California ISO

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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Please provide your organization's comments on the following issues and questions. For all topics please explain your rationale and include examples if applicable.

First Solar commends the CAISO for launching a stakeholder process on this important topic, and looks forward to a robust dialogue on how hybrid resources will participate in the grid going forward. As mentioned during the stakeholder meeting, we believe that the current queue makeup, about 40% of which are hybrid resources, should be viewed as a floor rather than a ceiling moving forward. Developers are seeing increasing demand for hybrid resources, which can provide dispatchable solutions and offer capacity attributes into the market more cost effectively than conventional resources. While a solar PV-plus-storage ("PVS") application will likely be the dominant structure developed, the CAISO should ensure that all hybrid applications are considered and accommodated in this initiative. For example, solar PV-plus-wind ("PVW") and solar PV-plus-wind-plus-storage ("PVWS") projects are gaining traction in other markets and are likely to appear in the CAISO interconnection queue as well.

It is important to recognize how these resources are being designed and will be operated. Merely focusing on price arbitrage may miss the important utilization of these resources for RA purposes, particularly when pairing a VER with storage. Given the demonstrated capabilities inherent in inverter-based resources like PVS and other hybrid resources, it is likely they will be designed and optimized to meet peak deliverability needs and act as RA

resources in the future. This is already being done in other surrounding jurisdictions, where PVS facilities are being contracted to help with peak capacity needs. CAISO should consider how to handle hybrid resources in a way that allows for such optimization.

In addition, to effectively capture the benefits of an integrated system, the operators of hybrid resources need to use the two components in tandem; they need the flexibility to design charging and discharging protocols that maximize the value of the renewable generation and the storage facilities. In that regard, using only a single resource ID aligns with how the integrated asset is operated and will allow the market to take advantage of the benefits offered by a hybrid resource. In the event that multiple resource IDs had to be used, it would be imperative that the resulting dispatch instructions from the CAISO not impact the charging/discharging of renewable generation from the battery, as that could undermine the operational benefits of a hybrid system, as well as put ITC benefits in jeopardy. We believe it will be difficult for the CAISO to avoid those adverse impacts under a multiple resource ID approach. Accordingly, we request that the CAISO work diligently to facilitate a single ID structure.

Finally, from a scheduling and logistics perspective, First Solar encourages the CAISO to establish three phases for this initiative:

- Phase 1 = items that require immediate attention

- Phase 2 = items that are important to ensuring the maximization of hybrid resources, but do not require an immediate fix

- Phase 3 = long-term discussion on how the CAISO markets, processes, and procedures must evolve for a grid that will be predominantly inverter-based

1. Interconnection

Please provide your organization's feedback on the interconnection topic as described in section 3.2.

First Solar recommends that the requirement for dynamic reactive power and total reactive power depend on the maximum deliverable output of the hybrid plant at the point of interconnection limit, rather than a power factor requirement for all of the installed capacity of inverters. The evaluation of the designed reactive power capability should consider the combined capability of the hybrid plant, not the capability of each portion of the hybrid plant independently. Studying the hybrid plant as a whole under various operating conditions, such as generation/delivery by each of the hybrid components, by each component at various levels, and by the plant under various levels of generation and charging, should allow for an appropriate requirement of dynamic and total reactive power to be part of the overall hybrid resource design. These requirements should be explicitly characterized to support hybrid plant design holistically as part of the interconnection request process.

2. Forecasting and Operations

Please provide your organization's feedback on the forecasting and operations topics as described in section 3.3.

FORECASTING

First Solar encourages the CAISO to continue making its forecast available to all VER resources, including those coupled as part of a hybrid interconnection with a single resource ID. The CAISO should be open to identifying structures that allow hybrid resources to retain their PIR status. The following examples highlight this position:

- It is possible that the storage component of a hybrid PVS project is used to firm and smooth the output of the solar component. This should not, alone, disqualify the resource from being considered a PIR.

- A hybrid PVS project that is designed to meet an RA need isn't necessarily performing price arbitrage against the market. Rather, it is intentionally shifting energy to a later time to meet the evening ramp and associated peak. It should be feasible to calculate the instantaneous availability, charge, discharge, and delivered energy for each component to show how the forecast MWh were actually (1) produced, and (2) delivered to either the grid or the battery system. Again, there should be a configuration and associated data requirements that allow this holistic structure to be considered a PIR.

We also request that CAISO make visible the data and analytics behind Table 4 on page 13, subject to appropriate aggregation such that no confidential data is exposed. By making the data available, stakeholders would be better positioned to critique the CAISO's methodology and provide helpful feedback.

OPERATIONS

First Solar respectfully disagrees with the statement on page 15 that "single resource ID hybrid resources are less-dispatchable than a traditional dispatchable resource." Inverter-based resources in general provide enhanced dispatch flexibility (as compared to conventional resources) when contracted and operated to maximize dispatchability. Inverter-based resources have no Pmins, can ramp from zero output to instantaneous maximum capability in a matter of seconds, and can provide services such as frequency regulation with significantly higher levels of accuracy than the fossil fleet.[1] The integration of storage simply enhances all of these capabilities. While it is true that, traditionally, these resouces have not provided dispatch flexibility to the CAISO, their capability to do so has been demonstrated. Moving forward, we request that CAISO recognize the dispatchability attributes of inverter-based resources and drive market design enhancements to take advantage of those attributes.

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[1] Indeed, in the paper developed by CAISO, NREL, and First Solar, the CAISO specifically stated that PV was "24-30 points better than fast gas turbine technologies" at regulation accuracy. https://www.nrel.gov/docs/fy17osti/67799.pdf at page 22.

3. Markets and Systems

Please provide your organization's feedback on the markets and systems topics as described in section 3.4.

The Master File restriction articulated on page 19, table 5, is a major concern that should be remedied. We respectfully disagree with the CAISO's characterization of this scenario as "stranded capacity". That interpretation goes counter to how the identified resource would have been designed to operate. Again, First Solar (and, likely, all other developers) look to provide an integrated solution to their offtakers. In the example given, the integrated solution is likely a peaking capacity renewable resource that allows for the delivery of renewable generation while also meeting RA needs. The Master File should not prevent the economic delivery of energy from one of these systems, and First Solar is concerned that this existing structure would violate FERC Order 841's requirements to provide a participation model that facilitates storage's participation in the wholesale market as well as FERC Order 845's requirement that hybrid resources be studied at a capacity level below the maximum nameplate of the separate components as long as a control system is in place to ensure the facility does not inject above its POI. During the interconnection request process right now, CAISO is already accepting PVS applications as a single resource ID, with joint grid requirements at POI. First Solar strongly recommends this item be considered a Phase 1 priority and be fast-tracked for resolution.

This also appears inconsistent with how the CAISO likely treats combined cycle units, where they can be operated as 1x1, 2x1, duct firing on/off, etc. (Multi-Stage Generation Model). Quite simply, those resources have flexibility in how they operate, which is accommodated today. Hybrid projects should be afforded the same consideration.

Related to this issue, First Solar suggests the CAISO review the Universal Market Participation Model as a potential long-term solution.[2] This approach warrants consideration broadly as part of a Phase 2 to this initiative, as it would require a longer lead time to develop; however, it could serve to place all generators and grid assets on equal footing and create additional visibility and operational control to the CAISO.

Lastly, it may be useful for the CAISO to facilitate an option where a hybrid resource with storage could be studied as charging only from on-site generation for a period of time, and then switch to being capable of grid charging in the future. For ITC purposes, a PVS project would prioritize charging the battery with the solar resource for the first 5 years, after which time the storage could be charged from the grid without resulting in a tax credit penalty. First Solar encourages, as part of Phase 2, a discussion around streamlining the study process related to that structure.

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[2] https://www.esig.energy/blog-the-universal-market-participation-model/.

4. Ancillary Services

Please provide your organization's feedback on the ancillary services topic as described in section 3.5.

First Solar is generally supportive of the creation of "plant potential", or headroom, and state of charge data points. First Solar is also supportive of these data points being visible for single resource ID configurations. However, the granularity, update frequency, and automation of these data points is essential in understanding its actual value and use to the CAISO.   Ideally, these data points would be dynamic and allow the CAISO to see the headroom available on a real-time basis.

First Solar opposes the creation of a minimum storage size to be able to provide regulation service. This is an unnecessary requirement as solar and all other inverter-based resources are capable of providing regulation service today without storage, and, as mentioned previously, at very high levels of accuracy and speed. Imposing a minimum threshold for hybrid resources is an unjust and unreasonable restriction.

Related to the Payment Rescission section, First Solar respectfully asks for clarification. It can be safely assumed that, if the resource is being curtailed, the curtailed production (presumably from the VER component of the hybrid resource) could be used to charge the storage component. What is unclear, based upon this section, is whether or not a hybrid resource responding to a RegDown signal could use that decrease in output to charge the storage, or if that would look like a violation and the CAISO would apply a payment rescission.

5. Deliverability

Please provide your organization's feedback on the deliverability topic as described in section 3.6.

In the proposed new off-peak deliverability study, storage (or the storage component of a hybrid resource) will always be curtailed before wind and solar, which is not consistent with the proposed on-peak methodology. CAISO should address this and change the off-peak study methodology to match the on-peak methodology. We are concerned that, for a hybrid resource using multiple resource IDs, the different components would end up with different deliverbility status. This is an unnecessary and confusing outcome for all market participants.

6. Resource Adequacy

Please provide your organization's feedback on the resource adequacy topic as described in section 3.7.

First Solar strongly supports collaboration by the CAISO and the CPUC on hybrid resources. As mentioned, the interconnection queue reflects a trend towards hybrid resources being the dominant new resources on the grid. It is imperative that the IRP process correctly consider and study how these resources can provide much-needed RA capacity to California.

Hybrid resources are designed as integrated solutions, and often are built to support a peak capacity need. To that end, any determination around how a single resource ID configuration's QC should take into account how the integrated resource will perform. Specifically, there should be a rebuttable presumption that a hybrid resource, on peak load days, would maximize its ability to meet the evening ramp and peak demand window per CAISO forecasts. While there are a near-infinite number of combinations for a PVS project that vary the capacity and energy of the storage unit against the capabilities of the solar asset, First Solar recommends the creation of a handful of proxy plant designs that would assist both the CAISO and the CPUC in determing the RA value for hybrid resources. Those proxy plant designs could include:

- 100 MW-ac solar asset (1.2 DC-AC ratio) with a 50 MW/200 MWh battery; 100 MW POI

- 100 MW-ac solar asset (1.2 DC-AC ratio) with a 100 MW/400 MWh battery; 100 MW POI

Lastly, we encourage the CAISO to hold a technical workshop on hybrid resources in the near future and invite the CPUC and hybrid resource developers to participate. This would provide a forum for broad discussions on how developers look to design and optimize hybrid resources, as well as allow for clear connectivity between the work performed in this stakeholder process and in the CPUC's IRP and RA proceedings.

7. Metering, Telemetry and Settlements

Please provide your organization's feedback on the metering, telemetry and settlements topics as described in section 3.8.

First Solar seeks to ensure that AC-coupled PVS projects could effectively charge the storage component without appearing to violate a DOT. For example, if the CAISO issues a DOT of 50 MW for a 100 MW AC-coupled hybrid project, and the VRE component is capable of producing 80 MW at that time, it should be able to deliver 50 MW to the grid and 30 MW to charge the storage component without violating the DOT.

8. Additional comments

Please offer any other feedback your organization would like to provide on the Hybrid Resources Issue Paper.

Hybrid resources are becoming the predominant design under development in many markets and it will be critical to ensure the CAISO is incorporating these resources and their full suite of capabilities into the market. As we look towards the future of the California system, it is evident that asynchronous generation will be the predominant source of energy and reliability services. This is an inevitability as we march towards the clean energy goals the State has established.

First Solar believes that, at some point, a fundamental change in how units are commited and dispatched must occur in order to facilitate this future state. It will no longer make

sense for market participants and the CAISO to try and force-fit inverter-based resources into a market construct that was designed based upon the benefits and limitations of the legacy fossil fleet. The future CAISO grid likely will center around discussions for how the remaining fossil fleet will need to modify their operations to fit into a renewable-dominated system. First Solar encourages the CAISO to create a Phase 3 for this initiative that acts as a forum to discuss market transformation more broadly and identify future state market constructs that contemplate this renewable-centric future.

As previously stated, First Solar encourages the CAISO to establish three phases for this initiative to ensure that each major item identified is addressed in the appropriate timeframe and with adequate time for stakeholders to provide input. To that end, First Solar recommends the following structure:

- Phase 1 (completed by end of 2019) = items that require immediate attention
  - Master File
  - Development of proxy plant designs to develop RA values for hybrid resources
  - Technical workshop on hybrid resources that includes participation by both developers and the CPUC

- Phase 2 (completed by Q3 2020) = items that are important to ensuring the maximization of hybrid resources, but do not require an immediate fix
  - Review and consideration of the Universal Market Participation Model
  - Creation of plant potential and state of charge data points
  - Ability for single resource ID hybrid resources to be treated as PIRs
  - Procedure to allow a hybrid resource that was initially structured to be charged by on-site generation only to transition to the capability to be grid charged when tax incentives allow that approach

- Phase 3 (initiated in Q4 2019/Q1 2020) = long-term discussion on how the CAISO markets, processes, and procedures must evolve for a grid that will be predominantly inverter-based