



## **Energy Storage Enhancements**

Stakeholder Comments Matrix and ISO Responses to the Revised Straw Proposal

May 23, 2022

Energy Storage Enhancements - Stakeholder Comments Matrix

Entity (Name)	1. Please summarize your organization's comments on the revised straw proposal.	2. Provide your organization's comments on the proposed energy storage resource model, as described in the revised straw proposal:	3. Provide your organization's comments on the proposed reliability enhancements for storage resources, as described in the revised straw proposal:	4. Provide your organization's comments on the proposed co-located enhancements, as described in the revised straw proposal:	5. Provide your organization's comments on the proposed WEIM classification for this initiative.
AES (Rahul Kalaskar)	<p>AES supports the CAISO's foresight to enable storage assets to substantially advance decarbonization while maintaining reliability by absorbing excess renewable energy and ramping meeting needs, among other use cases and benefits.</p>	<p>We request additional details re the ESR model similar to the NGR modeling details included in the CAISO's Market operations BPM.</p> <p>Once the CAISO introduces the ESR model and if the scheduling coordinators choose the ESR model, can the scheduling coordinator revert back to the NGR model? AES views the dynamic charging and discharging rates based on SOC as the key benefit of the ESR model, and so requests the CAISO discuss whether this could also (or alternatively) simply be added to the existing NGR model instead.</p> <p>AES requests a specific comparison of the models and how the market optimization will treat the implicit bid spreads under both the NGR and ESR models. We request the CAISO to support separate charging and discharging rates for ESRs and the NGRs. How will dynamic charge rates impact ancillary services and regulation awards? Will the CAISO use the same simplified ramping rules for thermal generators with dynamic ramp rates for the storage models? Would the Ancillary or regulation awards be rescinded if a resource receives a regulation award in the day ahead that no longer supports the SOC charging and discharging rates?</p>	<p>Could CAISO provide additional details about the specific scenario when the SOC does not support regulation award, but the resource LMP is above the charging bid?</p> <p>AES recommends that the CAISO consider SOC consumed in the day-ahead market rather than require scheduling coordinators to submit bids in real-time, resulting in sub-optimal dispatches.</p> <p>AES requests clarification of whether the CAISO plans to eliminate the Minimum State of Charge constraints (Min SOC) after the CAISO implements the changes to exceptional dispatch as proposed in the straw proposal. In the future, will the CAISO remove the minimum SOC constraint and use-Exceptional dispatch?</p> <p>We request the CAISO provide more details about how the CAISO plans to implement the logic for the second-tier constraints such that energy is available from storage resources to maintain reliability if a key grid element is lost to meet local reliability needs. Would this implementation be done as exceptional dispatch in both the day-ahead and real-time markets? How will the CAISO notify scheduling coordinators when the CAISO implements these tools to manage local reliability?</p> <p>Suppose the CAISO restricts the discharge ability for storage resources to meet local area needs either manually or by using constraints in the market application during those intervals. Would the storage resource get compensated for lost opportunity costs similar to cases when the storage resource is exceptionally dispatched?</p>	<p>We request that the CAISO provide similar functionality with the co-located and hybrid resource models to manage ITC. If there are reasons to treat co-located resources with ITC restrictions different from hybrid resources, we request the CAISO to provide additional details.</p> <p>At the same time, the CAISO is also proposing that this functionality will not be available to other projects after this policy is implemented. The CAISO's position to eliminate these features in the future is very concerning to storage developers.</p> <p>From the straw proposal, it is unclear how the CAISO will determine the sunset provision and how much lead time is provided to the storage developers to incorporate this decision into financing the project. Second, the CAISO does not offer details about the impact of storage resource charging limitations on grid reliability. Since the ITC can be a significant portion of the project finances, it is unclear why CAISO would discontinue a market feature driving the energy transition.</p>	<p>No response provided</p>

ISO Response		<p>The ISO provided additional detail on the energy storage resource model, and spent considerable time during the stakeholder meeting on the Revised Straw Proposal discussing the specifics of the energy storage resource model. The ISO may consider not pursuing proposed changes related to a new storage model</p> <p>As proposed, scheduling coordinators, can model storage resources either with the energy storage resource model or the non-generator resource model. Scheduling coordinators may freely revert to one model or the other.</p> <p>As proposed, the ISO is not considering enhancements to the non-generator resource model. We appreciate the suggestion to enhance the existing model as well as the proposed model. The ISO cautions that building a new model and making enhancements to the old model may entail significant additional effort to develop software solutions. This effort may directly detract from other high priority software improvements considered by the ISO.</p> <p>Ancillary service awards are based on the maximum and minimum amount of output a resource is capable of achieving. Reductions in a maximum output will impact the total amount of ancillary services a resource may qualify for.</p>	<p>The ISO co-optimizes ancillary service and energy awards. The ISO is not proposing to change any of the underlying market principles that drive these outcomes in this initiative. In the 15-minute market, if a storage resource does not have the required amount of state of charge to support an ancillary service award, then the award will be rescinded. Storage resources that are bidding to charge, will not receive schedules to charge if they are uneconomic.</p> <p>The proposal does not include changes to the minimum state of charge requirement. The minimum state of charge requirement was a tool that was implemented during the market enhancements for summer 2021 readiness initiative. In that initiative, the ISO stated that these rules would sunset after two years. This policy has not changed, since implementation. The exceptional dispatch tools proposed in this initiative are different than the minimum state of charge requirement. The ISO is not developing this tool as a replacement for the minimum state of charge requirement.</p> <p>The ISO is not proposing to use exceptional dispatch tools to ensure that local resources are available for when needed in the event of contingencies. These would be requirements that are included in the model. The ISO will not notify scheduling coordinators when storage resources are needed in local areas. The schedules the resources receive will ensure local reliability.</p> <p>The ISO is not proposing additional compensation for lost opportunity costs for storage resources that must retain state of charge in local areas at this time.</p>	<p>Thank you for your input and we appreciate your comments on this issue. The ISO will consider this feedback while balancing this new treatment and reliability.</p>	
--------------	--	--	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>American Clean Power - California, Energy Strategies</p>	<p>We have significant concerns regarding the restrictions that CAISO has proposed. The Co-Located Enhancements provide an essential solution to help mitigate grid charging concerns for resources that have signed contracts which prevent grid charging and are subject to ITC recapture risk. But the proposal that these accommodations only be allowed for resources already on the system by the time this policy is implemented is untenable.</p> <p>We request CAISO implement a different “cutoff” date for eligibility under this policy, which is based around contract signature date, rather than online date.</p>	<p>No response provided</p>	<p>No response provided</p>	<p>We believe CAISO's proposal needs revision...due to a variety of issues that are delaying project commercialization which are outside of developers' control. We believe the cutoff timeline overlooks practical considerations of how these contracts are signed and executed. The proposed cutoff dates for the policy enhancements to address ITC and property tax issues proposed in the Revised Straw Proposal are unreasonable and are likely to negatively affect projects that signed contracts years ago, but may not be online by the time which CAISO chooses to implement these enhancements. We request that CAISO extend the timeline for which projects would be eligible to use the Co-Located Enhancements tools in order to better align with the limitations and contractual requirements these resources face.</p> <p>ACP-California suggests a cutoff date should be based around when the contract was signed, rather than a near-term cutoff based on project online dates and policy implementation.</p> <p>ACP-California suggests that CAISO consider utilizing the date at which the next proposal is published as the date by which contracts must have been signed in order to be eligible for this treatment, so as not to implicate contracts which have already been signed that include these provisions.</p>	<p>No response provided</p>
<p>ISO Response</p>				<p>Thank you for your input. The ISO appreciates your comments on this issue, and will consider this feedback while balancing this new treatment for co-located resources and reliability.</p>	

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>APS, (Elizabeth Goodman)</p>	<p>APS agrees with the philosophy to build upon the foundation of the existing NGR and add functionality to the new energy storage resource (ESR) minimizing the risks associated with adjusting the existing NGR model.</p>	<p>APS agrees with further investigation of further market model enhancements with the energy storage resource (ESR) to ensure that storage is efficiently compensated, and the model can accommodate the unique features of storage resources.</p>	<p>No response provided</p>	<p>The current ITC rules will impact the participation of numerous APS co-located storage resources - APS supports the ISO offering functionality for storage resources to only bid discharge capability into the market and allow the storage resource to charge from on-site solar without a dispatch instruction or recognition from the ISO. APS agrees with PNM's comments related to ITC credit prior to policy implementation. APS opposes limiting the enhancements for ITC considerations for resources online prior to policy implementation</p>	<p>EIM classification rules 1-4 fall outside of the scope of EIM, although may influence market pricing and operations depending on the implementation for through participating in EIM - mutually beneficial developments in the ESR model should be shared, yet clarifications around which changes will only impact the CAISO BAA will avoid confusion.</p>
<p>ISO Response</p>	<p>Thank you for your support and continued participation.</p>	<p>Thank you.</p>		<p>Thank you for your input. The ISO appreciates your comments on this issue, and will consider this feedback while balancing this new treatment for co-located resources and reliability.</p>	<p>The proposed changes will be applicable to WEIM Entities balancing authority areas, WEIM Entities, or other market participants within WEIM Entity balancing authority areas, in their capacity as participants in WEIM. WEIM balancing authority areas may use the energy storage resource model and would fall within the scope of join authority.</p>

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>California Community Choice Association (Shawn-Dai Linderman)</p>	<p>CAISO should consider the use of the proposed tools for local areas and their impact on market prices in the TPP when evaluating whether to approve upgrades that would alleviate local area constraints and reduce reliance on the this tool.</p> <p>CAISO should expand its co-located enhancements proposal to all co-located resources eligible for ITC and tax benefits, regardless of when the contract was executed.</p> <p>CalCCA requests clarification on: (1) how bids would be submitted in the DA market considering the initial SOC is unknown; (2) whether its AS proposal would only apply to resources using the NGR model, not the ESR model, to the extent necessary to satisfy their award; (3) the rationale behind the time horizon proposed to calculate counterfactuals used to establish opportunity costs associated with EDs to hold SOC, as a different lookout period, such as 24 hours or all hours of the day following the ED, may be preferred given every increment of SOC is dependent on the previous SOC.</p>	<p>CalCCA requests clarification or an example on how bids would be constructed for day-ahead, given the SOC going into the first hour of the day will not be known when bids are submitted at 10 a.m. the day prior. This is especially important; how the resources bid will likely depend on the SOC of the resources at a defined starting point, which could vary significantly from the time bids are submitted for day-ahead to the beginning of the day.</p> <p>CalCCA supports requests by stakeholders on the call for the CAISO to provide more examples that explain how the CAISO will model variable ramp rates.</p> <p>CalCCA supports a robust market power mitigation mechanism for storage resources operating under the ESR model - CAISO should consider what happens if the mitigated bids to discharge are below the bids to charge, given the ESR model will have separate bids to charge and discharge.</p>	<p>The CAISO should clarify this proposal would only apply to resources using the NGR model. The CAISO should also clarify in its proposal that to the extent necessary to satisfy their award, the storage must provide an energy bid with its ancillary service award.</p> <p>CalCCA supports the CAISO implementing new functionality to allow operators to ED storage resources to hold SOC and compensating storage exceptionally dispatched to hold SOC using an opportunity cost methodology. CalCCA requests the CAISO further explain the rationale behind the time horizon proposed to calculate the counterfactuals used to establish the opportunity costs, which is currently the length of the ED plus the duration of the battery. A different lookout period, such as 24 hours or all hours of the day following the ED, may be more appropriate.</p> <p>CalCCA does not oppose the CAISO's proposal to schedule energy storage resources in day-ahead through the market when operators identify challenging constraints in local areas. The CAISO should, however, consider the use of these tools and their impact on market prices in the TPP when evaluating whether or not to approve transmission upgrades that would alleviate local area constraints and reduce reliance on the use of this tool.</p>	<p>CalCCA supports the proposed selectable functionality to limit dispatch instructions, so they are no greater than the forecast of the co-located renewable, but CalCCA opposes the CAISO's proposal to limit this functionality to resources that have contractual ITC implications or property tax implications in place prior to this policy being implemented. The ITC is a federal benefit that could potentially extend beyond its current five-year timeframe in the future. Only applying this functionality to existing resources with contracts signed before implementation (i.e., 2023) creates both uncertainty and new challenges for co-located resources coming to market, since new resources will have uncertainty around the ITC it can expect to receive. Further, compensation through the CAISO market cannot offset foregone ITC payments. This is exacerbated by the foregone property tax benefits that are lost by any amount of grid charging.</p> <p>CalCCA requests clarification on the process by which market participants would have the ability to request the functionality be added or removed. CalCCA understands that the New Resource Implementation (NRI) process can take a considerable amount of time.</p> <p>CalCCA supports the comments from Clean Power Alliance (CPA) submitted to the Revised Straw Proposal regarding the curtailment of co-located resources.</p>	<p>CalCCA has no comments at this time.</p>
--	---	---	--	--	---

Energy Storage Enhancements - Stakeholder Comments Matrix

ISO Response		<p>The bidding construct for resources participating using the non-generator resource model are more impacted by unknown state of charge levels – during any period of the day – than storage resources using the proposed energy storage resource model. For storage participating using the non-generator resource model, the resource is charged or discharged based on bid prices, and is completely agnostic about the state of charge. This could be problematic in cases where the scheduling coordinator anticipates high state of charge and is willing to sell energy at moderate prices. In real-time the storage resource may actually have a low state of charge, and may have a day-ahead dispatch that is counter to the ideal dispatch in real-time. The same kind of issue could occur when the day-ahead model anticipates low state of charge but the actual state of charge in real-time is high. This kind of issue is, at least partially, addressed by the energy storage resource model. This model allows a storage resource to bid, in both the day-ahead and real-time and real-time market a willingness for the resource to sell energy at any specific state of charge.</p> <p>If an energy storage resource is mitigated, both the bid curve to charge and discharge will be mitigated. This is the only way that the ISO can ensure that the curves are monotonically non-decreasing, which is necessary for the optimization software.</p> <p>The ISO appreciates the request for variable ramp rate examples in the new proposed model. We will consider these in future iterations of the initiative.</p>	<p>The proposal for the changes to ancillary service requirements would apply to resources participating with the energy storage resource model and the non-generator resource model.</p> <p>The ISO considered a number of time horizons and was attempting to balance a horizon that included a sufficient look-ahead to capture appropriate opportunity costs but short enough to avoid being overly computationally burdensome.</p> <p>In transmission planning process when a resource alternative is selected as an alternative to mitigate a reliability concern, it is assumed that the resource would be economically viable in the market through various market operation and compensation mechanism. Also, clarification is needed in regards to what “impact on market prices” is referring to.</p>	<p>Thank you for your input. The ISO appreciates your comments on this issue, and will consider this feedback while balancing this new treatment for co-located resources and reliability.</p> <p>As proposed, requesting this special functionality for co-located resources would require a consultation with the ISO and would require demonstration of circumstances where this treatment would be necessary. This process may be similar to setting up a negotiated default energy bid. Switching from this treatment to the traditional co-located model would be straightforward, and would only require sending notice to the ISO. This process would not require resources to go through the new resource interconnection process.</p>	
--------------	--	--	--	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>California Energy Storage Alliance, (Alexander Morris)</p>	<p>The proposed DEB formulation does not properly recognize the impact of SOC on the costs of an ESR and should be refined with consideration of historical prices.</p> <p>While CAISO's intent to minimize changes to the NGR model is reasonable, the new participation model is may create a disadvantage relative to NGR model.</p> <p>The ISO should provide more clarity on how the ESR model will co-optimize bids for products other than energy and issue the corresponding power dispatch instructions.</p> <p>The proposed method to calculate the opportunity costs of storage assets that have been subject to a state-of-charge exceptional dispatch (SOC ED) instruction merits improvement, particularly with regards to the number of hours it considers.</p> <p>The eligibility restrictions and limitations recommended for the co-located electable functionality are overly exclusive and have the potential to induce market uncertainty.</p>	<p>The ESR DEB proposal does not accurately recognize the impact of SOC on the costs of assets. CESA agrees with the recommendations made by Pacific Gas &amp; Electric (PG&amp;E) during the stakeholder call held by the ISO to discuss the revised Straw Proposal, to consider historical data to inform the slope, rather than only IFM values.</p> <p>ISO should consider the merits of applying several of the proposed characteristics of the ESR model to the NGR model. It is not readily obvious why some of the improvements of the ESR model has over the NGR model cannot be readily applied to the latter. ISO should consider, ad minimum, ensuring that both the NGR and ESR models allow for representation of transition times, cycling limits, and variable charge/discharge rates in the Masterfile. Otherwise, CESA considers there would be clear advantages for ESR resources as they would be better positioned to represent their marginal costs and ensure unfeasible dispatch instructions are minimized.</p> <p>CESA requests clarification regarding how the ESR model would deal with bids for other products, such as ancillary services, that are currently bid in terms of power. Will ESR assets be able to bid for these products with similar granularity? Will dispatch instructions be in terms of power or energy? Would co-optimization work as it currently does for NGR assets?</p>	<p>CESA considers that the duration of the horizon utilized to calculate the counterfactuals is unduly restrictive.</p> <p>First, CESA disagrees that the horizon should commence from the first interval where the exceptional dispatch to hold state of charge is in place; the horizon should commence when the initial instruction to charge was issued. Second, CESA disagrees that the horizon should be arbitrarily limited to the duration of the SOC ED plus the duration of the storage asset. The economics of storage resources are not restarted every number of hours, they are the result of a continuous set of iterative decisions. As such, an SOC ED instruction will have ripple effects beyond the immediate hours after it. In this context, CESA recommends the CAISO considers all the hours remaining in the day of the SOC ED when calculating the counterfactuals.</p>	<p>We find some of the recommended restrictions and limitations to be overly exclusive and potentially induce market uncertainty.</p> <p>CESA does not believe that contractual obligations should be necessary for an asset to use the electable functionality as the intention of applying for ITC compensation and its compliance falls squarely between the project owners and the Internal Revenue Service (IRS).</p> <p>CESA advises against limiting access to the electable functionality only for assets online by the time of implementation, instead recommending that eligibility should be tied to ITC eligibility, as demonstrated by the asset owner.</p> <p>Finally, CESA requests clarity regarding the duration of the electable functionality once an asset is able to select it - the proposal suggests that resources will only be eligible for this electable functionality for a 5-year period upon joining the grid, effectively eliminating the possibility of older standalone generation assets that wish to add storage to be eligible. CESA does not believe that this limitation is reasonable as the 5-year period may not be adequate for all assets: it may be too short for projects that will still need to go through testing and commissioning while it may too long for projects that started their ITC period prior to policy implementation. As a result, CESA recommends the elimination of this provision. If the ISO decides to retain any of the aforementioned eligibility restrictions for the electable co-located functionality, it should, ad minimum, include an explanation on why the restrictions and their potential market effects are reasonable.</p>	<p>No response provided</p>
---	---	---	---	---	-----------------------------



Energy Storage Enhancements - Stakeholder Comments Matrix

ISO Response		<p>As proposed, the ISO is not considering enhancements to the non-generator resource model. We appreciate the suggestion to enhance the existing model as well as the proposed model. The ISO cautions that building a new model and making enhancements to the old model may entail significant additional effort for software develop. This effort may directly detract from other high priority software improvements considered by the ISO.</p> <p>The ISO appreciates that offering two models for storage resources could lead scheduling coordinators to opt for one model over the other.</p> <p>The ISO does not anticipate changing the co-optimization between energy and ancillary services in the day-ahead market. A storage resource using the energy storage resource model would be co-optimized similar to other resources. The resource could clear some – or all – capacity for ancillary services, and the remainder could be used for energy. The storage resource would still be subject to the requirements for state of charge for ancillary service awards and the model would ensure that state of charge for the resource does not exceed upper and lower bounds.</p> <p>As proposed, bids for ancillary services would still be submitted, in terms of capacity, for energy storage resources.</p> <p>Awards for ancillary services for energy storage resources will continue to be awarded in power/capacity (MW).</p>	<p>The proposal outlines that exceptional dispatch instructions that result in resource charging will be compensated similar to existing exceptional dispatch instructions, where resources receive payments for the energy provided at the higher of the bid price or the prevailing market price. The opportunity cost compensation is for intervals where the storage resource is prevented from providing output, when it may have been economic to do so.</p>	<p>Thank you for your input. The ISO appreciates your comments on this issue, and will consider this feedback while balancing this new treatment for co-located resources and reliability.</p>	
--------------	--	--	--	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>California ISO - Department of Market Monitoring, (Adam Swadley)</p>	<p>(DMM's full comments are available at: <a href="http://www.caiso.com/Documents/DMM-Comments-on-Energy-Storage-Enhancements-Revised-Straw-Proposal-Apr-7-2022.pdf">http://www.caiso.com/Documents/DMM-Comments-on-Energy-Storage-Enhancements-Revised-Straw-Proposal-Apr-7-2022.pdf</a>)</p>	<p>DMM supports the CAISO's development of an energy storage model that reflects costs of energy storage resources dependent on state of charge. DMM also supports the application of local market power mitigation to resources using the energy storage resource model. However, extension of current energy storage default energy bids to the energy storage resource model may have mixed implications for accuracy of marginal cost estimates. The new model also introduces additional considerations for monitoring and market power mitigation.</p>	<p>DMM supports market enhancements that improve the availability of ancillary services awarded to energy storage resources, and the proposed enhancements to allow state of charge exceptional dispatch of energy storage resources. The CAISO proposes that resources receiving an exceptional dispatch for state of charge be compensated for the opportunity cost of missed market opportunities. While this type of compensation may be appropriate, the CAISO's proposed approach should be further developed to consider resource energy bids in counterfactual analysis in order to avoid overestimating applicable opportunity costs. DMM supports enhanced tools to manage local area reliability needs. As an additional component of these enhancements, the CAISO should consider ways to address the potential for unmitigated local market power that may result during charging of a storage resource needed for local reliability. Such enhancements will become increasingly important as reliance on storage resources within transmission constrained areas increases.</p>	<p>The investment tax credit (ITC) and property tax issues seem significant enough to discourage participation; DMM therefore does not oppose the "grandfathered" type of provisions and continues to recommend that the CAISO and stakeholders develop a reasonable model for incorporating ITC reductions into bids.  It will be important that the CPUC's new slice-of-day resource adequacy framework and the CAISO's UCAP policy appropriately differentiate between the capacity contributions of the two types of storage resources. Storage resources that can never charge from the grid will be less flexible and less able to supply capacity at all critical hours than storage resources that can charge from the grid - therefore, co-located resources that are constrained to not charge from the grid should receive a lower capacity payment than storage resources that can charge from the grid.  DMM continues to recommend that the CAISO consider mechanisms that could better align day-ahead and real-time state of charge levels to prevent potential BCR gaming opportunities</p>	
<p>ISO Response</p>		<p>Thank you for your support. The ISO is considering extending the stakeholder process for the energy storage resource model to allow additional time to vet the issues associated with the new model.</p>		<p>Thank you for your input. The ISO appreciates your comments on this issue, and will consider this feedback while balancing this new treatment for co-located resources and reliability.</p>	

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

<p>California Public Utilities Commission - Public Advocates Office, (Patrick Cunningham)</p>	<p>The Public Advocates Office at the California Public Utilities Commission (Cal Advocates) comments are focused on the CAISO's proposed co-located energy storage enhancements. Allowing existing and future energy storage resources to optimize incentives for renewable charging while providing needed grid reliability services will provide the greatest value for California ratepayers.</p>	<p>Cal Advocates has no comments on this issue at this time.</p>	<p>Cal Advocates has no comments on this issue at this time.</p>	<p>Allowing co-located resources to bid marginal costs that reflect any lost value from grid-charging will provide market incentives for "clean charging" of the resources, while also providing needed resource flexibility to the CAISO - the same tools should be available for all ITC-eligible projects during their initial five-year ITC periods and the tools should not be restricted to co-located resources that are interconnected to the CAISO grid before the functionality is implemented. The CAISO's tools should also accommodate resources' property tax incentives as long as the incentives are extant.</p>	<p>Cal Advocates has no comments on this issue at this time.</p>
<p>ISO Response</p>				<p>The ISO agrees that storage resources should be allowed to reflect all lost value from grid charging in bids. The ISO will consider alternatives in future iterations of this initiative.</p>	

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Clean Power Alliance of Southern California (CC Song)</p>	<p>The CAISO market should do everything reasonable to accommodate ITC restrictions.</p> <p>CPA recommends that ISO adopt a procedure to attenuate its exceptional dispatch curtailment orders to co-located facilities.</p> <p>It would be more reasonable to allow the enhancement for ITC-qualifying resources with contracts signed by the time the policy goes into effect.</p>	<p>CAISO could further improve its proposed co-located enhancements by optimizing curtailment orders rather than simply permitting storage charging to deviate down during intervals with renewable curtailment. In comments to initial Straw Proposal, CPA suggested Equations 1-3 to adjust curtailment orders so that charging instructions can continue as scheduled. Optimizing curtailment orders with respect to the characteristics of co-located resources would result in greater state of charge (SOC) in subsequent periods, improving reliability and value-capture by market participants.</p> <p>[Full example in comments] - The example illustrates that curtailment orders that are met with downward charging deviations have a reduced effect on clearing system oversupply, and that there exists an alternate, lesser curtailment order which ISO would prefer because it reduces the same amount of system oversupply while allowing incremental charging with higher SOC carried into future intervals.</p> <p>[See also CPA's comments to initial Straw Proposal] - Equations 1-3 below demonstrate the optimal curtailment conditions under CPA's alternate recommendation</p>	<p>Permitting access for co-located resources based on their contracting dates fairly balances market participants' interests with ISO's desire for an expiration date for this functionality and is also more aligned with the Federal Government's clean energy objectives embodied in the ITC.</p> <p>If tight supply chain conditions persist into next year, ISO might find parties opportunistically requesting implementation delay so they can quality. It might even be reasonable for ISO to acquiesce to such a delay under that condition.</p>	<p>CPA requests clarification about the risk of grid emergencies mentioned on page 5 of Revised Straw Proposal - that co-located enhancements would not be available during a grid emergency or when a grid emergency is imminent (the typical case being a heatwave with excessive load). During such an emergency, storage charging is disincentivized by high wholesale electricity prices and the co-located enhancement almost certainly would not come into play. Is there a different type of grid emergency that temporarily revoking co-located enhancements would address? Are power oversupply conditions liable to create a grid emergency? Is ITC-storage grid charging truly necessary to avert such an emergency? Please clarify the potential risks of a grid emergency that exempting the application co-located enhancements would ameliorate.</p>	<p>No response provided</p>
--	--	--	--	--	-----------------------------

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>	<p>The ISO is concerned about the potential reliability impacts that the observing these contractual obligations in the market model will have on reliability. The ISO is also concerned about a precedent being set where other resources on the grid may assume that the ISO models will accommodate all contractual restrictions. A key principle for the ISO has been to model physical attributes of resources, rather than contractual obligations, partly to ensure maximum availability of all resources participating in the market, which – in turn – gives our operations team the greatest ability to meet load at any given time and allows for the most efficient overall market outcomes.</p> <p>The ISO appreciates that allowing contracts signed for co-located resources prior to policy implementation may be prudent.</p>	<p>Thank you for your input; while curtailment issues are not in scope for this particular initiative, the ISO will take this into consideration when developing the next proposal iteration.</p>	<p>The ISO understands the desire for storage resources to have contractual obligations on grid charging restrictions reflected in the market models. The ISO has concerns regarding the limitations that this could impose on operating the fleet and potential for reliability concerns.</p> <p>The ISO has no issue with storage resources reflecting investment tax credit considerations in contracts. The contracting terms described, explicitly prohibiting grid charging, do not match investment tax credit rules. These prohibitions maximize credits for the facilities trying to take advantage of them.</p> <p>The ISO appreciates and supports incentives to foster the buildout of storage. Storage buildout is critical for the state to meet greenhouse gas reduction goals. The ISO is concerned about federal policy that incentivizes resources buildout, but prohibits full participation in the energy and ancillary service markets through those incentives.</p> <p>In light of the anticipated tight conditions this summer the ISO is concerned about any policy development that would potentially induce resources to delay market integration. The ISO is focusing on accommodating any new generation possible prior to the summer.</p>	<p>The ISO is currently compiling data to better classify when grid reliability may be a concern in the future, and if insufficient rate of charge led to these concerns. The ISO has not completed analysis at this time.</p>	
---	--	---	--	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

Columbia University in the City of New York (Bolun Xu)	The proposed ESR bidding model will improve storage profitability and utilization compared to the prior power bidding model by around 5% to 10% according to my group's research results.	My group has developed algorithms to calculate the storage opportunity value based on price series as a function of SoC, these tools will help CAISO to generate default bids using physical storage parameters, including nonlinear efficiency, power rating, and degradation cost. The tool will also help CAISO to monitor market power of storage participants, and conduct market price and efficiency analysis with increasing storage share.	No response provided	No response provided	No response provided
ISO Response	The ISO appreciates your support and analysis of the proposed energy storage resource model.	Thank you.			

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Long Duration Energy Storage Association of California, (Julia Prochnik)</p>	<p>A principal concern expressed and supported by the long duration energy storage community is “a lack of compensation during critical periods when the ISO must retain state of charge on some energy storage devices, precluding their active participation in the real-time markets. The traditional bid structure must change and adapt to provide credit and or cost recovery for charging and discharging short and long duration energy cycles.</p> <p>In response to the concern expressed regarding limited time horizon, the LDESAC encourages the CAISO to consider a range of options giving the flexibility needed to ensure the many grid services and characteristics of LDES are permitted in the marketplace</p>	<p>The LDESAC is encouraged by the modeling improvements and look forward to the dialogue and additional thoughts to improve the state of charge cost and credit optimization. When considering new advisory intervals to dispatch storage resources, the LDESAC suggests expanding the scenarios to look at multi-hour needs and multi-day peak needs to address the duration curves (e.g., caused by multi-day weather events or grid instability over 8 eight hours).</p>	<p>As mentioned before, the LDESAC would like to expand the three areas and broaden the terms to address duration and seasonal attributes in each category as well as the diversity of state of charge from different types of long duration energy storage. The LDESAC supports:</p> <ol style="list-style-type: none"> <li>1) extending the look ahead window in the real-time market, understanding the technology limitations, but would like to revisit the metrics in the tools and parameters to consider the diverse technologies and attributes of LDES,</li> <li>2) developing an energy shift product could be really helpful and LDESAC looks forward to participating in more discussions, and</li> <li>3) enforcing specific requirements that incorporate LDES attributes to ensure state of charge is equitable to all types of storage in the real-time market.</li> </ol>	<p>System operators should develop a robust, enduring framework for capacity accreditation that both captures differences in storage duration and evolves as storage penetration grows and the overall system's loads and resources change. Periods where storage, especially LDES is critical will become more frequent as storage penetration increases and traditional resources retire.</p>	
---	--	--	---	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>	<p>The ISO has mentioned that compensation for long duration, or very long duration resources will be a key challenge in the future. The ISO is not proposing new market tools to provide that compensation in this initiative. Today the ISO has very little long duration storage capacity installed but anticipates that this number will grow in the future. As more of this capacity interconnects, the ISO will begin to consider new market tools for compensation for their participation. The ISO also participated in the CEC workshop on long-duration energy storage on April 5, 2022, focused on examining opportunities to advance non-lithium-ion, long-duration energy storage technologies through the Electric Program Investment Charge (EPIC), proposed state funding, and federal infrastructure funding. The ISO is reaching out to state agencies to develop a common definition of long-duration storage and how much the grid needs to meet the state's goals while maintaining grid reliability during the transition.</p>	<p>The time horizon that the market considers is an important characteristic for efficient market dispatch. As storage resources and state of charge from storage resources are required for longer periods of time the ISO may consider extending markets to include additional increments of time. Extending the market to include additional periods may improve efficiency of outcomes. These problems can be even more significant and challenging to address as storage is needed in a future month or potentially a future season.</p> <p>The ISO notes that multi-hour considerations are already captured in the day-ahead market. However, anything beyond the midnight-to-midnight timeframe is not captured. The ISO anticipates efficiency benefits from storage being available for discharge in the morning hours, by 2024 at the latest. The ISO also appreciates that multi-day planning and positioning of storage for peak loads could also greatly improve outcomes. The ISO looks forward to tackling these problems in the future.</p>	<p>Expanding the look-ahead window in the real-time market is not in scope for the energy storage enhancements policy. This idea has been discussed in the context of this policy and in other policies and generally the ISO notes that although there would likely be benefits to extending the look-ahead horizon, there are significant technological burdens to doing so at this time. The ISO does not foresee an ability to overcome these challenges in the near future.</p> <p>The ISO is not currently considering introducing an energy shift product in this policy, but may do so in future iterations of this policy, or in new policies related to storage resources.</p> <p>The ISO believes that long duration energy storage resources will be critical to operating the future grid. Ensuring that market models capture key operating realities of these initiatives will be important. The ISO is eager to learn what additional tools or functionality may be necessary to accommodate long duration resources.</p>	<p>The ISO does not oversee the resource adequacy program, which is responsible for developing methodologies for crediting storage, and other resources, to ensure long-term reliability while operating the grid. The local regulatory agencies across the state are responsible for setting these guidelines. The largest of these agencies, the CPUC, currently has an open proceeding, called resource adequacy reform, to consider changes to the existing resource adequacy program that would likely change counting rules for storage resources.</p> <p>The ISO agrees with the principle that resources that are physically capable of more participation, or are more reliable than comparable resources be more valuable in the established resource adequacy program.</p>	
---	--	--	---	---	--



Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Marin Clean Energy, (Vidhi Chawla)</p>	<p>The CAISO should provide additional explanation and examples comparing the proposed Energy Storage Resource (ESR) model to the Non-Generator Resource (NGR) model to show how the ESR model works in practice.</p> <p>The CAISO should conduct further discussions with stakeholders on the proposed Ancillary Services (AS) modeling that will require storage resources to accompany AS awards with energy bids.</p> <p>It is critical the CAISO extend the functionality to restrict grid charging for all co-located resources utilizing the Investment Tax Credit program (ITC) and/or having property tax implications irrespective of when these resources come online and remove the five-year limit on how long these resources can take advantage of this functionality.</p>	<p>The CAISO should provide additional explanation or examples on how the Energy Storage Resource (ESR) model works in practice and compares to the existing NGR model. MCE supports the CAISO's efforts, however, at this time, MCE is still seeking to understand how it works in practice to improve energy storage arbitrage.</p> <p>Many non-lithium-ion batteries have additional physical limitations that cannot be modeled in the NGR model. For example, there are limits on moving between charge and discharge, transition times, transition costs, and varying ramp rates at different megawatt (MW) and megawatt hour (MWh) levels. MCE asks that the CAISO incorporate these constraints into the existing NGR model and continue to work with stakeholders to develop the ESR model.</p>	<p>At this point, MCE does not support the Ancillary Services (AS) proposal as it may put at risk energy storage resource revenues when providing regulation. Because depletion is not accounted for in the day-ahead AS awards, we would expect energy storage resources would likely be frequently forced to uneconomically dispatch to support the award. The CAISO should provide an estimate of these costs prior to moving forward with this aspect of the proposal. CAISO should conduct further discussions with stakeholders on this issue before adopting any changes related to this enhancement.</p>	<p>CAISO should not restrict this functionality only to resources that have contractual ITC implications or property tax implications in place prior to this implementation. MCE urges the CAISO to make sure that the functionality to restrict grid charging for co-located resources is extended to all storage resources irrespective of their online date.</p> <p>The CAISO's Resource Adequacy Availability Incentive Mechanism (RAAIM) penalty on charging availability would also be double penalizing a resource under the existing rules.</p> <p>The CAISO should avoid imposing a five-year limit on restricting grid charging for all resources but rather allow these resources to utilize this functionality for as long as necessary to take advantage of the various tax incentives (ITC, property taxes etc.).</p> <p>Contractual limitations are important for optimized resource performance and financing and therefore should be modeled as physical limitations. In the case of co-located battery storage resources, contractual limits can include physical limitations in order to comply with the financing agreement that the particular resource may have in place. These contractual limitations can prevent resources from incurring excessive maintenance costs or voiding warranties which underlie the financing agreements. A physical limitation should not reflect maximum resource performance at any cost, but what the resource has been designed to do under its financing agreement.</p>	<p>No response provided</p>
---	---	--	--	---	-----------------------------

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

<p>ISO Response</p>		<p>The ISO will continue to seek feedback on ways to improve examples and specific details that would be helpful to improve understanding, and is considering extending the stakeholder process for additional time to vet the energy storage resources model.</p> <p>The ISO agrees that there are some modeling features, including those listed by Marin Clean Energy, that are not available to storage resources using the non-generator resource model. The ISO has not included enhancements to these features for the non-generator resource model because of the additional software development effort necessary for implementation. The ISO anticipates that developing the energy storage resource model will be very complex, and making similar changes to the non-generator resource models could result in a significant amount of additional development effort.</p>	<p>The outlined proposal never introduces intervals where storage resources would be uneconomically dispatched. The proposal only requires bids for energy.</p>	<p>The ISO is not sure how the resource adequacy availability incentive mechanism would double penalize resources under the existing rules.</p> <p>The idea behind the 5-year limitation, is that this would accommodate resources on the system, but that resources arbitrarily far in the future would not be eligible for this treatment, and that resources would not receive this treatment indefinitely. The ISO is concerned about a significantly large amount of storage using this treatment and the potential for reliability concerns.</p> <p>The ISO has taken strong positions previously to not honor contractual arrangements made by resources on the grid. The ISO does this to help ensure fair treatment of all resources across the grid. This policy represents a departure from the previous stance and a willingness to make some accommodations for contractual obligations.</p>	
---------------------	--	---	---	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Middle River Power, LLC, (Brian Theaker)</p>	<p>MRP reiterates that, while the ESR model is an improvement over the current functionality, the CAISO should also strive to incorporate what MRP believes to be more important functionality (addressing cycling/mileage limitations) in the ESR model.</p> <p>MRP supports the CAISO's proposal for compensating resources that have been exceptionally dispatched to hold State of Charge ("SOC").</p> <p>MRP supports the CAISO's efforts to develop co-located resource functionality that helps manage grid charging. MRP continues to encourage the CAISO to coordinate the Resource Adequacy implications of that functionality with other CAISO Resource Adequacy stakeholder efforts.</p> <p>MRP supports the proposed EIM classification.</p>	<p>CAISO should clarify whether, under the proposed ESR model, charging and discharging dispatch levels would be binary (i.e., the model would dispatch the resource to charge or discharge at either the resource's Pmax or Pmin). MRP appreciates from the discussion in the RSP (page 12) that the storage resource will be dispatched at either its maximum charging or discharging level if the resource is inframarginal, but the resource could be dispatched to charge or discharge anywhere in its applicable operating range if the resource is marginal. MRP requests the CAISO correct MRP's understanding of how the ESR model will dispatch the storage resource if that understanding is incorrect.</p> <p>CAISO must incorporate a better way to manage cycling and mileage within its ESR model. Otherwise, storage resources' Scheduling Coordinators are likely to seek to manage those significantly affecting limitations through highly sculpted energy offers, which may lead to suboptimal results.</p>	<p>Appreciates counterfactual dispatch to compensate a storage resource for its lost opportunity cost, but actual prices used to calculate the proposed compensation are likely to be higher than the counterfactual prices would be if the CAISO had accounted for the energy storage's dispatch, because the energy storage's output was effectively withheld from the solution when it was instructed to hold SOC, forcing the CAISO to go farther up the supply stack and increasing the clearing price. While this is a good thing for the storage resource receiving the exceptional dispatch compensation, it is not for the market participants that will bear the uplift charges.</p> <p>Given the CME initiative, MRP is circumspect that the proposed procurement of capacity/energy from conventional resources to meet the "second tier" constraints and incorporating the actions into market prices, will yield positive results.</p>	<p>MRP supports the CAISO's efforts to develop co-located resource functionality that better helps Scheduling Coordinators manage the grid-charging risks for the ESR. MRP strongly agrees that the resource adequacy implications, including the must-offer obligation, resource counting, and RAAIM implications of the co-located resource functionality must be considered and coordinated with other affecting proposals being developed within the RA Enhancements initiative.</p>	
---	---	---	--	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>ISO Response</p>	<p>The ISO is trying to strike a balance between implementation effort and features offered to resources. Stakeholder feedback on these options is important and will shape the features that the ISO actually proposes and develops.</p>	<p>If the energy storage resource is not marginal, the dispatch levels will typically be binary, at the Pmin or Pmax. If the resource is marginal, it could be dispatched anywhere within this operating range.</p> <p>The ISO anticipates that storage resources would manage cycling with bids, but appreciates that this could lead to sub-optimal outcomes, noted in these comments.</p>	<p>The ISO appreciates that prices may be lower if storage resources are able to participate, and provide supply to the market. The ISO is not proposing to develop counterfactuals – to estimate what prices may have been – with full participation of the storage resources. Finding these prices could be very computationally burdensome and may be challenging to determine. The ISO does anticipate monitoring payments made to resources dispatched with these tools, and may reevaluate this methodology in the future.</p>	<p>The ISO appreciates Middle River Power's support and is actively developing rules for must offer obligations, resource counting, and resource adequacy availability incentive mechanism treatment in the resource adequacy enhancements stakeholder process.</p>	
---------------------	---	--	--	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Northern California Power Agency, (Michael Whitney)</p>	<p>NCPA asks CAISO to present further analysis comparing the NGR and ESR models under various similar strategies and conditions in an effort to determine if one outperforms the other and the market can settle on the superior model. NCPA is concerned that maintaining two storage models will be too cumbersome and could result in market result publication delays and settlement issues. NCPA supports comments for further working group meetings.</p> <p>NCPA is concerned that exceptionally dispatching an RA resource to hold SOC could be an issue due to an oversimplified counterfactual calculation that would potentially result in compensation greater than realized opportunity costs.</p> <p>NCPA asks CAISO to resolve the issue of energy awards that encroach into A/S capacity and make it unavailable to provide that product when needed without inhibiting the SC's ability to fully cooptimize the bids with all certified products. CAISO should not overly rely on regulation that could drain the SoC and make it unavailable.</p>	<p>NCPA wishes to see a more thorough comparison of the NGR and ESER models: Why would a storage resource SC pick one over the other? How much effort would be involved for CAISO to maintain two battery models? How do the ESR model state of charge bids give a resource more control over the state of charge than NGR bids where the SC effectively controls the state of charge through pricing signals?</p>	<p>NCPA currently does not support imposing further constraints on A/S bids and would like to better understand the root cause of energy market results conflicting with A/S market results resulting in a state of charge that is unable to support the A/S obligation.</p> <p>NCPA is concerned that exceptionally dispatching an RA resource to hold a state of charge could be an issue due to an oversimplified counterfactual calculation that would potentially result in compensation greater than realized opportunity costs. Paying them for exceptional dispatch could result in a duplicate reliability charge to load since these resources are already compensated for reliability purposes.</p>	<p>NCPA supports CAISO offering additional flexibility to existing co-located resources with grid charging restrictions associated with ITC and property tax benefits.</p>	<p>No response provided</p>
--	---	--	--	--	-----------------------------

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>	<p>The ISO does not anticipate delays in publishing settlement data because of the development of the energy storage resource model. The ISO will consider further working groups and discussions on paths forward for modeling updates for storage resources.</p> <p>The ISO intends to continue co-optimizing energy and AS awards in the DA market. Bids for both services may be submitted by scheduling coordinators for consideration in the market. The market software will pick the cost minimizing mix of energy and AS from all resources that meets the market constraints in place. Resources awarded AS in the DA market, then must be available to provide those services in the real-time market. During intervals when a resource has a specific regulation award, the resource may be asked to respond to automatic generator control instructions to the limit of capacity awarded. These instructions may reduce SOC for storage resources providing these services, which could reduce ability to provide energy or AS in the future.</p>	<p>A scheduling coordinator may pick one storage resource model over the other because of the bidding structure offered. The energy storage resource model offers a way to tailor bids to state of charge, where the bids for the non-generator resource model are agnostic about the state of charge. The proposed energy storage resource model will also include more features – like transition times and variable upper and lower operating limits – which the proposal does not extend to the non-generator resource models.</p> <p>Developing a new market model is not an insignificant amount of work. The ISO anticipates that developing the energy storage resource model will be a very heavy software implementation burden. Making the same features proposed for the new energy storage resource model and applying those features to the non-generator resource model will also require a significant amount of software development effort. If the ISO considers the developing the energy storage resource model and enhancements to the non-generator resource model, the lift may be close to double what is anticipated for the current proposal. All development work, from all stakeholder initiatives, is prioritized through a single internal process to determine when software will ultimately be developed and released. Additional development work sometimes means longer times until implementation.</p> <p>The ESR model allows storage resources to specify prices to discharge (or charge) based on state of charge. The bidding model for the non-generator model does not allow for this control. For example, suppose a scheduling coordinator is submitting bids for a 10 MWh 4-hour storage resource. The scheduling coordinator believes that prices will be very high - say \$250/MWh – in the successive hour, and predicts that prices would be relatively low – say \$60/MWh - in hours following the successive hour. The scheduling coordinator may choose to bid the resource in the current hour to discharge anytime prices are above \$60/MWh, at level of state of charge above 2.5 MWh, but if the state of charge is below 2.5 MWh, then the resource is only willing to discharge if prices are higher than \$250/MWh. The energy storage resource model ensures that if modeled state of charge dips below 2.5 MWh, the resource will be compensated at \$250/MWh for energy. There is no feature that allows for this control in the non-generator resource model.</p>	<p>Today, ancillary service products are awarded in terms of capacity, and not in terms of energy. This means that energy awards will be limited by the upper operating bounds of the resource and the total amount of ancillary services that are awarded to the resource. This also means, that unlike energy awards, the ISO does not update state of charge for storage resources that receive awards for ancillary services because the actual impact to state of charge is unknown. This can result in situations where the day-ahead market anticipates that storage resources will have significant amounts of state of charge, but in the real-time market they may actually have little or no state of charge, which could result in rescinded ancillary service awards or inability to respond to automatic generator control signals from the ISO.</p> <p>The ISO is interested in how storage resources are already compensated for reliability purposes and learning more about how fair compensation should be calculated.</p>	<p>Thank you.</p>	
---	--	--	---	-------------------	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">NV Energy, (Lindsey Schlekeway)</p>	<p>No response provided</p>	<p>It is unclear whether these proposed enhancements address the issues stated by participants and would be helpful if CAISO could provide examples that compare the NGR and ESR models to explain how the new resource model affords better energy storage management for the scheduling coordinator.</p> <p>NV Energy requests that CAISO provide more information about the commitment costs rules for ESR model - would the commitment costs be subject to a cap, would they be allowed to change in price at different states of charge, or could the price increase for different hours throughout the day?</p> <p>Battery energy storage resources incur additional costs (wear-tear) when cycled more frequently than the contract limits that must be managed by scheduling coordinators. NV Energy would support a market model limitation that applies a constraint to prevent the market from cycling the resource above these limitations. Short of that modeling enhancement, could CAISO explain how scheduling coordinators could use this resource model to meet those limitations or reflect those additional (degradation) costs if incurred?</p>	<p>No response provided</p>	<p>NV Energy does not support this proposal and proposes that CAISO reconsider the 5-year period because it may restrict the ability for this resource type to participate within the EIM. It is important to note that the Investment Tax Credit ("ITC") has incentivized this type of contract which is written for longer terms than 5 years. Additionally, there are several co-located energy storage projects being brought online within the EIM footprint that have these restrictions. The CAISO's proposed 5-year period could have an impact on the ability for these resources to participate in the EIM.</p>	<p>No response provided</p>
--	-----------------------------	--	-----------------------------	---	-----------------------------

Energy Storage Enhancements - Stakeholder Comments Matrix

ISO Response		<p>Are there specific examples that would be helpful to illustrate the differences between the two models? The ISO would like to accommodate additional examples, if they would be helpful in describing how the proposed resource model would work.</p> <p>Storage resources participating in the market today do not have associated commitment costs or minimum run times. The ISO is not proposing to include this functionality in the energy storage resource model at this time.</p> <p>Pricing in the ISO follows predictable patterns. Knowing these patterns, scheduling coordinators for storage resources could use the proposed energy storage resource model to bid a resource into the market to prevent losing money from cycling beyond contractual limits, that represent actual higher costs for the resource to run. For example, suppose it is late afternoon and a storage resource has already cycled 0.4 times for the day, and the resource incurs additional costs after cycling 1.0 times. Further, suppose that the resource has a full 10 MWh state of charge, and the scheduling coordinator anticipates that the resource will charge very little through the end of the day. The scheduling coordinator might bid the resource to discharge anytime prices are higher than the typical marginal cost to operate, as long as the resource has a state of charge above 4 MWh. The scheduling coordinator could then bid a higher marginal cost – one that includes the additional wear and tear from the resource cycling more than 1.0 times – for any energy below 4 MWh.</p>		<p>The idea behind the 5-year limitation, is that initially this would accommodate resources on the system, but that resources arbitrarily far in the future would not be eligible for this treatment, and that resources would not receive this treatment indefinitely. The ISO is concerned about a significantly large amount of storage falling under this treatment and the potential for reliability concerns. We appreciate concerns related to resource interconnection and participation, and will consider this as policy development moves forward.</p>	
--------------	--	---	--	--	--



Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Pacific Gas &amp; Electric (JK Wang)</p>	<p>PG&amp;E reiterates that CAISO should prioritize the time-critical issues of reliability enhancements. The proposed ESR model could lead to significant complexities in implementation, which requires much more thorough development and iteration with market participants. PG&amp;E finds the CAISO has not responded to many of our concerns and questions in previous comments</p>	<p>CAISO has not addressed concerns raised in PG&amp;E's previous comments over the proposed SoC stage transitions: (1) Since the bid price depends on a battery's SoC, a battery's dispatch instructions could vary greatly between DAM and RTM. PG&amp;E is concerned that these dispatch uncertainties could distort market decisions (e.g., unit commitment) and price signals in DAM and suggests the CAISO consider limiting the use of the proposed ESR model to RTD only; (2) PG&amp;E is concerned about the resulting settlement complexities and requests the CAISO provide examples of how the batteries will be settled. A/S provision capability: PG&amp;E requests the CAISO clarify (i) whether a resource can provide regulation up and down simultaneously; and (ii) how the A/S capability is defined under the proposed model.</p> <p>PG&amp;E requests the CAISO provide full formulations that show how the ESR model is integrated into the market optimization and supports the concerns and requests from SCE to provide an example showing how a bid constructed based on SOC under the ESR model would translate to a bid formulated under a traditional bid construct. How will the bid curve of its full range for a resource be used in the market optimization?</p> <p>PG&amp;E requests that the CAISO provide a response to previous comments re to ensuring adequate functionality of the CAISO's Outage Management System (OMS) in regards to NGRs, as CAISO technical staff indicated that these concerns would be addressed in this initiative.</p>	<p>PG&amp;E requests the CAISO split the initiative into two tracks, wherein Track 1 prioritizes urgent issues of reliability enhancements for storage resources in Exceptional Dispatch (ED) and Ancillary Services (A/S), with remaining issues addressed in Track 2 after Track 1 is implemented.</p> <p>The CAISO has not addressed PG&amp;E's previous concerns and questions of the Minimum State of Charge constraint (Min SoC), compensation for Exceptional Dispatch that requires batteries hold SoC (ED SoC), and Ancillary Service (A/S) requirements. PG&amp;E reiterates those questions and concerns:</p> <p>(1) PG&amp;E is concerned that the proposed ED SoC has loopholes allowing for profit-seeking batteries to bid strategically. The proposed enhancement for Ancillary Service (A/S) could result in resources' shortfall of Bid Cost Recovery (BCR) and requests clarification on how the CAISO would dispatch a resource to adjust its SoC if its bids were consistently uneconomic. If a storage resource, providing spin or regulation up reserves, submitted bids to charge only at -\$100 or lower, how would this process work? Likewise, assume this resource has a more reasonable charging bid but is never economic as it approaches its lower SoC limit, what would be the expected outcome?</p> <p>(2) The proposed A/S enhancement would reduce the potential regulation value of batteries; PG&amp;E suggests that requiring "encumbered" energy bids that can be used as needed by CAISO operators (i.e., can be inserted into the bid stack when needed, while regulation awards overlapping the inserted bids can be rescinded in the corresponding periods and directions only) might be an acceptable compromise addressing the issue.</p> <p>(3) PG&amp;E requests the CAISO ensure consistent cost calculation for different markets in future proposal development.</p> <p>(4) PG&amp;E believes the Min SOC constraint plays an important role in today's day-ahead market and continues to request the CAISO clarify the following if it is eliminating the Minimum State of Charge Constraint (Min</p>	<p>PG&amp;E continues to request the CAISO clarify, for co-located resources, whether curtailment of battery charging from on-site renewables is applicable to the scenarios of the reliability enhancements in the proposal.</p> <p>The reliability enhancements of the proposal (e.g., ED to hold state of charge, local reliability charging requirements, and charging bids to support A/S) could require charging from the grid, and not only from the co-located resource. It should be pointed out along with the prohibition on curtailment of charging during reliability over-generation events.</p>	<p>PG&amp;E requests the CAISO clarify the role of the WEIM Governing Body on the proposed reliability enhancements. PG&amp;E believes some part of the enhancements, for example, the enhancements on internal tools to ensure local reliability, are limited to day-ahead market applications and the WEIM GB should not have joint authority over them.</p>
---	--	--	---	--	--

			<p>SoC)? If so, PG&amp;E is concerned, given the Minimum SoC constraint is critical for the system to automatically respond to emergency events (e.g., Summer 2021). The CAISO needs to provide a more detailed model and prove it is feasible to implement for multiple batteries.</p> <p>(5) Could the proposed counterfactual compensation method be applied to Min SoC, instead of accompanying the new EDSoc? It seems applying the proposed method to the existing ED, which is based on Min SoC, would result in fair compensation to the batteries, with no need to develop a new EDSoc. PG&amp;E finds the proposed counterfactual compensation method for ED SoC is incomplete and continues to request the details of the proposed method by clarifying: Will the method be extended to allow compensation for resources that are prevented from charging (versus discharging) by an EDSoc? What if a resource was uneconomic during portions of the EDSoc instruction? During the 3/21/22 call, DMM commented that the example did not consider resource bid prices when calculating the resource's opportunity costs. PG&amp;E agrees that the proposed method would not result in appropriate economic compensation, based on the example. What if the resource's award changed during EDSoc instruction because of market economics? What if it doesn't follow SOC instructions? Should there be a cost recovery disqualification process and what would the associated thresholds be? How to ensure tech-agnostic treatment in markets? With high opportunity costs for the commercial batteries (that respond to market signals and could be highly uncertain in availability) to provide reliability service by holding SoC, and given the proposed timeframe, PG&amp;E is concerned of these issues will be addressed.</p> <p>(6) PG&amp;E requests more details on the enhancement to internal tools - What planning timeframes are considered and how they will interact with market inputs? How are storage resources modeled, e.g., as individual units or aggregation, their physical constraints, and responsiveness? What is the compensation mechanism which should capture the opportunity costs of batteries reserving capacity?</p>		
--	--	--	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>ISO Response</p>	<p>The ISO tries to ensure as much feedback as possible on areas of policy where new development will be complex and areas where stakeholders express concern. The ISO will keep this in mind as the energy storage enhancement policy evolves.</p>	<p>Dispatch instructions in the real-time market are independent of dispatch instructions in the day-ahead market. This implies that actual state of charge could be very different between the markets for storage resources using the non-generator resource model and for resources using the proposed energy storage resource model. The energy storage resource model could help to bring state of charge closer together between the two markets because of the unique bidding construct for the energy storage resource model. At this time the ISO is proposing to allow the use of either the energy storage resource model or the non-generator resource model in both the real-time and day-ahead markets.</p> <p>The ISO is not proposing any unique treatment to settlement for resources using the energy storage resource model. Resources using this model will receive energy and ancillary service awards, and will be settled in a manner similar to other resources on the system.</p> <p>Energy storage resources will be able to provide ancillary services similar to other resources that participate in the day-ahead market. Similar to storage resources using the non-generator resource model, resources using the energy storage resource model will be able to provide regulation up and regulation down, and they can receive awards for both products in the same hour. Similar to treatment for the non-generator resources, energy storage resources will receive limited upper bounds on energy awards in hours when receiving ancillary service awards. For example, is a +/- 10 MW storage resource that is awarded 4 MW of regulation up, may only receive a maximum dispatch for energy during that hour of 6 MW. This is true under the current model and proposed energy storage resource model.</p> <p>The bidding constructs for the proposed energy storage resource model and the non-generator resource model are different. Bids for the non-generator resource model will specify a range of output for the resource at a specific price, while the proposed energy storage resource model will specify a price where a resource is willing to charge or discharge based on state of charge. For the existing model, the dispatch instruction dictates the level of output and is determined by the bids and the actual locational prices at the resource's location. The dispatch instruction for</p>	<p>The ISO will consider prioritizing the highest value work from this initiative.</p> <p>The ISO has not proposed that it would adjust state of charge for storage resources that receive ancillary service awards. Similar to today, a storage resource that submits bids to charge at only -\$100/MWh be dispatched to charge only when prices reach or exceeded those levels. Regardless of the bid for the resource, the ISO will continue to only dispatch resources when they are economic.</p> <p>Today the market cannot award energy into an operating area that is set aside for ancillary services. This is to help ensure that a resource can always respond to automatic generator control signals. The ISO does rescind instructions in the 15-minute market today when storage resources have insufficient state of charge to provide regulating services.</p> <p>The ISO is not eliminating the minimum state of charge requirement. The minimum state of charge requirement is a tool that was introduced in the market enhancements for summer 2021 readiness initiative. In that initiative, the ISO developed policy that created the tool and proposed to sunset the tool after a two year period. The energy storage enhancements policy does not propose any changes to the minimum state of charge requirement.</p> <p>The ISO may consider retaining the minimum state of charge requirement into the future. Two concerns with this tool are that it only applies on days when there is an infeasibility in the residual unit commitment process and that it applies to all storage resources on the system. The ISO operators may want to dispatch storage resources to hold state of charge on certain days when there is no residual unit commitment market infeasibility, they may want to only dispatch resources to hold state of charge in a certain area, or they may only want storage resources to hold state of charge during hours when the storage resources did not receive a day-ahead award. The minimum state of charge requirement does not allow for any of these alternatives currently.</p>	<p>The proposal would require that all storage resources be subject to the rules proposed for reliability. All storage resources would be subject to exceptional dispatch instructions, requirements for dispatch ancillary service awards and dispatch instructions for local reliability.</p>	<p>The ISO will carefully consider the WEIM Governing Body classification.</p>
---------------------	---	---	---	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

		<p>the proposed model will dictate whether the resource will charge, discharge or do nothing based on a combination of the modeled state of charge of the resource and the locational prices.</p> <p>The ISO is not currently proposing changes to the outage management system in this initiative.</p>	<p>The ISO is not proposing to change compensation for storage resources that are prevented from charging. The ISO does not anticipate this scenario being a concern that requires frequent operator action. After reviewing operational data, if these scenarios do occur often, the ISO may propose this functionality.</p> <p>If a storage resource is uneconomic during the period that it is prevented from discharging, it implies that prices are low, which implies that opportunity costs and payments would also likely be low. If prices are low during the exceptional dispatch period and higher following the period, then there is no compensation awarded. If prices are low during the exceptional dispatch period and lower during the following period, then the resource will receive compensation, under the current proposal, as the resource would legitimately would have lost the ability to sell at the higher prices. The ISO may consider putting in a limitation requiring that prices exceed bids to discharge during intervals when the exceptional dispatch prevents discharge.</p> <p>Market economics certainly could change the output of resources that are issued exceptional dispatch. This is often precisely the purpose of exceptional dispatch. The ISO is not intending to a full market solution where the storage resource is fully participating. This is computationally burdensome and not practical as a solution for this tool.</p> <p>All resources participating in the ISO market are required to follow operator instructions and exceptional dispatch from the ISO. Failure to do so could result in operator communication to the resource scheduling coordinator, revocation of an interconnection agreement, referral to FERC and/or fines. Because these rules are fundamental to market participation, the ISO does not envision needing additional rules to ensure compliance from storage resources or other resources that may receive exceptional dispatch instructions.</p> <p>This proposed exceptional dispatch function only applies to resources that the ISO tracks state of charge for. The exceptional dispatch</p>		
--	--	---	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

			<p>authority and the compensation treat all resources with state of charge functionality the same.</p> <p>The point of the compensation methodology for the exceptional dispatch is to ensure that storage resources with high opportunity costs to holding state of charge do receive adequate compensation. Please submit details on insufficient compensation to the ISO for consideration.</p> <p>The ISO, CPUC and CEC use many different planning models with different goals. Some of these models are used to determine effectiveness of potential new transmission projects, effective operation in local areas, future overall market cost and efficiency, or feasibility to operate the grid reliably with specific resource mixes, greenhouse gas reduction goals, and/or assumptions regarding changing load. All of the planning models include storage of varying technologies and duration. Some include hurdle prices for storage to charge and discharge. Some studies are performed at the system level, some in zones, and some at the nodal level. To perform any planning study, assumptions must be made to abstract some of the detail away from specific generator information. This is done for storage and other technologies, and may be necessary to arrive at a solution in a reasonable timeframe. Most planning models do not include reservation of capacity for storage or other resource technologies.</p>		
--	--	--	---	--	--

<p>Phoenix Consulting, Large-scale Solar Association, (Susan Schneider)</p> <p>LSA continues raise its previous comments: (1) clarify other currently available tools for grid-charging management of storage CLR's under current market rules; or (2) consider additional LSA-suggested tools for grid-charging management of storage CLR's; (3) acknowledge comments on the Revised Straw Proposal. (4) Provide clarification on current market rules and whether its other reform suggestions were considered and, if so, why they were not proposed.</p> <p>LSA supports the providing grid-charge management options for MFR CLR's</p> <p>LSA has significant concerns with the new restrictive and contradictory proposed eligibility rules, as well as the potential inflexibility of the election. The new 5-year "hard" limit in the Proposal exacerbates this deficiency. The federal tax structure is not under CAISO jurisdiction or developer control.</p> <p>LSA supports the proposed Pseudo Tie MFR CLR eligibility for Aggregate Capability Constraints (ACCs).</p>			<p>LSA mainly supports, with suggested modifications and clarifications:                  Element #1: Clarify how this provision will work if the storage CLR bids into the Day Ahead Market                  Element #2: This element is ambiguous - it would make sense if the reference was to the scheduled or dispatch levels, but the reference to the "forecast" is not clear                  Element #4: LSA does not understand how this approach would be practical. LSA previously requested that the CAISO clarify whether certain grid-charging management tools that may be available now, under current market rules for MFRs in a CLR configuration; LSA again requests that the CAISO address these suggestions</p> <p>Remove the "contractual" and "contracts" provisions and reinstate the former framework, to avoid federal or state rules that could modify tax rules going forward. LSA recommends that the CAISO include in the concept design some ability to disable this feature, e.g., on an hourly basis or based on market parameters (e.g., market energy prices below a specified level). The eligibility rules should also consider property-tax issues.</p> <p>Clarify whether/how this proposal would apply to forward schedules in either Day Ahead or Real Time markets, e.g., how the Day Ahead market would be affected.</p> <p>A second kind of "economic" curtailment is proposed, and that the concept does not address the first kind of curtailment - the CAISO should provide this important clarification, and if the recently implemented Minimum State of Charge (MSOC) feature provide another exception to exercise of this concept?</p>	
--	--	--	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>	<p>The primary tool for co-located resources to manage grid charging today is bidding. A resource could manage this by bidding to charge at typical prices at or below levels for expected energy from the on-site renewable resource. Then, the storage resource could bid at significantly lower prices for energy beyond the expected energy. When developing the initial framework for co-located storage resources the ISO did not anticipate a need for this functionality.</p> <p>The ISO will consider alternates to the previously proposed contracting requirements for the proposal going forward.</p>			<p>The proposal would apply to co-located storage resources bidding into the day-ahead market. The day-ahead market awards output from the co-located variable resources, based on bids and forecasts, and the market will ensure that charging schedules for co-located storage resources would not exceed those levels.</p> <p>The proposal will not dispatch storage resources to charge at levels above co-located renewable dispatch instructions. This may apply to forecasts, insofar as forecasts inform dispatch instructions.</p> <p>The ISO may consider reducing the limitations on which resources may apply for this treatment.</p> <p>The ISO may consider the potential to disable this optional feature, on an hour by hour basis.</p> <p>The ISO is not proposing a second kind of economic curtailment. If a solar resource is economically curtailed, a co-located storage resource will not receive a dispatch instruction beyond the instruction issued to the renewable resource.</p> <p>The minimum state of charge requirement, implemented prior to summer 2021, is only in place through the end of summer 2022. The ISO does not anticipate that these two tools would overlap. However, because the minimum state of charge requirement is a reliability tool, it could result in storage charging in excess of co-located renewable generation.</p>	
---	---	--	--	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

Public Service Company of New Mexico PNM, (Kelsey Martinez)	No response provided	PNM would like the CAISO to define the process for transitioning a resource from an NRG to the new resource type. Would these resources have to re-register, or will the CAISO allow a transition outside of the registration process?		<p>PNM is supportive of the Enhanced Co-Located Functionality to ensure market dispatch instructions do not result in grid-charging addressed in section 4.3.1</p> <p>Do not support the proposal to limit this enhancement to resources that are participating at the time this ISO policy enhancement goes live. With its proposed enhancement, the CAISO seems to, at once, recognize the crucial role that the ITC currently plays in bringing energy storage to the market, while also ignoring it as a persistent feature of future projects. We believe the proposed enhancement should apply to all energy storage resources utilizing the ITC in the future.</p> <p>The other eligibility requirements proposed for the Energy Storage Enhancement and outlined in Section 4.3.1, including the requirement to have contractual investment tax credit implications and the requirement to limit the enhancement to five years for those resources, are supported by the commenters.</p>	
ISO Response		The scheduling coordinator would not have to re-register to switch from the non-generator resource to the energy storage resource. Pending full implementation details, this could likely be accomplished through a master file change.		The ISO may consider changes to the requirements for the special co-located treatment.	



Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Rev Renewables, (Renae Steichen)</p>	<p>While the revised straw proposal improves on the previous iteration in some areas, such as on compensation for exceptional dispatch that more closely reflects costs of removal from the market, CAISO should prioritize incremental changes to the existing non-generator resource (NGR) model, which supports operating resources and reliability today, over a new untested model still in development.</p> <p>The ESR model still requires much more detail and revisions before finalization: (1) Concerned that the ESR model completely removes the ability to express bids in terms of power (incremental MW); (2) CAISO should explain how the ESR model would function in the day-ahead or fifteen-minute markets and in the context of ancillary service awards, prior to moving to a draft final proposal; (3) Changes are needed to the ESR ramp rate and dynamic capacity limits to avoid unnecessarily curtailing energy storage flexibility.</p>	<p>(1) Energy storage bids allow resources to offer both incremental power and incremental state of charge; (2) CAISO should allow resources to submit tiered bids in terms of incremental MW for each tier of bids of incremental state of charge, which would allow battery storage to more accurately reflect the incremental cost of additional MWh allowed in the ESR model without losing the ability to reflect the cost of incremental MW included in the NGR model; (3) Dynamic capacity limits should reflect resource capabilities - separate charge and discharge dynamic capacity limits are required to accurately reflect physical capabilities of battery resources (a single parameter symmetrically limiting power output in both directions when the battery is near full or near empty would dramatically and unnecessarily limit energy storage resource flexibility; details included in the March 21 presentation and discussion should be included in the next draft proposal to allow for more detailed review); (4) Addressing the variable charge rate problem requires power (dynamic capacity) limits, not ramp limits - variable charging (and discharging) rates should be reflected in dynamic capacity limits, and to the extent that ramp rate limits are used, they must include individual charge and discharge limits, and REV strongly suggests that resource owners be able to set dynamic capacity and other parameters by resource to accurately reflect their resource capabilities; (5) Provide additional analysis of realistic examples, including the day-ahead market and ancillaries, especially a discussion of how ESR energy awards are co-optimized with ancillaries; (6) Prioritize improvements to the NGR model - fixing the variable charging rate problem alone would be a significant and important improvement; (7) How will the ESR model functions under multi-interval optimization (MIO), which produces uncompensated out-of-merit dispatch for NGR resources?; (8) Day-ahead DEBs should allow pricing opportunity and risk costs for similar reasons that such costs are important and recognized in real-time energy storage bid formation, and we would appreciate additional transparency on the performance of DEBs in action</p>	<p>Ancillary Services - REV supports</p> <p>Exceptional Dispatch - REV continues to support and suggests that CAISO also ensure the current state of charge is also factored into the MW/MWh exceptional dispatch instructions to avoid unnecessary confusion and resource cycling.</p> <p>Compensation for EDs to Hold State of Charge - REV supports CAISO's revised proposal and appreciates progress on this issue; requests (1) CAISO consider a longer time horizon than the ED period plus the duration of the storage resource; (2) that CAISO evaluate the impacts of financial settlement among the day-ahead and fifteen-minute markets together with the real-time market; (3) that CAISO consider compensating resources for ancillary service awards invalidated by exceptional dispatch, even if only at the day-ahead price of those awards. Lack of compensation for AS awards invalidated by ED makes it more risky (and thus expensive) for resources to provide ancillary services; (4) consideration of our suggestion that this counterfactual calculation tool could also be useful to CAISO in assessing performance of the real-time market engine in the context of multi-interval optimization and out-of-merit energy storage dispatch from inaccurate advisory prices</p> <p>Tools for Local Areas - REV generally supports, but requests (1) more detail and examples of how this would work in practice; that (2) CAISO ensure the market process is transparent to the resource operators so that it knows it is procured for a local need; (3) clarification that resources will be compensated for the reliability service of holding SOC (for example, would it receive compensation in the day-ahead market as a product? If the resource is withheld from the real-time market due to local area needs, would BCR similar to the ED methodology need to be implemented?)</p>	<p>REV has no comment at this time.</p>	<p>REV has no comment at this time.</p>
---	---	---	---	---	---

ISO Response	<p>The ISO is considering timing concerns in developing all aspects of this policy.</p>	<p>Enhancing the energy storage resource model to include bids for state of charge and energy dispatch will make the model significantly more complex. The model is able to accommodate the state of charge bids currently by anticipating using the same underlying bidding framework that is available to most resources today. Adding an additional level of complexity to the bidding framework may not be technologically feasible. The ISO appreciates that this could allow storage resources additional flexibility while bidding into the market.</p> <p>The ISO appreciates that the physical capabilities of storage resources may not match the proposed modeling changes for the upper and lower power limits of resources. The ISO will consider this feedback as the proposal evolves.</p> <p>The ISO intends to continue co-optimizing energy and ancillary service awards in the day-ahead market similar to how this is performed today. Bids for both services may be submitted by scheduling coordinators using the proposed energy storage resource model for consideration by the ISO market. The market software will pick the cost minimizing mix of energy and ancillary services from all resources that meets the market constraints in place. Resources – including storage resources using the proposed model – may be awarded ancillary services and/or energy awards, similar to how most resources are awarded these products today. The ISO will consider including additional examples of how this optimization may be done in future iterations of this initiative.</p> <p>The ISO may consider changes to the non-generator resource model in future iterations of this proposal.</p> <p>The energy storage resource model will function similar to other resources in the real-time market, with the multi-interval optimization. The ISO agrees that dispatch instructions issued through the real-time market can be uneconomic, when bids for the binding interval are less than locational marginal prices for a specific interval when a resource is scheduled to discharge or when bids for the binding interval are greater than locational marginal prices for a specific interval when a resource is scheduled to charge. The ISO also agrees that sometimes these instructions are the result of conditions</p>	<p>Sometimes the operations team issues exceptional dispatch instructions to storage resources today to ensure that these resources have full, or high state of charge. This can occasionally lead to situations where the exceptional dispatch is inconsistent with feasible resource operation because the resource is already at or very near full state of charge. The proposed exceptional dispatch should alleviate these potential issues. The proposal will automate the dispatch instructions from instructions to charge or instructions to meet or exceed state of charge once the required state of charge is reached. The ISO has not proposed including state of charge in the existing dispatch instructions, but may consider this in further policy development.</p> <p>The ISO may consider longer durations in the compensation proposal for exceptional dispatch.</p> <p>The ISO will consider potential additional analysis that could be performed on the compensation for exceptional dispatch.</p> <p>The ISO agrees that resources must be compensated for lost regulation awards, when exceptionally dispatched. Today, when a resource receives an exceptional dispatch that results in an infeasible award for ancillary services, the ISO buys that award back at the day-ahead prices. The same logic would apply to storage resources that could not deliver ancillary service awards because of exceptional dispatch to hold state of charge.</p> <p>The ISO is not considering methods to compensate resources that are uneconomic because of multi-interval optimization in this initiative. The ISO considers this to be an issue that potentially impacts all resources, not just storage, and must be addressed in an initiative with a wider audience.</p> <p>The ISO may consider additional examples to include in the proposal to address questions about the local reliability tools, and will consider potential notifications to storage resources that are dispatched for local needs.</p>		
--------------	---	--	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

		<p>that are anticipated to materialize within the multi-interval optimization. These uneconomic dispatch instructions are not unique to storage resources and may occur for almost all resources on the grid. The frequency of these occurrences may be higher for storage resources because of their use limited nature. The ISO is not proposing changes to the underlying construct of the real-time market and anticipates that concerns because of the real-time market and multi-interval optimization will persist with the new energy storage resource model. The ISO may consider changes to the market construct in stakeholder initiatives that are not specific to storage resources.</p> <p>The ISO does not agree that opportunity costs should be included in default energy bids in the day-ahead market. Because storage resources are able to bid a price to buy energy and a price to sell energy, the day-ahead market will always ensure that storage resources are scheduled at times when the difference between charging and discharging prices is at least as great as the difference between the two bid prices. The day-ahead market also considers round trip efficiencies, in this calculation.</p>	<p>The ISO is not inclined to include additional compensation for storage resources holding state of charge to ensure local reliability. The ISO has worked with a number of storage providers in local areas, and these resources typically receive compensation through the resource adequacy construct or through other arrangements above typical capacity prices with the expectation that they will be required to provide state of charge in these local areas on some days during the year. Further, the ISO believes that payments for these services are better arranged as fixed payments, rather than side payments in the energy market.</p>		
--	--	--	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Silicon Valley Clean Energy &amp; Central Coast Community Energy, (Oren Weiner)</p>	<p>Supports the ESR model subjecting it to market power mitigation and new default energy bid option. Requests ISO to consider and describe how it will address potential market power for required charging of storage resources in local areas.</p> <p>Urge expediting the NRI process to switch between hybrid to co-located resource models</p> <p>Support compensating storage resources for holding state of charge based on CAISO's proposed opportunity cost methodology</p> <p>Supports proposal to enhance logic for second tier constraints in local areas to ensure capacity is available from traditional resources and energy is available from storage resources to maintain reliability</p> <p>Modify the proposed co-located enhancements to commence regardless of contract execution and online date; any limitations should balance the benefits to be gained by removing grid charging restrictions against the costs to consumers of losing ITC and property tax benefits.</p>	<p>The Joint CCAs support the requests made by stakeholders for the CAISO provide functionality &amp; capability to manage state of charge and appreciate the ISO working expeditiously to create the new Energy Storage Resource (ESR) model.</p> <p>The Joint CCAs support CAISO's proposal to subject resources using the energy storage resource model to market power mitigation, and to provide access to a new default energy bid. We are concerned, however, that particularly for energy storage resources within local capacity areas, the proposed default energy bid may not sufficiently mitigate energy storage charging bids. That is, could there be instances in which a local energy storage resource has been discharged in real-time, and thus needs to be charged (at any price) to meet local capacity area reliability requirements? It isn't obvious to the Joint CCAs whether the CAISO's proposed market power mitigation will adequately address the potential for exercise of market power for required charging. Joint CCAs request that CAISO consider and describe in the final proposal how its proposed approach would address this concern.</p> <p>The Joint CCAs urge the CAISO to expedite the NRI process for switching between hybrid to co-located resource models. Because the impacts of the different models will not be fully known prior to implementation, it is imperative that market participants have the ability to easily switch models in case there are unforeseen consequences of one model vs. another.</p>	<p>The Joint CCAs support CAISO's proposal for compensating storage resources for holding state of charge based on an opportunity cost methodology that captures the revenues that the resource would have received had it been optimally participating in the market during the exceptional dispatch and for a period of time after the exceptional dispatch. Joint CCAs urge the CAISO to monitor the results of its proposed approach and to perform an assessment, after a reasonable period of time, of the efficacy of its approach and to identify whether changes are warranted.</p> <p>The Joint CCAs support CAISO's proposal to enhance the logic for second tier constraints in local areas to ensure that capacity is available from traditional resources and that energy is available from storage resources to maintain reliability in the event a key grid element is lost to meet local reliability needs. As noted, Joint CCAs request that CAISO consider and describe in the final proposal how its proposed market power mitigation approach will adequately address the potential for exercise of market power for required charging of storage resources in local areas.</p>	<p>The Joint CCAs urge the federal ITC and property tax benefit electable functionality to be provided towards all co-located resources for the duration of their ITC &amp; property tax commitments; before establishing a cutoff date for continued recognition of ITC and property tax restrictions on grid charging, the CAISO should conduct studies demonstrating that the benefits realized from removing grid charging restrictions from all co-located storage resources, rather than a smaller subset of resources, outweigh the lost ITC and property tax benefits. At a minimum, the cut-off date such apply to resources with contracts executed as of that date, not just those connected to the grid as of that date and should apply for the duration of the grid charging restrictions.</p>	<p>No response provided</p>
--	--	--	--	--	-----------------------------

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>		<p>The ISO is also concerned about the exercise of downward market power. This was one topic discussed in detail in the fourth phase of the energy storage and distributed energy resource initiative. The ISO chose to not address these concerns in that initiative, but does plan to address them in a future initiative. The ISO agrees that there is no policy in place currently to address negative market power, and is actively monitoring for this behavior in the market.</p> <p>Resources will not be required to go through the new resource interconnection process to switch between the non-generator resource model and the energy storage resource model. The process will likely be similar to a master file parameter change.</p>	<p>The ISO will monitor the efficacy of any new policy after implementation.</p>	<p>The ISO appreciates the feedback for co-located resources, and will consider it in the next iteration of the initiative.</p>	
---	--	---	--	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Six Cities, (Margaret McNaul)</p>	<p>Six Cities support most aspects of the Revised Straw Proposal, requesting further changes to certain elements of the proposal related to co-located resources and, specifically, the proposed revisions that the CAISO has developed to assist co-located resources in management of grid charging risks.</p>	<p>The Six Cities note that the CAISO has provided additional detail on the energy storage resource ("ESR") model, as the Six Cities requested in their earlier comments, and they acknowledge that the CAISO spent considerable time during the stakeholder meeting on the Revised Straw Proposal discussing the specifics of the ESR model. The Six Cities continue to support adoption of this model, and they also support retention of the non-generator resource ("NGR") model.</p> <p>The CAISO acknowledges that the proposals in this initiative are related to those under development in the Resource Adequacy Enhancements initiative. See, e.g., Revised Straw Proposal at 27. For this reason, the Six Cities request that the next RA Enhancements proposal include specific discussion of RA-related topics for the ESR model so that stakeholders can evaluate this model in relation to the NGR model.</p>	<p>The Six Cities continue to find that the proposed reliability enhancements described in the Revised Straw Proposal are reasonable, including the application of market power mitigation to storage resources. At this time, the Six Cities do not oppose the concepts that the CAISO has advanced regarding the development of default energy bids for resources using the ESR model.</p> <p>The Six Cities also do not oppose the proposals to (i) require ancillary services bids from storage resources to be accompanied by a bid for energy; (ii) implement exceptional dispatch authority for storage resources to hold their state of charge; (iii) use an opportunity cost-based compensation approach for storage exceptional dispatch; or (iv) enhance the modeling of constraints in CAISO market processes to improve use of storage, including to manage local reliability.</p>	<p>The Six Cities generally support the CAISO's proposed enhancements for co-located resources; in particular, the proposal to make the discharge limit option electable, rather than mandatory, and applying it for a five year period, to conform to duration of ITC eligibility, unless the resource owner opts to terminate participation earlier. The Six Cities also agree with the structuring of this option such that the storage charging would conform to the forecast and production of the associated variable resource.</p> <p>Remove requirement that the resource actually be online at the time this policy is implemented; instead include resources under development pursuant to power purchase or other development agreements that were executed prior to implementation of this policy. There are resources currently under development pursuant to pre-policy contracts containing prohibitions on grid charging that may not yet be online at the time this policy is implemented, but soon thereafter.</p> <p>The Six Cities urge the CAISO revise its proposal that co-located storage resources be permitted to deviate in the downward direction from dispatch schedules when the adjacent renewable resource is producing less than its forecast. For example, a scenario when the CAISO curtails solar resources but does not allow the co-located storage to reduce its charging to the level of curtailed output for the adjacent renewable resource will likely cause the storage resource to charge from the grid, and the Six Cities are concerned that this loophole in the discharge limit option creates risks that storage resources will violate contract restrictions on grid charging or will otherwise render these resources ineligible for their full ITC credit amounts and limit the benefits of the discharge limit option.</p>	<p>No response provided</p>
<p>ISO Response</p>		<p>Thank you for this feedback. The ISO will continue to spend a significant amount of time and thought to the treatment of storage resources in the resource adequacy enhancements initiative.</p>	<p>Thank you for your support, detailed input and overall continued engagement.</p>	<p>The ISO appreciates the feedback for co-located resources, and will consider it in the next iteration of the initiative.</p>	

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Solar Energy Industries Association, (Gabel Associates, Derek Hagaman)</p>	<p>SEIA supports the concept of the Energy Storage Resource model but has some implementation concerns, described in greater detail below.</p>	<p>SEIA supports the concept of the Energy Storage Resource model but believes more details are needed, discussed further below.</p>	<p>The proposal to support DA ancillary service awards with bids for energy is a good idea, and likely a solution that can be implemented without limiting a storage resource's ability to provide ancillary services. SEIA would appreciate additional details on this aspect of the straw proposal including the ability to require accompanying energy bids without limiting ESR ancillary service awards.</p>	<p>SEIA appreciates CAISO's responsiveness to stakeholder concerns regarding the ITC implications for co-located resources required to charge from the grid. For simplicity and transparency, SEIA believes that the application of this provision should be tied to the IRS ITC eligibility rules. More specifically, the duration of the provision applicability to a resource should be tied to the duration of the documented IRS limitation.</p> <p>SEIA believes limiting this provision to resources that are online at the time this policy goes live is arbitrary and introduces additional unnecessary uncertainty to projects and asks that CAISO justify this element of the proposal. A project's COD, for example, can change, often for reasons beyond the developer's control, and adding this level of uncertainty further complicates the process. SEIA is interested in the additional benefit to the system for implementing this timing requirement, noting that the uncertainty it creates could have material impacts on project development.</p> <p>Finally, SEIA asks that CAISO clarify or define the "contractual" implications described in the final last paragraph on page 25 of the straw proposal. SEIA understands the potential interaction of grid-charging with tax credit eligibility, but would like to know if CAISO is envisioning other forms of contractual limitations like PPA terms limiting grid-charging. SEIA believes that tying eligibility for charging limitations to PPA terms would be unduly discriminatory towards resources.</p>	<p>Support</p>
<p>ISO Response</p>		<p>Thank you for your support and the opportunity to address your questions.</p>	<p>The ISO will consider how best to include additional details about this aspect of the proposal in future iterations.</p>	<p>The ISO appreciates these concerns and will consider how best to clarify these in the next iteration of the proposal.</p>	

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Southern California Edison (Aditya Chauhan)</p>	<p>CAISO should ensure the ESR proposal is fully developed with necessary details being worked out and available for stakeholders' evaluation. If necessary, the CAISO should consider holding a workshop to go through detailed design and ensure all issues around settlements, dispatch, price formation and market power mitigation are fully addressed.</p> <p>SCE has provided a list of detailed questions below that should be addressed by the CAISO in the next iteration of its proposal.</p>	<p>The CAISO should clarify whether it will be able to elect the functionality to limit dispatch instructions for storage resources so that they are no greater than the forecast of co-located renewable resources</p> <p>When a resource incurs both OC and Bid Cost Recovery (BCR) under the CAISO Exceptional Dispatch proposal, will the resource be eligible for both? Will the resource be compensated for an amount higher of the two? If the resource is eligible for OC in addition to BCR, the CAISO should examine if there is a double payment issue that load has to pay for the cost.</p> <p>The opportunity cost is based on energy bids but does not take into consideration Ancillary service awards when resources are exceptionally dispatched - how would bid cost recovery apply to in this scenario when AS is clawed back? Does a unit getting BCR also have eligibility for OC? Under the ESR model, will an energy storage resource be eligible to set the market clearing price when it is dispatched at either Pmin or Pmax? It is SCE's understanding that currently, when a resource is dispatched at Pmin or Pmax, the resource is considered as a constrained resource not eligible to set the market clearing price. The CAISO should confirm this understanding. If this understanding is correct, the CAISO should consider whether this presents an issue under its proposal and if so, how to address the issue.</p> <p>What criteria will be used to determine when an outage card is required? Does "depleted" (page 27) mean SOC=0? Or perhaps near zero? Is an outage only required during nighttime hours? What if clouds and SOC=0 during midday? Can the entire outage card be removed at the break of dawn? Or is it anticipated that the availability would need to "walk up" during morning ramp?</p>	<p>Can the CAISO utilize the example given on page 11 and show how the bid spread is utilized? Currently the example does not utilize bid spreads to award the unit and instead utilizes the bid price themselves to determine when to charge and discharge.</p> <p>Can the CAISO elaborate on the example given on page 12 and explain why the CAISO decided to discharge the resource at a higher level when it had not hit the \$100/MWh price? SCE's understanding of all other resources is that the resource would not be dispatched at the higher bid curve if the bid price was not hit. Why the change for energy storage unit?</p> <p>Can the CAISO explain how to address concern on variable charging and discharging rate (i.e., possible overpayment of A/S in DA which won't materialize in RT as CAISO may award energy instead of A/S as resource is not adequately charged, causing increase in RT A/S prices as CAISO needs to go to market to procure A/S in RT)? "To prevent these concerns, the ISO proposes that in the future all ancillary service awards for storage resources be accompanied with bids for energy. For example, a storage resource with a 10 MW regulation up award, could be required to provide a bid to charge for 10 MW." Since bids are a function of SOC, how would an SC bid a MW qty &lt; PMAX or &gt; PMIN?</p>	<p>A resource cannot charge for a capacity amount, it has to charge for an energy amount that supports a specific capacity amount - the CAISO should provide an example. Specifically, using a 10 segment bid curve for charging, how would that 10 segment curve function fit into the Ancillary Services constraint in the optimization?</p> <p>Can the CAISO show how an AS bid would look with the new ESR model will look like? Enhancements to ES AS bidding may be required to allow for multiple bid points for AS to represent characteristics at the upper/lower limits as well as ACC and grid charging co-located limitations.</p> <p>Further: (1) including energy bids will influence the price formation of the Ancillary Services Marginal Price (ASMP), which has not been considered or addressed by the CAISO; (2) CAISO should clarify how AS will interplay with the enhanced co-located functionality to prevent grid charging - would this functionality also prevent AS dispatches from causing the co-located resources from charging off the grid? (3) SCE requests the CAISO provide further details, including the details on minimum online capacity(MOC) constraint when applied to local energy storage resources and how the constraint will be priced in the market optimization; CAISO should provide details on how the MOC formulation may or may not interact with the Imbalance Reserve Product capacity procurement; (4) regarding the eligibility of the proposed electable functionality to limit dispatch instructions for storage resources so that they are no greater than the forecast of co-located renewable resources, SCE encourages the CAISO to strongly consider extending this treatment to new resources (in addition to existing resources) that are subject to ITC constraint.</p>	
--	--	--	---	---	--



Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>		<p>The ISO will allow electable functionality for co-located storage resources so that they are not charged beyond energy coming from co-located renewable resources.</p> <p>The opportunity cost payments for exceptional dispatch are meant to compensate storage resources that are prevented from responding to high real-time prices because of exceptional dispatch. This compensation will offset potential bid cost recovery payments that are made to the resource over a 24 hour period. Compensating for both could result in double payment.</p> <p>If an exceptional dispatch impacts the amount of ancillary services a resource may provide the ancillary service schedule is bought back at the day-ahead price. The ISO is not proposing a change to this methodology, and the ISO is not proposing a change to the way this impacts the bid cost recovery calculation.</p> <p>An energy storage resource could potentially set price at the minimum or maximum operating output. Consider a resource that can produce up to 10 MW and a system that needs to serve exactly 10 MW of load. In this scenario, this resource could set the marginal price.</p> <p>The ISO requires that resources that are unavailable submit outage cards to the ISO through the outage management service. This alerts the market and the ISO operations team that certain resources are unavailable. This is important because it informs the ISO about the capabilities of the fleet. This is also a requirement for storage resources. If a storage resource is not available for dispatch it is required to submit an outage card, and this would include situations where a co-located storage resource that cannot charge from the grid is fully depleted and has no ability to recharge.</p>	<p>The example, illustrated in the graph on page 12, could result in a storage resource that is dispatched based on spread bids in the day-ahead market. First, if the storage resource is charged up to full state of charge, then the price spread that must be achieved to discharge the resource down to 80 MWh must be greater than \$25/MWh (\$45/MWh – \$20/MWh). Further, if sufficient price spreads emerge beyond \$40/MWh (\$60/MWh - \$20/MWh) the resource will be discharged down to 15 MWh. Finally, if sufficient price spreads emerge beyond \$80/MWh (\$100/MWh - \$20/MWh) the storage resource will be dispatched to fully discharge. If no price spreads materialize in the day-ahead market in excess of \$25/MWh the storage resource will not be scheduled to charge and discharge, although it may be scheduled to charge, if prices are low; or to charge, if prices are high.</p> <p>There is an error in the example at the bottom of page 12. The resource would not be dispatched below 15 MWh if prices did not materialize above \$100/MWh.</p> <p>Variable charging rates only impact storage at the extreme upper or lower end of the operating range. Storage resources still must meet state of charge requirements to provide ancillary services. These requirements may preclude resources from providing ancillary services in the range of operation where minimum and maximum output are impacted. All resources that provide regulating services are subject to testing and must certify that they can respond to signals from the ISO. Storage resources may be decertified if they are unable to respond to signals in the real-time market. The ISO will continue to actively monitor ancillary service participation to ensure that resources are able to respond.</p> <p>A resource cannot bid output above the Pmax, or below the Pmin.</p>	<p>The ISO may consider including such an example in a future iteration of the proposal.</p> <p>Ancillary service bids with the proposed energy storage enhancements model will look similar to bids for ancillary services for storage resources using the non-generator resource model today.</p> <p>The ISO is not considering expanding the biddable curve with more than one part for ancillary services in this proposal. The ISO may consider including this in a different initiative, with an audience broader than just the storage community.</p> <p>Co-located storage resources that take advantage of the special treatment to never charge beyond energy from on-site renewables could still participate in the energy and ancillary service markets. In these cases the ISO would never award charging energy and regulation down in excess of the schedule for the on-site renewable. If awarded regulation, the storage resource is required to respond to automatic generator control instructions issued from the ISO.</p> <p>The ISO may consider how to include additional details on the minimum on-line commitment constraints in future iterations of the proposal.</p> <p>The ISO may consider alterations to the proposal for co-located storage resources in future iterations of this proposal.</p>	
---	--	--	---	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Vistra Corp, (Cathleen Colbert)</p>	<p>The plan for this initiative is too aggressive and does not allow for robust stakeholder development of a new storage participation model; it has not provided sufficient examples or simplified excel models illustrating the design and expected outcomes of the new energy storage resource participation model, nor how the new model versus the old model would have impacts on price formation. Further, we believe that these scenarios being modeled must include when a storage resource is mitigated. As such Vistra requests the CAISO release at a minimum a second revised straw proposal, but likely we anticipate there may be a need for a third. The second revised straw proposal should contain the additional level of detail described above.</p> <p>Requests CAISO review its Straw Proposal comments and provide a stakeholder comment matrix in the revised straw proposal. We believe CAISO can better develop a proposal that has the change to gain broad support if it proactively responds to comments using the matrix.</p>	<p>We respectfully request the CAISO provide written stakeholder responses to our stakeholder comments in the next iteration responding to questions we posed on the straw proposal to:</p> <p>(1) What is the definition of “transition”? (2) What cost components make up the transition cost? If there is no transition time, will the transition cost be required to be \$0/transition or is this intended to approximate the charge-discharge spread the storage asset is willing to transfer between modes regardless of actual costs or need for transition? (3) Would there be default energy bid curves for the charge curve versus discharge curve and when will there be the discussion of how the DEBs would be formulated? (4) Will the CAISO continue to enhance both NGR and new model when modeling improvements are decided or is the CAISO effectively saying that it will set up the new model and that will be its preferred model that will continue to be enhanced over time?</p>	<p>(1) Exceptional dispatch rules specific to out-of-market dispatches for batteries should be included in the Tariff recognizing unique characteristics of storage. We still strongly believe more clarity on mitigating risks of infeasible ED being issued is critical;</p> <p>(2) Allow for overlapping outage cards for storage to better reflect outages: Outage Management System should allow Scheduling Coordinators to better reflect conditions limiting battery operations;</p> <p>(3) Commit to issuing a market notice prior to enforcing the Minimum State of Charge constraint;</p> <p>(4) Provide written stakeholder response to our stakeholder comments in the next iteration explaining your rationale for not including these three items in scope; provide written stakeholder responses to the questions we posed on its proposals in this section in the next iteration. Vistra requests the CAISO provide responses to:</p> <p>(5) Size of the issue the AS rule would address? How the CAISO envisions the tool for local area considerations would “weigh trade-offs between starting gas and charging storage”. Please confirm if this is an out-of-market action or contingency modeling enhancement that is being proposed? If the tool can be used for out-of-market actions, what steps operators would operators take to implement the decisions the tool identifies and what settlement rules would apply to the gas and storage resources as result of any operator action?</p> <p>(6) If this is a proposal for implementing a version of contingency modeling enhancements, please confirm that and provide details on what elements would be implemented? Please explain whether contingency modeling enhancements as a whole should be re-examined for implementation with the addition of explicitly holding SOC if economic? If not, explain your rationale for not implementing CME and how this would differ?</p> <p>(7) Adopt dynamic modeling of foldback impact on Pmin/Pmax for batteries</p>	<p>Vistra provided our comments on these proposals in the last iteration. To be concise, Vistra opposes the proposed co-located enhancements, regardless of whether it is limited to resources currently online for five years or less.</p>	<p>The energy storage enhancements project should be under Western Energy Imbalance Market Governing Body's joint authority. Please see our previous comments for explanation.</p>
--	--	---	---	---	--

Energy Storage Enhancements - Stakeholder Comments Matrix

ISO Response	<p>As policy development continues, the ISO may consider additional iterations of written proposals and examples.</p>	<p>Transition is switching from charging in one interval to discharging a successive interval, or switching from discharging one interval to charging in a successive interval.</p> <p>The idea of the transition cost is that it models costs of switching from charging to discharging, or from discharging to charging. If there are costs incurred from switching between these two operating modes, they should be included in bids.</p> <p>The formulation of the default energy bid curve for the energy storage resource model is included in section 4.1.1 of the proposal and does include a methodology for mitigating charging and discharging bids. The methodology is very similar to the methodology developed for the default energy bid for the non-generator resource model.</p> <p>The ISO intends to stakeholder improvements to storage resource modeling in the future, and will seek input on changes to both models as they are considered.</p>	<p>Sometimes the operations team issues exceptional dispatch instructions to storage resources to ensure that these resources have full, or high state of charge. This can occasionally lead to situations where the exceptional dispatch is inconsistent with feasible resource operation because the resource is already at or very near full state of charge. The proposed exceptional dispatch should alleviate these potential issues. The proposal will automate the dispatch instructions from instructions to charge to instructions to operate at or above state of charge once the required state of charge is reached. The ISO has not proposed including state of charge in the existing dispatch instructions, but may consider this in further policy development.</p> <p>The ISO is not proposing changes to the outage management system in this proposal. Changes that would impact all resources submitting outage cards would need to be proposed in stakeholder process with a broader audience.</p> <p>The ISO does not have any data to share publicly depicting the magnitude or frequency of issues related to ancillary services.</p> <p>The proposed tool for the local area will weigh tradeoffs between gas and storage resources as they contribute to total cost, similar to the way the market optimization is performed today. These will not be out of market actions.</p> <p>The operators will not have to take any specific actions to ensure reliable schedules for local reliability, and these resources will not receive unique settlement.</p> <p>The ISO is not pursuing contingency modeling enhancements. The contingencies that would have been addressed in the contingency modeling enhancement initiative generally became moot due to changes to the NERC/WECC standards.</p> <p>The ISO is also not considering modeling changes to a battery resource's Pmin/Pmax at this time.</p>		
--------------	---	---	--	--	--

Energy Storage Enhancements - Stakeholder Comments Matrix

<p>Western Power Trading Forum, (Carrie Bentley)</p>	<p>Concerned the initiative will not provide meaningful enhancements needed to integrate large amounts of storage; unclear what is prioritized, which is natural as storage participation as an arbitrage resource started to occur at large scale in the last few months. WPTF is concerned that even this limited experience has not informed this policy direction.</p> <p>Should demonstrate challenges with operating storage in the RT market how CAISO addresses them. The impact of the flexible ramping product on battery storage schedules is particularly important (unclear how the ESR model will improve energy arbitrage in real-time).</p> <p>Requests CAISO create realistic examples prior to the next draft, showing inefficient arbitrage under the NGR model and how it the new model can resolve it..</p> <p>How can the NGR model be enhanced? What are stakeholders giving up in possible NGR model enhancements by the CAISO moving forward with a new model? How will the CAISO prioritize enhancements over time?</p>	<p>CAISO should clarify how the new model resolves the major issues scheduling coordinators face when bidding storage in the real-time market. The CAISO seems to imply that because the energy storage resource model will allow storage resources to better reflect their marginal cost that this will help with efficient real-time market energy arbitrage. This is confusing because the main problems with storage optimization have nothing to do with reflecting a storage resource's marginal cost.</p> <p>Many of the features of the energy storage model (allowing transition times and costs, and varying ramp rates) could also be incorporated into the existing NGR model, but this is not in the CAISO's proposal. WPTF asks why not? Is it because there is something in the model that prevents it or is it because the CAISO is resource-constrained and so already is only able to support key features in one model? Why doesn't the energy storage model allow an end of hour state-of-charge range like the NGR model? Again, is it incompatible with the model or simply just left off?</p> <p>We reiterate our concerns from the last comment draft, that based on our initial understanding of the ESR model, we are concerned the model would lead to systemic price differences between the day-ahead and real-time whenever a battery was the marginal resource. It is our understanding that in day-ahead the price/SOC pair would be static for an hour, whereas in the fifteen-minute and five-minute market the bid price would increase as the SOC increased in each interval. Thus, a storage resource producing a static MW amount across an hour in day-ahead would have a fixed price but would have an increasing price over that same hour in real-time, even with the same bid curve. WPTF asks the CAISO to evaluate this potential in more detail along with other potential price formation, bid cost recovery, and gaming potential in the model.</p>	<p>Slide 24 of the Revised Straw Proposal Presentation states that the 15-minute market reoptimizes ancillary services (AS) - at this time the real-time market does not re-optimize AS.</p> <p>Generally, WPTF is concerned the AS aspect of this proposal is discriminatory and inefficient. Forcing uneconomic energy market participation to preserve an AS award for storage resources only is not technology neutral. Additionally, it seems like this would inefficiently increase the AS price because scheduling coordinators would need to price the risk of uneconomic energy dispatches into their regulation offers.</p> <p>We support estimating regulation conversion to energy (also called "depletion") and limiting day-ahead AS awards using the estimated impact of conversion.</p> <p>WPTF supports including opportunity costs into the exceptional dispatch payment logic, but believes this must be done for all resources with similar opportunity costs and cannot be isolated to a particular technology as this would be discriminatory.</p>	<p>WPTF do not support forcing co-located resources to charge when they have bid a charging schedule less than or equal to their renewable forecast. Forecasts are sometimes wrong and there has been no analysis demonstrating reliability risk for less load to be on the grid on the occasion. Prior to moving forward, WPTF asks the CAISO to estimate the impact of allowing deviations and provide a reliability or market efficiency reason for the proposal. The ITC lowers the cost of renewable integration and so there should be a compelling reason for the CAISO to compel grid charging in the event of forecast error.</p>	<p>WPTF supports the WEIM classification.</p>
--	---	---	--	--	---

Energy Storage Enhancements - Stakeholder Comments Matrix

California ISO

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">ISO Response</p>	<p>The ISO believes that the energy storage resource model will help storage resources manage state of charge, which are associated with marginal costs. If this model does achieve these improvements, then it will improve the efficiency of storage resources buying and selling energy in the market.</p>	<p>The statement that 'storage optimization ha[s] nothing to do with reflecting a storage resource's marginal cost,' is concerning as this is a fundamental premise for the ISO optimization and overall performance. The ISO would like to explore this statement further.</p> <p>Developing a new model requires a significant amount of lift for the software development team. Developing a new model and making changes to the existing model would essentially require double the implementation burden. In proposing to only develop the new model, the ISO was hoping to avoid some of this implementation burden. The ISO may potentially explore changes to the non-generator resource model in future iterations of this proposal.</p> <p>The ISO may consider additional concerns around price formation in future iterations of this proposal.</p>	<p>The ISO is not proposing that uneconomic bids be accepted by the market.</p> <p>The ISO does not believe that the exceptional dispatch provisions are discriminatory. They only apply to resources where the ISO actively tracks state of charge. This methodology would be applicable to any resource that has a state of charge value tracked by the ISO market software.</p>	<p>The ISO may consider changes to the proposed policy for co-located resources.</p>	
---	---	---	--	--	--