the VER over the storage NGR component such that the solar isn't being curtailed to make room for the storage's discharging in the event that the VER generation has exceeded its forecast and the storage was already scheduled for the rest of the headroom on the interconnection.

3. Markets and Systems

EDPR appreciates CAISO identifying the stranded capacity issue associated with limiting the output of multiple resources ID hybrid resource configurations to their total interconnection rights. We believe this is an important issue to address, both for commercial development reasons and for market efficiency. We look forward to reviewing more details regarding the hybrid resource constraint being considered by the ISO and encourage the ISO to develop solutions that can meet the interconnection timelines of hybrid resources in the queue.

EDPR would like to point out that for multiple resource IDs with grid charging capabilities, the project level constraint that would have to be implemented for DC and AC coupled systems looks different. For AC coupled this is the POI limit, but for DC coupled this is the inverter limit and the solar generation potential is the DC solar production. Prioritizing clipped energy charging is important to why DC coupled system's pose a benefit, and therefore needs to be taken into account if CAISO is dispatching the storage charging under multiple resource IDs in a DC coupled configuration.¹

EDPR looks forward to CAISO's proposed solution in its Straw Proposal. Any solution to multiple resource IDs sharing a common interconnection should address the following:

- As noted by CAISO, a hybrid resource with separate resource IDs will have each resource bid separately as allowed for by its Tariff. To the extent one of a project's resources is an Eligible Intermittent Resource (EIR) and is in the Participating Intermittent Resource (PIR) program, it should be allowed to fully participate in that program even if its forecasted generation exceeds a project's Point of Interconnection (POI) MWs. CAISO's solution to

¹ This is seen as difficult because on the equipment controls, the battery is charging from clipped energy without fully knowing how much otherwise clipped energy there is. The battery is charging in a somewhat trial and error situation through increasing its charging until it sees the solar output drop. A path forward that contemplates the storage charging free of CAISO dispatch when charging from what would be otherwise clipped energy could be interesting, but there would have to be a way to differentiate what was charged from clipped energy versus what was not, which would require comparing timestep data from each resource through the settlement process.

limit dispatch or market instructions to the POI MWs should allow for PIR generation (as forecasted or as generated) in excess of the POI MW limitation to charge the battery behind the same POI constraint. To the extent such charging of the battery, which has a separate resource ID, occurs, it should be considered a CAISO instruction. All forecasted generation from the PIR resource should be settled as instructed energy, consistent with current PIR rules.

- Whether as part of a hybrid resource or simply a stand-alone EIR with a high DC-to-AC ratio, CAISO needs to confirm in its Straw Proposal that its EIR forecasting methodology assures that any AC limitations are properly modeled. For example, an EIR may be modeled as producing up to 100 MW on the DC side. CAISO's EIR forecasting tool is driven by meteorological conditions including local solar or wind conditions. If, however, the DC output is constrained by a low AC to DC ratio (e.g., 0.5), output to the grid will never exceed a certain amount. This amount, which should represent the EIR resource's Pmax may or may not exceed the POI MWs but in any event will be the MW level managed with other resources sharing the same POI to ensure that POI MWs are not exceeded. CAISO's solution to limit dispatch or market instructions to the POI MWs should include factor in EIR forecasting tools that can expressly model such DC-to-AC constraints.

4. Ancillary Services

For the regulation service, the paper mentioned possible creating some minimum size requirements for storage proportion on a hybrid resource under a single resource ID. EDPR doesn't think this should be necessary and would rather have additional telemetry required to enable CAISO to see that the project has enough storage capacity to deliver upon the amount that was bid. The requirements for storage in a hybrid should be no different than the storage size required to participate in the market as it would as a stand-alone storage NGR.

5. Deliverability

No comments at this time.

6. Resource Adequacy

EDPR appreciates the ISO identifying the gaps and questions associated with single resource ID configurations providing RA and we support exploration of this topic in this stakeholder process. The use of the exceedance methodology, especially given the lack of immediately available historic data, deserves further discussion. The method of using the individual components of the hybrid asset (even if registered under a single resource ID) would be a better process in the interim than

utilizing the 70% exceedance methodology because the storage dispatch could be utilized differently leading to difference exceedance value calculations.

7. Metering, Telemetry and Settlements

EDPR would appreciate if the DC metering methodology could be further explained, especially around aggregating DC metering on a utility scale project.

Exhibits figure 8-10: EDPR suggest that the ISO consider showing the DC/DC converter on the configuration to more accurately represent the DC coupled configurations.

8. Additional comments

No additional comments at this time.