California ISO

Hybrid Resources

Second Revised Straw Proposal

April 29, 2020

Table of Contents

1. Executive summary

Interest in energy storage is significant and continues to grow as state and federal policy makers and regulators support energy storage development and believe in its ability to help decarbonize the grid. In California, energy storage paired with wind and solar may accommodate the retirement and reduction of natural gas fired generation. Interconnection customers submitted a significant number of interconnection requests for projects that incorporate stand alone and hybrid energy storage resources in response to this direction. The ISO anticipates the quantity of mixed-fuel resources will increase significantly in the coming years. Today, there is relatively little interconnected to the ISO grid, however the interconnection queue includes more than 24,000 MW of mixed fuel projects including nearly 20,000 MW of storage. This represents roughly half of all generation in the interconnection queue currently.

The ISO is committed to enhancing the participation of energy storage in the ISO's markets and is continually working with stakeholders to identify potential new or enhanced market rules and business processes needed to accommodate the unique attributes of energy storage. In anticipation of hybrid resources connecting to the grid, the ISO developed a hybrid resources technical bulletin in 2016 to provide initial guidance.[1]

Resource developers are combining generation technologies such as gas, solar or wind projects with energy storage to create enhanced resources for grid operations and systems that qualify to receive investment tax credits. The ISO received many inquiries from interconnection customers interested in developing such projects, and anticipates that hybrid resources and co-located projects will be developed on a wide scale in coming years.

The ISO launched this stakeholder initiative to identify potential new or enhanced market rules and business processes needed to accommodate hybrid resources. The ISO proposes two sets of market rule changes within this initiative to facilitate mixed-fuel type projects (i.e. hybrid and co-located resources) participation in the ISO's markets. The first set of modifications generally concern setting up and operating hybrid resources. These changes remain under development through this stakeholder process. The ISO intends to work collaboratively with stakeholders to complete the design of these market rule changes later this year and anticipates implementation of these changes in the market in fall 2021. The second set of modifications involve co-located resources. This paper will serve as the final iteration, or the "final proposal," for these rule changes. The ISO plans to present market rule changes for co-located resources to the ISO Board of Governors for approval in July 2020, and implement these changes in the fall 2020.

Hybrid Resource Market Rule Changes

The ISO proposes to extend market functionality similar to tools for standalone variable energy resources (VER) to hybrid resources. This aspect of the proposal will allow hybrid resources to

[1] Hybrid Resources Technical Bulletin, 2016: https://www.ISO.com/Documents/TechnicalBulletin-ImplementationofHybridEnergyStorageGeneratingFacilities.pdf.

utilize forecast data, charging models and market insight to ensure that they are bidding in such a way so that they will receive feasible market awards and dispatch instructions. This functionality is not the same as the tools that are used for the variable energy resources, and will require additional data submission from the scheduling coordinators to maintain limits on submitted bids.

Through these changes, the ISO markets will recognize upper and lower limitations on bids for these hybrid resources to enable their participation, while minimizing the possibility for infeasible market awards and dispatches. This approach may allow hybrid resources to conduct their own onsite optimization of underlying resource components. The ISO notes that this aspect of the proposal will only apply to real-time markets. The proposal also provides hybrid resources the ability to be modeled with a negative output range, similar to non-generating resources (NGRs) because many hybrid resources will include energy storage components with the ability to charge from the grid.

The ISO proposal will require that a forecast for all variable energy components of hybrid resources be generated, either by the ISO, or submitted by market participants. The ISO also addresses the need for new resource adequacy provisions for hybrid resources, including proposals for default Qualifying Capacity counting rules and Must Offer Obligations for hybrid resources.

Co-located Resource Market Rule Changes

Second, the ISO proposes to enhance the ability of co-located projects to participate in the market. The ISO proposes to lift the requirement that the combined Pmax must sum to the interconnection rights of a co-located resource and impose a market constraint on the two resources to ensure that joint dispatch does not exceed interconnection rights at the point of interconnection (POI) to the ISO controlled grid. To effect this change, the ISO will enforce what it refers to as the aggregate capability constraint where net output at the point of interconnection will be limited to the maximum and minimum capacity studied in the generator interconnection process. Each co-located resource will have a separate resource ID, be metered and telemetered separately.

2. Stakeholder engagement plan

Date	Milestone
December 10	Revised straw proposal
April 29	Second revised straw proposal for hybrid resources, final proposal for co-located resources
May 7	Stakeholder call for second revised straw proposal for hybrid resources and final proposal for co-located resources
July 22-23	ISO Board of Governors meeting for co-located proposal
July	Publish draft final proposal for hybrid resources
October	Publish final proposal for hybrid resources
November 18-19	ISO Board of Governors meeting for hybrid proposal

3. Definitions

The ISO proposes the following definitions:

- **Hybrid Resource:** "A resource type comprised of two or more fuel-type projects, or a combination of multiple different generation technologies that are physically and electronically controlled by a single owner/operator and scheduling coordinator (SC) behind a single point of interconnection ("POI") that participates in the ISO markets as a single resource with a single market resource ID, is optimized by the CAISO in the market as a single resource and is metered and telemetered at the high side of the interconnection transformer. Hybrid resources are not eligible to be variable energy resources."

The ISO recognizes that this definition may not be universal. For example, pairing a small amount of energy storage with a conventional generator where the storage would only be used to meet station power demand may not require any treatment unique to hybrid resources beyond how the resource is initially studied and modeled. The proposed hybrid resources definition will not apply to multi-stage generators or other resource configurations that have multiple units of a single fuel-type or single generation technology.

The ISO also proposes to require that hybrid resources meet the minimum sizing requirements for both of the underlying generation components: 500 kW for any participating generator hybrid resource component and 100 kW for any storage hybrid resource components.[2] The ISO has clarified this aspect of the proposal to avoid confusion regarding the sizing requirements for hybrid resources.

Co-located Resource: A resource type comprised of two or more-fuel type projects, or a combination of multiple different generation technologies behind a single point of interconnection that participates in the ISO markets as different resources with different market resource IDs, is optimized by the scheduling coordinator's bids or self-schedule in the market and each resource is individually metered and telemetered. Co-located resources may be comprised of one or more variable energy resources and resources that are not variable energy resources.

[2] ISO Tariff Section 4.6.3.2 requires participating generators to be 500 kW or greater. Pursuant to Order No. 841, the ISO has proposed to lower the minimum capacity requirement for storage resources to 100 kW, effective December 3, 2019.

4. Proposal

In this second revised straw proposal the ISO outlines rules for hybrid and co-located resources, including market participation rules, forecasting requirements, ancillary services eligibility, metering requirements, and implications for participation in the resource adequacy program. These proposals are summarized by the following list, and details are provided in each of the subsections below.

Key Policy Proposals:

- (4.1) Hybrid resources will have access to the same bidding tools as other resources
- (4.1) Hybrid resources will be expected to follow ISO dispatch instructions
- (4.2) Hybrid resources are not VER resources, but will have access to dynamic limits
- (4.2) Hybrid resources will submit meteorological data for all VER components
- (4.2) ISO will offer forecasting services for VER components of hybrid resources
    - Hybrid resources may self-provide forecasts to the ISO for VER components
- (4.2) Hybrid resources will have access to a "dynamic limit" tool, similar to VERs
    - Hybrid resources will be allowed to self-submit dynamic limits to real-time bids
    - Hybrid resources can use ISO forecasts to inform dynamic limits
- (4.2) ISO will not track state of charge for hybrid resources
- (4.3) Hybrid resources will be modelled using the NGR model
- (4.4) Hybrid resources will provide metering data at their point of interconnection
- (4.4) Hybrid resources will provide metering data for all VER components
- (4.5) Co-located resources will be subject to an aggregate capability constraint
    - The implementation in 2020 will include energy only and will include AS in 2021
- (4.5) Pmax values for co-located resources will not be limited by the interconnection
- (4.5) Co-located resources will be priced at the point of interconnection
    - If co-located resources exceed POI limits the ISO may reduce resource PMaxs
    - ISO may re-open this component of proposal if there are reliability concerns
- (4.5) Co-located resources may only submit bids from one scheduling coordinator
- (4.6) Hybrid and co-located resources may provide ancillary services after fall 2021
- (4.9) Must offer obligations will not change for co-located resources
    - Obligations will be based on individual resource type
- (4.9) Hybrid resources shown for RA will be required to bid or self-schedule 24x7
    - Hybrids will have access to outage cards for charging storage components
    - Hybrids will use dynamic limits to manage variable output

4.1. Market interaction

Hybrid resources will be optimized and dispatched by the ISO in the day-ahead and real-time markets like other resource types. Hybrids will receive market awards based on cleared schedules and bids submitted 75-minutes prior to the operating hour. The ISO will expect hybrid resources to follow all ISO market awards and dispatch instructions, and will assess uninstructed imbalance energy (UIE) at the real-time market prices for any deviations from dispatch instructions.

To address timing risk between bid submission and dispatch, the ISO is offering use of a dynamic limit tool, which can limit the dispatch instruction from the ISO for portions of the bid curve that are unavailable for dispatch. The aggregate capability constraint is discussed further in section 4.2 below.

The ISO will not track state of charge for hybrid resources. Resource operators will need to manage the state of charge of any storage component through typical bidding patterns and submissions of the upper dynamic limit.

4.2. Forecasting and dynamic limits

Today, the ISO classifies wind and solar stand-alone resources as variable energy resources (VERs). The ISO uses forecasts for these resources to determine an upper economic limit that they may receive for a market award through ISO dispatch. This tool allows variable energy resources additional flexibility to bid into the ISO markets, particularly in real-time.

As an example, the sun may be rising and solar output at a specific resource may be increasing from 50 MW, to 52 MW, to 55 MW during three specific consecutive five minute intervals. All ISO resources are only allowed to submit one bid curve applicable for each hour, which cannot be adjusted during that hour, inclusive of solar resources. The ISO has market rules that limit the upper range that a solar resource may be dispatched to in the real-time market. For this example resource, the ISO would be limited to send a dispatch instruction to this resource at a level equal to or less than the forecast value. This ensures that the resource generally receives a feasible dispatch instruction, and limits the resource's exposure to deviation charges, which is calculated based on the difference between what was produced and the dispatch instruction.

This tool uses forecasts generated either by the ISO, or may be submitted to the ISO from the variable energy resource owner.

The ISO proposes to not classify hybrid resources as variable energy resources, even though hybrid resources may include a wind or solar component. The ISO will offer forecasting services for the wind or solar components of the hybrid resources, similar to what is provided to stand-alone variable resources today. These forecasts will only be for the variable (solar or wind) component of the hybrid resource and are not meant to provide forecast data for the entire output of the hybrid resource. These forecast services will be optional, and resource owners can elect not to receive and pay for this ISO service.

If resource owners do not elect to have the ISO generate a forecast for the VER component of a hybrid resource, and the resource includes a wind or solar component, it will be required to provide meteorological information as well as a forecasts for any variable components to the ISO. This means that if a hybrid resource with a solar and storage component interconnects to the grid, the ISO will require the same information about the operation of the solar resources (effectively behind the hybrid meter) as would be required of a stand-alone solar resource. This will ensure that the ISO is able to predict renewable generation and variability of output at a specific electrical location, for the purposes of reliability.

Wind or solar resources as a component of a hybrid resource will be required to submit 1) a topographical map, 2) site information sheet (designating either ISO or scheduling coordinator forecasts), 3) real-time metrological station data (with meteorological stations in accordance with Appendix Q, Section 3.1), 4) real-time forecast data (if scheduling coordinator provided), 5) real-time telemetry data, and 6) the high sustainable limit. The high sustainable limit is a measurement that was outlined in detail in the revised straw proposal, and essentially is a real-time telemetered estimate of what the variable component is capable of producing.

The ISO proposes a “dynamic limit” tool, which will be used to limit the economic dispatch of a hybrid resource, similar to the tool that limits the upper economic dispatch of variable energy resources today. These two tools would be fundamentally different. The tool for the variable energy resources is derived by the ISO and generated strictly from the forecast generation for the variable energy resource. The dynamic limit tool proposed for hybrid resources will only be determined based on values submitted to the ISO from the hybrid resource scheduling coordinator. These values will limit the dispatch instruction for the hybrid resource in the positive or negative direction. The dynamic limit tool will be the tool available to scheduling coordinators to ensure that hybrid resources do not get scheduled for an infeasible dispatch, based on potential state of charge conditions, renewable availability, internal storage charging schedules, etc. Both tools will only be available to resources in the real-time market, and will not be available in the day-ahead market.

The dynamic limit tool will be optional, and will not be required for all 5-minute intervals. Hybrid resources will be allowed to submit a dynamic limit or not, but are not required to do so if the resource is capable of performing at the entire range of the bids in the real-time market. Dynamic limits can be updated once every five minutes, and will include hybrid limits for each 5-minute interval in a three hour window, for each submission. Resources may choose to use forecast values from variable energy resource components for their dynamic limits. If the forecast values for the variable energy component is generated from the ISO, there may be lag between when the forecasts are generated and when they are imposed as limits for the dynamic limits for hybrid resources. This lag will be the result of the time the ISO takes to generate the forecast data and transmit that to the hybrid operator, receipt of that data and processing, and finally submission of the data to the ISO for use as a dynamic limit.

4.3. Master file and interconnection

Hybrid resources will be modelled in the ISO's master file system as non-generating facilities because of the ability to charge the resource from the grid (dispatch less than 0 MW) and the ability for resources to provide energy to the grid (dispatch greater than 0 MW). The corresponding fuel type for hybrid resources will be "other," as the underlying components of the resource will likely be multiple fuel types. Hybrid resources will not receive treatment as a variable energy resource, eligible intermittent resource (EIR), or a participating intermittent resource (PIR), although some of the requirements may be similar.

Modelling and interconnection requirements may not universal true for all resources. Each hybrid resource will be reviewed by the ISO and evaluated on an individual basis. Some resources with multiple fuel types may not be categorized as non-generating resource types. For example, if a gas resource undergoes plant augmentation and adds a relatively small battery to the resource to enhance ramp capabilities, ancillary service capabilities, and upper economic bound, the ISO may choose to continue modelling such a resource as a gas resource, as the resource will generally behave and be dispatched like a gas resource. For hybrid resources that have a relatively similar capacity between renewable generation and storage, these will generally fit into the non-generating resource model.

Components of hybrid and co-located resources will be studied independently when interconnecting with the ISO. Each component of these resources will be studied as synchronous or asynchronous individually, where wind, solar and storage resources are asynchronous, and gas and hydro resources are synchronous.

4.4. Metering and telemetry

Telemetry and metering will record the net output of the hybrid resource. Additional data and telemetry may be required for hybrid resources providing ancillary services and hybrid resources that include renewable components.

The ISO will not require separate metering and telemetry requirements for each underlying component of a hybrid resource, only the renewable resource components. The data and telemetry from the wind and solar resource components of a hybrid resource will be used by the ISO for reporting purposes. The ISO is registered with WECC as a qualified reporting entity (QRE) and reports meter data for renewable resources using the western renewable energy generation information system (WREGIS).[3] Including metering and telemetry data for all renewable components of hybrid resources will allow the ISO to continue provide the following four functions: 1) WREGIS reporting, 2) visibility into actual operations and ISO's ability to meet all NERC real-time control standards, 3) providing public data for load served by renewables in real-time, and 4) providing aggregate information to the CEC and CPUC to measure progress toward state energy and environmental strategic goals.

[3] For additional information on the western renewable energy generation information system refer to the following link: https://www.wecc.org/WREGIS/Pages/default.aspx.

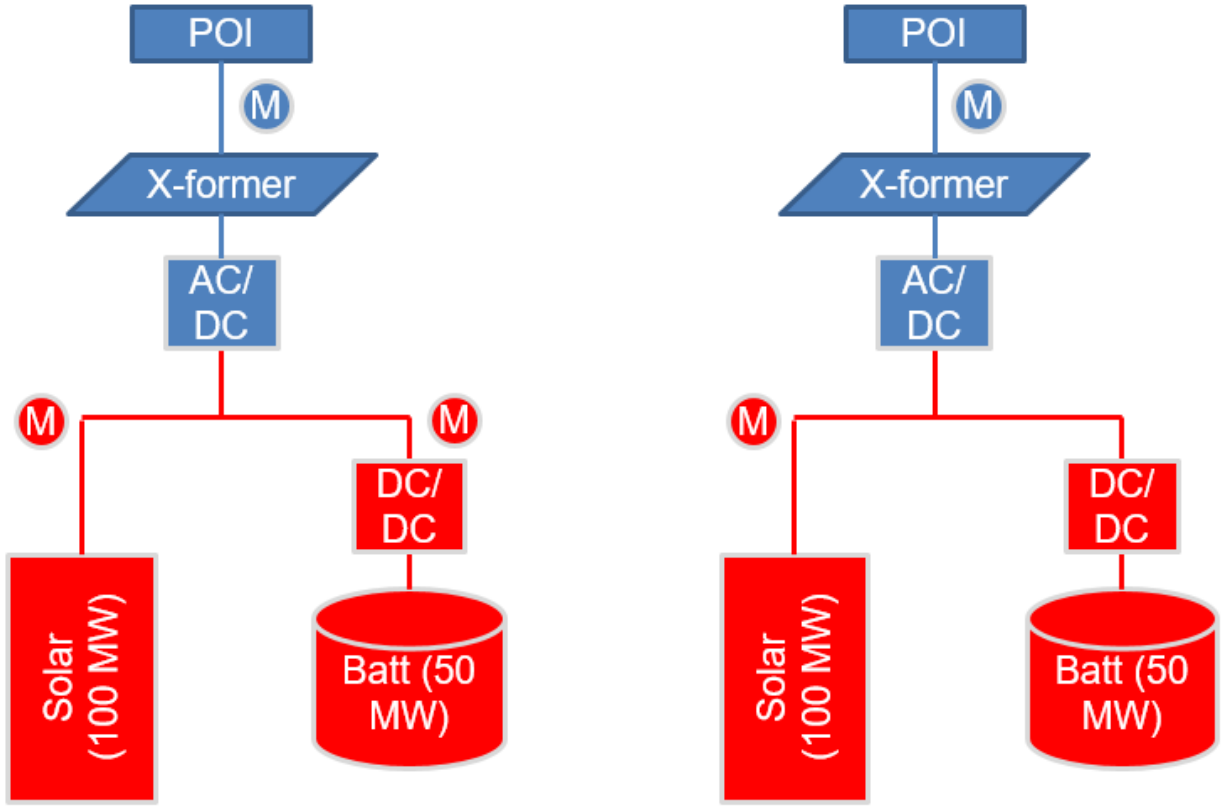
The ISO intends to work closely with interconnection customers during the market implementation of new hybrid resources to ensure that the metering configurations allow for RPS reporting and any necessary netting and losses calculations are appropriately developed.

The ISO notes that it will consider all relevant CEC renewable portfolio standard reporting guidelines applicable to hybrid resources when determining the necessary calculations and reporting activities. The ISO will also consider any other applicable regulatory guidelines for renewable portfolio reporting.

Figure 1 shows a metering diagram on the left, for a co-located resource, and a metering diagram on the right, for a hybrid resources. Most resources on the ISO grid are unique with unique metering requirements, co-located resources and hybrid resources in the future are no different. The ISO metering team reviews metering plans for new resources and verifies that these plans meet ISO standards for reporting. In both cases, metered output is compensated at the ISO point of interconnection.

The ISO accommodates co-located resources today, and requires accurate information for energy flowing from each resource across the point of interconnection, inclusive of losses, to the grid. The metering diagram in Figure 1 shows three meters, one at the DC line from each component of the co-located resource. These meters are required to distinguish between energy coming from a particular resource. The diagram also shows a meter at the point of interconnect. This meter is not required, if the actual amount of injected energy can be determined from the meters at the resource level. As noted above, metering may be required for any renewable components of a hybrid resource for state reporting purposes. Further, the ISO will require accurate metering for energy at the point of interconnection, whether this be a meter directly at that location, or individual meters at each component of the hybrid resource.

Figure 1: Metering diagram for a co-located (left) and hybrid resource (right)



4.5. Aggregate capability constraint for co-located resources

The ISO presents the aggregate capability constraint for energy only contained within this initiative as a final proposal, and intends to develop the proposed methodology for market use in fall 2020. This methodology will be enhanced with the full implementation of the aggregate capability constraint, inclusive of ancillary services, which will be implemented in fall 2021. This will be the final opportunity for stakeholders to review the methodology for the energy only aggregate capability constraint as part of the policy proposal process. The ISO intends to present this component of the policy at the board of governors meeting in July, prior to submitting a request to FERC for tariff approval. Draft tariff language will be posted publically with this paper for stakeholder review.[4]

Today aggregate values for the Pmax of each resource may not exceed the total interconnection rights at the point of interconnection for all co-located resources. This can prevent resources from being able to express actual operating output in their Pmax and bidding ranges in the market. The ISO proposes to allow resources to register their maximum operating limit as their Pmax, even if the aggregate values of these maximum operating limits are greater

[4] Hybrid resources policy website: http://www.caiso.com/StakeholderProcesses/Hybrid-resources.

than interconnection rights set forth in their generator interconnection agreements. However, the ISO will limit market awards and dispatches from these co-located resources at the point of interconnection to the total amount of interconnection service rights held by the project with co-located resources. The CAISO proposes to implement a new market constraint – the aggregate capability constraint – to effect this outcome.

Energy-only constraint (Fall 2020)

The purpose of the aggregate capability constraint is to limit co-located resource output to the project's interconnection rights. This constraint will reflect a co-located project's total interconnection rights by adjusting market awards to these limits. The initial constraint will be developed for implementation in fall 2020, will only include energy. This implies that co-located resources with this constraint in place will not be ineligible to provide ancillary services until implantation of the full constraint in fall 2021.

$$MAX\left[0, \sum_{i \in S} (EN_i)\right] \leq UL$$

$$MIN\left[0, \sum_{i \in S} (EN_i)\right] \geq LL$$

Where:

i	Resource
S	Set of resources
EN	Energy schedule
UL	Upper limit
LL	Lower limit

The constraint will not limit or impact the bid amount (MW) or bid price ($/MWh) of the co-located resources, rather the constraint will limit the respective market awards such that the aggregate dispatch will not exceed the project's total interconnection limit. The pricing node for purposes of co-located resources subject to the aggregate capability constraint will be at the project's point of interconnection to the ISO Controlled grid, rather than the physical resource location behind the constraint.

The ISO will enforce this limit as a new constraint in the market model, but will not reflect the impact of the binding constraint on the settlement price that the relevant co-located resource will receive. Congestion from this binding constraint will only be used to determine the quantity of dispatch for each co-located resource. The shadow price of the binding constraint will not be used for settlement of the relevant co-located resources. This treatment allows co-located resources to receive prevailing market prices at the point of interconnection, which results in inconsistencies between dispatch and prices when the total interconnection limit is binding.

Today the ISO includes congestion pricing from the ISO controlled transmission applied to resources at different locations across the gird. This results in prices for resources that are

consistent with dispatch instructions – i.e. when prices are equal or higher than marginal cost the resource is dispatched up, when prices are lower than marginal costs the resource is dispatched down. This paradigm may not hold true for co-located resources when the interconnection constraint binds. Resources may not be dispatched to a higher level, even though prevailing system prices could be near the $1,000/MWh price cap. Upon implementing these prices, the ISO will require additional controls to ensure that resources do not provide energy above explicit dispatch instructions that could potentially cause the total generation from co-located resources to exceed the point of interconnection limit.

If the ISO detects behavior from a specific co-located resource that may jeopardize the interconnection limits, the ISO will retain authority to review and revert the Pmax values of the co-located resource consistent with the practice in place today. This will require that the summation of all Pmax values for co-located resources does not exceed the point of interconnection limit. The ISO would determine the co-located resource's Pmax values on a pro-rata basis.

Further, if the ISO finds that co-located resources are broadly not following dispatch instructions because of this inconsistency, where the ISO may determine that this approach is not achieving its objective of balancing efficient use of the interconnection capability while maintaining and ensuring reliable operation, this component of the policy may be revisited. Specifically, the ISO may reconsider how co-located resources are priced so that these resources receive prices behind the point of interconnection, rather than in front of it. This would imply that when prices are high and co-located resources are collectively capable of producing above the interconnection limit, then the price signal would equal the marginal cost of one of the co-located resources, rather than the prevailing price at the point of interconnection.

Full constraint (Fall 2021)

The ISO proposes to use the following formulation, inclusive of ancillary services and energy, for the full implementation of the aggregate capability constraint for co-located resources. This constraint will continue to be discussed in the stakeholder process, until the final proposal. The ISO will request approval for this proposed formula at the November 2020 Board of Governors meeting, and plans to implement this constraint in fall 2021. The full implementation of this constraint follows:

$$MAX\left[0, \sum_{i \in S} (EN_i + RU_i + SR_i + NR_i + FRU_i)\right] \leq UL$$

$$MIN\left[0, \sum_{i \in S} (EN_i + RD_i + FRD_i)\right] \geq LL$$

Where (in addition to what is specified above):

RU Regulation up award
RD Regulation down award
SR Spinning reserve award

NR Non-spinning reserve award
FRU Flexible ramp up award
FRD Flexible ramp down award

Today, the ISO is challenged when manually managing independent resources behind constraints. Manual intervention could have unintended consequences on local congestion, and can occasionally cause line limits, or other system limits, to be violated. ISO operations see this as a potential concern for co-located resources that are subject to the co-located constraint proposed here. If multiple resources at one co-location are managed by independent scheduling coordinators, there is a potential for a resource to increase output, in response to operator instruction and another resources, responding to economic dispatch to also increase output. To mitigate these risks, will require that only one scheduling coordinator be allowed to submit bids for any one specific co-located set of resources.

4.6. Ancillary services

All resources, including hybrid and co-located resources will ultimately be eligible to participate in the ancillary services market, and will be subject to the same requirements as other participating resources for eligibility to provide these services into the market.[5] [6] Ancillary services consist of spinning reserve, non-spinning reserve, regulation up and regulation down.

Hybrid resources are dissimilar to other resources in the ISO market. Hybrid resources have expanded flexibility for bidding into the markets, and access to a tool that can limit the range of dispatch available to the ISO. The ISO proposes that hybrid resources maintain information internally including: energy awards, ancillary service awards, and state of charge and couple that information to provide bidding limits to the ISO such that the resource is always capable of delivering any award within the potential dispatch range. The ISO software will continue to co-optimize energy and ancillary service bids from hybrid resources, with the same process that is used today. During some intervals, when variable output is high and the battery is not being charged, hybrid resources may be capable of producing up to their full interconnection limits, and no limit reduction will be needed. During other periods, such as periods when a hybrid is performing off-grid storage charging the limits might need to be significantly reduced, and updated on a 5-minute basis as potential output for variable components change.

The ISO may require verification of all hybrid operating information to ensure that resources are capable of meeting bids.

4.7. Settlement

The ISO does not envision significant changes to the settlement process in place today with the introduction of this policy. As noted above, hybrid resources will receive dispatch instruction

[5] Tariff appendix K discusses specific guidelines for ancillary service qualifications.
[6] Co-located resources will not be able to provide ancillary services until the full aggregate capability constraint is implemented in fall 2021. Resources with this constraint will only be eligible to provide energy with the initial implementation in fall 2020.

from the ISO based on the single set of bid curves and the dynamic limit values submitted for the resource. The hybrid resource will then be required to deliver that energy to the point of interconnection. Failure to do so exposes the resource to typical uninstructed imbalance energy charges.

4.8. Market power and strategic bidding concerns

The ISO will monitor all hybrid resource forecasts and bids for strategic behavior. The ISO requires that resources be bidding in full capability for most resources on the system, and hybrid resources are not an exception. However, hybrid resources have periods when they may charge underlying storage components, and periods where energy is coming from potentially variable sources. The ISO intends to collect forecast data on variable resources as well as bid and outage data, and intends to use that information to monitor that hybrid resource bids in the market are appropriate. Bidding requirements and must offer obligations are discussed further in Section 4.9.

The ISO also recognizes that there could be several thousand megawatts of hybrid capacity on the system in the next few years, including some projects in local areas with narrow capacity margins. These projects may have more frequent ability to exercise market power in these areas. The ISO is not planning to implement market power mitigation at this time, but will likely include this in a future version of the hybrid resources initiative to address these concerns.

4.9. Resource Adequacy

The resource adequacy (RA) counting rules and must offer obligations for hybrid resources are vital to ensuring that hybrid resources can participate in ISO markets thereby supporting system and local reliability.

Local regulatory agencies (LRAs) determine counting rules to determine resource adequacy capacity. The ISO then takes this information and studies resources for their deliverability, and may reduce the amount of capacity each resource may qualify for. After this value is established load serving entities (LSEs) then compose supply plans with resources in order to meet their capacity obligations. Shown resources are then subject to ISO's provisions on availability, through the must offer obligation (MOO).

Any counting rules applied to hybrid resources may have impacts on ISO markets and operations. The ISO believes that RA counting rules should provide fair and accurate capacity valuations, as these rules will impact interconnection configurations and ISO visibility into resources that are operated on the system. The ISO continues to engage in the CPUC process to establish these practices.

The ISO currently has must offer obligations in place for all stand-alone resources. These must offer obligations will persist for all co-located projects. The ISO will continue to expect that co-located wind and solar resources to offer all available capacity into the market, when available.

The ISO proposes that hybrid resources be subject to a 24x7 must offer obligation, similar to most resources in the fleet today. The ISO recognizes that hybrid resources with storage

components will likely have multiple hours during the day while they are using on-site generation to charge storage components. This will likely result in periods when the resource is incapable of bidding all capacity into the market. During these hours the hybrid resources will have access to outage cards that may be used during non-availability assessment hours (AAHs). The resource will be required to provide full resource adequacy capacity during the availability assessment hours. The ISO further recognizes that the hybrid resources with variable energy components may not be able to bid the full resource adequacy capacity because of potential for variable underlying resources. Non-availability due to the variable nature of a hybrid component is understood by the ISO. These kinds of variability need not be reported to the ISO with an outage card, but may be captured in the dynamic limits of a hybrid resource so that the resource is always capable of delivering what is bid into the market, during all intervals. Other resource limitations, such as mechanical problems with the variable generation equipment or with the storage component will require reporting through outage management system (OMS).

For example, if a hybrid resource is comprised of a 100 MW solar resource and a +/-50 MW 4-hour storage resource with a 100 MW interconnection limit, then the resource has a must offer obligation of 66 MW for the entire day. During the peak solar hours, there may be intervals when the solar is forecast to produce at a consistent output of 80 MW for several hours, but if the hybrid resource plans to use a portion of that output to charge the on-site battery (at a full 50 MW) then the hybrid resource will only have 30 MW of availability to bid onto the grid. The resource would be required to enter an outage card for 50 MW to account for the unavailability of the storage resource, relative to the must offer obligation of the resource. Further, the absence of the additional 20 MW of solar output should be captured by the aggregate capability constraint, or an additional outage card. This will provide the ISO visibility that the hybrid resource is only capable of generating 30 MW, and that any dispatch of 30 MW will result in the same amount of energy being delivered to the grid. If the forecast solar availability changes during the charging periods, the resource would continue to update the ISO to new availability via the dynamic limit. All updates submitted through the dynamic limit tool would not be subject to resource adequacy availability assessment mechanism (RAAIM).

As noted above, the ISO will have access to forecast data, and will continue to monitor bidding and availability for hybrid resources, as they are integrated onto the ISO system.

5. EIM Governing Body Role

This initiative proposes to modify market rules that apply generally to the real-time market to facilitate participation by hybrid resources, including rules governing interconnection, providing ancillary services, metering and a range of other topics. Staff believes the EIM Governing Body should have an advisory role in the approval of the proposed changes.

The EIM Governing Body should have an advisory role because the proposed changes contemplated in this paper would apply generally and uniformly to all market time frames and across the entire ISO footprint. At this preliminary phase, it is foreseeable that some of the potential rule changes would apply only in the ISO's balancing authority area, for example rules about interconnection. That fact should not affect this proposed decisional classification, however, because staff does not currently foresee the adoption of rules that will be specific to EIM balancing authority areas. With that said, this proposed classification reflects the current state of this initiative and may change as the stakeholder process moves ahead.

If any stakeholder disagrees with this proposed classification, please include in your written comments a justification of which classification is more appropriate.

6. Next Steps

The ISO will discuss the second revised straw proposal for hybrid resources and the draft final proposal for co-located resource aggregate capability constraint for energy during a stakeholder meeting on May 7, 2020. Stakeholders are asked to submit written comments by May 28, 2020 to initiativecomments@ISO.com. A comment template will be available at: http://www.ISO.com/informed/Pages/StakeholderProcesses/HybridResources.aspx