



## **Storage Design and Modeling**

# **Second Revised Straw Proposal on Outage Management Topic Group**

**May 7, 2026**

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## 1. Executive Summary

Battery storage resources have unique factors that drive outages and operational capabilities. As the California Independent System Operator (the ISO) continues to integrate more storage resources into its markets, it is important to improve how storage resources can represent and communicate these capabilities and outages to the ISO. This paper discusses potential improvements to better reflect battery storage outage factors in the ISO's systems. The potential improvements include:

- **Reflect nonlinear discharging and charging of lithium-ion batteries in the market model:** Batteries charge at a lower rate when they are nearly full and discharge at a lower rate when they are nearly empty. This reduction in responsiveness and dispatch capability is referred to as nonlinearity, or foldback. Today, the market model does not recognize this nonlinearity, which can result in infeasible dispatch instructions being issued to storage assets near the limits of their state-of-charge. To address this, the ISO proposes developing new Master File fields and a set of associated constraints to better model nonlinearity. Given current and planned implementation projects, the ISO expects that this modeled solution could be implemented no earlier than spring 2027. In the interim, storage market participants can limit their risk of entering the nonlinear range and receiving infeasible dispatch instructions by only reflecting the state-of-charge range unaffected by foldback in the Master File. If market participants do not do so, any unavailability impacts due to nonlinearity on their charge and discharge capabilities should be conveyed via plant trouble outage card submissions before the modeled solution is implemented.
- **Adding functionality to the Outage Management System (OMS):** The ISO is considering four technological upgrades.
  - Enhancements prioritized for 2026:
    - Automatically accept requests to update existing outage cards. This enhancement will allow participants to view their requests and make further changes while under ISO review. Requests will continue following the existing review process.
    - Allow new resources to test their ability to charge during the new resource implementation process.
  - Enhancements slated for future prioritization:
    - Improve functionality of the out-of-service checkboxes for storage resources.
    - Allow the submission of partial outages for ancillary services.

This paper will be discussed at the stakeholder meeting scheduled for May 18, 2026. Written comments in response to this paper and meeting are due June 1, 2026. The initial Revised Straw Proposal, published August 8, 2025, discussed three potential updates to the ISO's Business Practice Manuals (BPMs): (1) clarify outage reporting for all capability attributes, (2) add storage-related cause descriptions in the nature of work table, and (3) clarify the definition of state of charge. The ISO will submit these three updates as proposed revision requests in the BPM Change Management process. These three proposed revision requests will reflect minor redlines suggested by commenters in response to the initial Revised Straw Proposal. Stakeholders seeking to further engage with the BPM changes should refer to the BPM Change Management process.

## 2. Introduction

As California transitions to a clean energy fleet, the ISO has integrated significant amounts of renewable resources, such as wind and solar, into the electricity grid. Storage<sup>1</sup> assets charge when electricity is less valuable and discharge when electricity is more valuable. Today, most storage assets are four-hour lithium-ion batteries. Over the past five years, storage capacity has proliferated in California. Grid-scale batteries in the ISO system have grown from approximately 500 MW in 2020<sup>2</sup> to over 15,800 MW as of March 1, 2026. This trend has also occurred across the broader West. By the end of 2025, the Western Energy Imbalance Market (WEIM), excluding the ISO's footprint, accounted for 8,500 MW of energy storage capacity, an increase of 69 percent compared to late 2024.<sup>3</sup>

Storage assets have played a key role in ensuring grid reliability as they have become a larger share of the resource mix. Batteries engage in daily charge and discharge cycles, largely driven by solar energy production. In doing so, batteries contribute to meeting the grid's ramping needs and allow for greater utilization of intermittent renewable energy.

The ISO uses the Outage Management System (OMS) to track transmission and generation outages. Organizations submit transmission and generation outages requests through outage cards on the system. The ISO reviews and evaluates the impact of each request on the ISO grid and approves outages accordingly. Over the years, the ISO, market participants, and other stakeholders have learned more about how storage assets operate on the ISO grid. These stakeholders have identified opportunities to improve the ISO's systems and processes. This paper details ISO and stakeholder-proposed enhancements related to storage modeling and processes related to outage management, namely:

- **Creating a modeled solution to represent the nonlinearity of lithium-ion batteries:** Lithium-ion battery energy storage systems, the most common storage technology in the ISO, exhibit nonlinearity in their charging or discharging capabilities near their state-of-charge limits. As a battery approaches its upper state-of-charge limit, its maximum charge rate is limited. As a battery approaches its lower state-of-charge limit, its discharge capabilities are limited. Both cases hinder the resource's ability to respond to grid demands. For batteries, this phenomenon is known as foldback. Today, the market model does not recognize this nonlinearity, which can result in infeasible dispatch instructions being issued to storage assets near the limits of their state-of-charge. To address this, the ISO proposes developing new Master File fields and a set of associated constraints to better model nonlinearity. Given current and planned implementation projects, the ISO expects that this modeled solution could be implemented no earlier than spring 2027. In the interim, market participants can limit their risk of entering the nonlinear range and receiving infeasible dispatch instructions by only reflecting the state-of-charge range unaffected by foldback in the Master File. If market participants do not do so, any unavailability impacts due to nonlinearity

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<sup>1</sup> This initiative and paper focus on storage that has connected via the non-generator resource participation model. All information does not include pumped storage and proxy demand resources.

<sup>2</sup> DMM, "Special Report on Battery Storage", July 2023, at 3.

<sup>3</sup> DMM "Memorandum", February 2026, at 9.

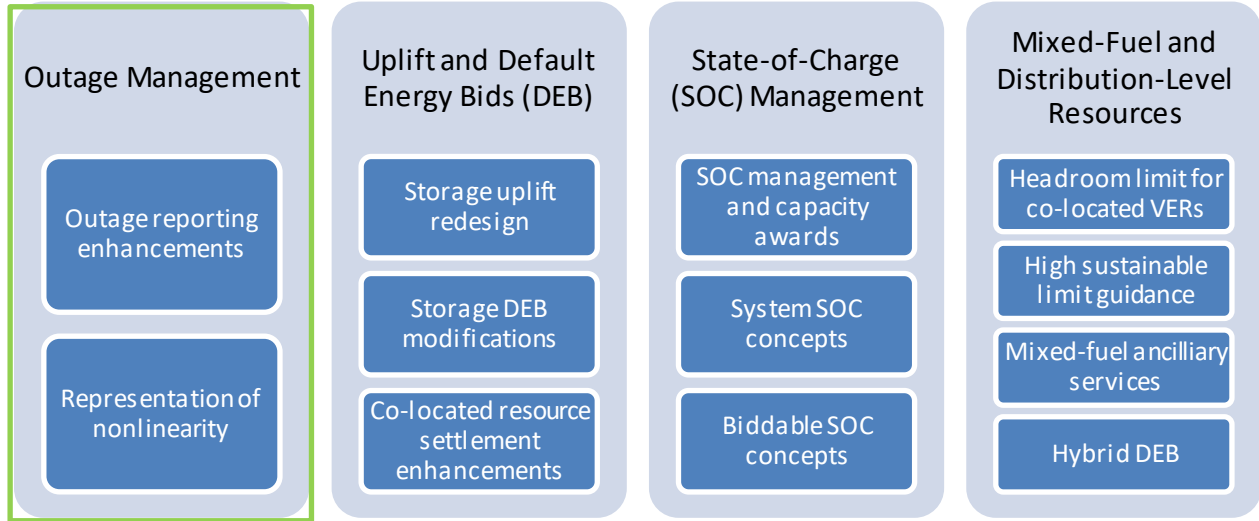
on their charge and discharge capabilities should be conveyed via plant trouble outage card submissions until the modeled solution is implemented.

- **Adding functionality to the Outage Management System (OMS):** The ISO is considering four technological upgrades to the Outage Management System (OMS). These four improvements have been prioritized given their feasibility and relative value, while accounting for active, committed, and non-discretionary projects, including the modeled nonlinearity solution.
  - **Enhancements prioritized for 2026:**
    - **Introduce additional automation to accept outage change requests into the system immediately after submission:** This enhancement will allow participants to immediately view the outage change request reflected in the outage card. This enhancement will also allow participants to make further changes to the same outage, if needed, while under review. Accepted requests will follow existing reviews, as determined by the ISO and outlined in the relevant BPM.
    - **Allow for power minimum rerates on test energy cards during new resource implementation:** When adding new capacity, storage resources would be able to test their maximum charging availability in the outage management system.
  - **Enhancements slated for future prioritization:**
    - **Improve functionality of the out-of-service checkbox for both charging range and discharging range:** Today, there are two out-of-service checkboxes for storage resources: one for negative generation (charging) and one for generation (discharging). This technological upgrade would consider simplifying the two checkboxes into one out-of-service checkbox.
    - **Allow non-null values for non-generation outage cards:** Currently, the ISO allows non-null values for generation on outage cards. For example, a resource with a power maximum of 100 MW could request to be on partial generation outage of 50 MW. However, resources are not allowed to submit non-null values for other cards. For instance, a resource cannot request to be on partial outage for ancillary service awards. This modification would allow all resources, not just storage assets, to submit partial outages for ancillary services.

### 3. Stakeholder Process

To address these challenges and other elements related to energy storage participation, the ISO launched the Storage Design and Modeling initiative. Given the complexity, broad scope, and interrelated nature of some items, the ISO created four topic groups to facilitate parallel development, efficient stakeholder engagement, and phased resolution. Figure 1 shows these topics as grouped. The solid green box shows topics discussed in this paper. Topics may shift groupings as needed.

Figure 1. Topic Groups



This paper is the second revised straw proposal for the Outage Management topic group. This second edition incorporates feedback from working group meetings and the rounds of written comments received afterwards, as well as ISO implementation assessments. Figure 2 shows the typical process from a stakeholder initiative.<sup>4</sup> The ISO is at the “develop” stage regarding the Outage Management topic group within the Storage Design and Modeling initiative.

Figure 2: Stakeholder Process Milestones



<sup>4</sup> The revised straw proposal discusses changes to Master Files, automation of business processes, and enhancements to the Outage Management System. None of the currently proposed measures require amendments to the CAISO tariff that would necessitate decision from the ISO Board and the WEM Governing Body prior to implementation. Next steps are outlined by topic.

## 4. Outage Reporting Enhancements

Through working group meetings, the ISO and stakeholders identified ways in which the Outage Management Business Practice Manual (BPM) and Outage Management System (OMS) could evolve to more accurately represent generation and charging availability of storage resources. The initial Revised Straw Proposal, published August 8, 2025, discussed three potential updates to the ISO's Business Practice Manuals (BPMs): (1) clarify outage reporting for all capability attributes, (2) add storage-related cause descriptions in the nature of work table, and (3) clarify the definition of state of charge. Commenters supported this direction and suggested limited edits. The ISO will submit these three potential updates as proposed revision requests in the BPM Change Management process where continued discussion will take place. Stakeholders seeking to further engage with the potential BPM changes should refer to the BPM Change Management process.

In addition to the elements related to the Outage Management BPM, the ISO also received broad support for potential technological enhancements to the Outage Management System. Discussed enhancements for implementation feasibility review included: (1) automatically accepting updates to existing outage cards, (2) allowing for power minimum rerates on test energy cards during new resource implementation, (3) improving functionality of the out-of-service checkbox, (4) allowing for non-null values for non-generation cards, and (5) allowing for overlapping outage cards. While some elements would benefit all resources, these potential enhancements offer particular benefits to storage assets because of their operating characteristics. In the first revised straw proposal, the ISO noted that an initial impact assessment determined the resulting project to be large, due to changes to both OMS and other systems. The ISO also indicated that, while the full feasibility evaluation was not complete, the project could be completed no sooner than the spring of 2027.

### 4.1. Commenter Feedback on the Revised Straw Proposal

Commenters generally agreed on the need to enhance the Outage Management System to better reflect storage operations. AES, the California Energy Storage Alliance (CESA), Pacific Gas & Electric (PG&E), Portland General Electric (Portland), San Diego Gas & Electric (SDG&E), and Southern California Edison (SCE) supported enhancements to the Outage Management System to improve visibility into true outages and temporary derates. Commenters stated their priorities as (1) enabling overlapping outage cards, (2) adding automation to the acceptance of updates to existing outage cards, and (3) reducing manual reporting burdens. Many commenters stressed that timely, accurate outage management data allows market participants to accurately reflect constraints dependent on state-of-charge, temperature limits, and equipment conditions. As such, most commenters noted that OMS improvements are foundational to effective storage integration. Most commenters also expressed interest in the identified implementation timeline of no-sooner-than spring 2027, and asked for additional information on the development effort, sequencing, and milestones.

## 4.2. Second Revised Straw Proposal and Next Steps

In response to stakeholder feedback, the ISO explored phased implementation rollouts for OMS enhancements. This prioritization considers current and expected implementation commitments, as well as the acceleration of a modeled nonlinearity solution as described in the next section of this paper.

First, the ISO is nearing completion on automation that allows most outage change requests to be accepted into OMS immediately after submission. In this context, acceptance means that the system has consumed and reflected the outage change. As such, this enhancement will automatically move change requests from the pending state to being visible within the system, immediately reflecting market participant change requests in the outage management card. In most cases, the impacted outage card will revert to “Submitted” or “Study” status from “Approved” status. This is because acceptance does not equate approval. All outage changes remain subject to the same review, study, and approval requirements as before, including evaluation by reliability coordinators, operations engineers, and system operators in accordance with established reliability procedures. Any necessary restudies for approval decisions will continue to be performed. This enhancement will improve system responsiveness because the change request, in most cases, will be automatically accepted and be visible instead of having the change remain “pending” and waiting for manual acceptance. Moreover, thanks to this modification, market participants will be able to make further changes to the same outage if needed and have it be reflected immediately in the system. This improvement also improves data timeliness and system responsiveness by reducing the number of outage change requests remaining locked in a pending state for extended periods, particularly in the planning horizon.

In addition, the ISO is currently working on allowing for power minimum rerates on test energy cards during the new resource implementation process. When adding new capacity, storage resources would be able to test their maximum charging availability in the outage management system. This testing capacity would be limited by both Master File values and what is approved by the ISO for testing. Both efforts target implementation by the end of 2026.

These two items have been funded and slated for implementation this year. The next steps for these two items will focus on revising the applicable BPM language once implementation has been completed. The ISO will submit any necessary updates to the BPM language as proposed revision requests in the BPM Change Management process, where continued discussion will take place. Stakeholders seeking to further engage with the potential BPM changes relative to these two prioritized OMS enhancements should refer to the BPM Change Management process.

The ISO will continue exploring implementation prioritization for (1) improving the functionality of the out-of-service checkbox for both charging range and discharging range, and (2) allowing for non-null values to be included in non-generation outage cards. This is due to the relative implementation burden of these projects and the ISO’s intention to pursue a modeled nonlinearity solution for non-generator resources no sooner than Spring 2027. As such, prioritization will account for active, committed, non-discretionary, and other policy projects. At this time, the ISO expects that these projects would be considered for completion no earlier than Spring 2027.

Finally, the ISO performed further analysis on the feasibility of allowing for overlapping outage cards. This assessment indicated that such an enhancement to OMS would be cost-prohibitive. Therefore, the ISO will no longer explore this proposal at this time.

## 5. Representation of Nonlinearity

Lithium-ion battery energy storage systems, the most common storage technology in the ISO, exhibit nonlinearity in their charging and discharging capabilities near their state-of-charge limits. Nonlinearity, also known as foldback, is a reduction in responsiveness and dispatch capability. As a battery approaches its state-of-charge limits, its maximum charge or discharge capabilities are affected, hindering the resource's ability to respond to grid demands. For example, a 100 MW energy storage resource may only be able to charge at 50 MW as its state-of-charge approaches its upper limit. Conversely, this same asset may only be able to discharge at 50 MW as the state-of-charge approaches its lower limit. In both cases, the effects on charging and discharging become more pronounced the closer the asset is to its state-of-charge limits.

In the revised straw proposal, the ISO indicated that scheduling coordinators should continue to use outage cards to convey unavailability associated with nonlinearity while a modeled solution was developed. The ISO indicated that the "plant trouble" nature of work designation should be used to reflect the impacts of nonlinearity. This position was informed by the policy principle that using a nature of work exempt from the Resource Adequacy Availability Incentive Mechanism (RAAIM) is inappropriate for a known technological limitation that can be minimized, and by the language related to the qualifying capacity of storage resources from the California Public Utilities Commission's (CPUC).<sup>5</sup> The ISO also indicated that pursuit of a modeled solution would be considered in tandem with the development of a new participation pathway for storage resources that would be based on the biddable state-of-charge concept.

### 5.1. Commenter Feedback on the Revised Straw Proposal

Commenters supported the ISO's efforts to address storage nonlinearity. However, the majority raised strong concerns about the proposed near-term reliance on plant-trouble outage cards and potential RAAIM exposure. The Western Power Trading Forum (WPTF), American Clean Power-California (ACP-California), the California Community Choice Association (CalCCA), Portland, NextEra, AES, CESA, REV Renewables (REV), Terra-Gen, and others argued that nonlinearity is an inherent operating characteristic, not an outage, and warned that treating it as plant trouble may create risks that could result in a double penalty for storage assets. Several parties emphasized that focusing on the four-hour resource adequacy definition before nonlinearity is modeled could unfairly erode resource adequacy value, reduce effective supply, and increase costs to ratepayers. Many stakeholders stressed that these issues are especially problematic as the CPUC considers transitioning towards an accreditation system based on unforced capacity (UCAP) concepts.

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<sup>5</sup> Cal. P.U.C. Dec. No. 14-06-050 at B-9.

Many commenters, including CalCCA, AES, CESA, REV, SDG&E, and WPTF, supported using the “technical limitations not in market model” outage classification as a more appropriate interim measure while recognizing that state-of-charge and foldback conditions change dynamically and may not be accurately tracked through OMS processes designed for static outages. In addition, ACP-California, CalCCA, NextEra, REV, SCE, and the Six Cities emphasized that any reassessment of the qualifying capacity, the unforced capacity methodology, or four-hour delivery requirements belongs in the resource adequacy rulemaking at the CPUC or the ISO’s Resource Adequacy Modeling and Program Design (RAMPD) initiative.

Some commenters supported the temporary guidance. PG&E and SCE expressed support for the ISO’s interpretation that storage must continuously discharge at its resource adequacy capacity for four hours, with foldback managed operationally. PG&E viewed foldback as limited to conditions at the extremes of state-of-charge and argued that storage can mitigate risk by setting appropriate minimum state-of-charge values in the Master File. SCE supported the use of the plant trouble nature of work and its RAAIM treatment but stated that any broader reconsideration of resource adequacy rules should occur first through CPUC processes.

Stakeholders agreed on the long-term solution: directly modeling nonlinearity as part of the ISO’s optimization process. Portland, REV, CESA, Terra-Gen, WPTF, AES, and the ISO’s Department of Market Monitoring (DMM) all supported incorporating foldback into the current non-generator resource market model through new Master File parameters, constraints based on state-of-charge, or dynamic curves.

DMM supported treating foldback as a physical limitation and continuing to require outage reporting, including RAAIM exposure. DMM also endorsed the proposed long-term modeling improvements. DMM recommended interim clarification through the Outage Management Master File and later incorporation of foldback parameters and SOC-based bidding into the Master File.

In sum, commenters differed sharply on the near-term solution and had broad long-term alignment that current stopgaps should be clearly labeled interim and paired with a concrete roadmap toward market-based modeling that allows for the optimization of storage dispatch in a manner that incorporates and considers the effects of foldback.

## 5.2. Discussions following the publication of the Revised Straw Proposal

During the November 11, 2025 stakeholder meeting, the ISO had discussed a potential clarification to ensure that storage resources should only reflect in the Master File the range of state-of-charge of their resources that is unaffected by foldback, as defined by the minimum and maximum continuous energy limits. The ISO had explained that this clarification would improve consistency across storage assets, reduce reliability and operational risks, and eliminate the need to rely on outage cards to manage nonlinearity while a modeled solution was developed, thereby mitigating associated RAAIM exposure. The ISO had underscored that, once resources only reflect the non-foldback range, the market optimization would no longer dispatch into the foldback region. As a result, outages would no longer

have been needed to represent foldback behavior, and related discussions about RAIM and UCAP impacts would have been rendered moot because no outage would ever be recorded due to foldback.

The ISO had characterized this proposal as an interim solution alongside its intent to evaluate a more comprehensive modeled approach for the non-generator participation pathway, which would potentially involve additional Master File parameters that capture continuous energy limits inclusive of the foldback range. The ISO had emphasized that proceeding with this interim path would also enable the collection of operational data, which could later be used to assess the value and feasibility of a more detailed, optimization-based solution for modeling foldback behavior in the long term.

During that same stakeholder meeting, REV presented a proposal to add fields in the Master File that would allow the ISO to linearly approximate the nonlinearity experienced by non-generator resources. REV's proposal would create new Master File fields that capture the linear and nonlinear ranges, as well as additional fields that would capture the impact on the minimum and maximum power outputs when resources enter the applicable nonlinear range. In their presentation, REV noted that these values could be designed in a manner that would allow for real-time updates, better reflecting operating conditions.

In comments following the November 2025 stakeholder meeting, AES, CalCCA, and CESA strongly opposed the notion of clarifying that the minimum and maximum continuous energy limits should exclude foldback regions. They argued this approach improperly conflates planning and operational frameworks, and risks withholding physically available energy. These commenters argued that the exclusion of the foldback range from the optimization could materially harm reliability, raise costs, and undermine emergency operations.

Instead, a significant share of commenters including AES, CESA, CalCCA, Vistra, REV, and NV Energy, supported expediting development of a market-based solution that captures the impacts of nonlinearity for non-generator resources within the market's optimization. These commenters stated a preference for integrating foldback parameters into the market model through enhanced Master File fields to allow dispatch in the foldback range at reduced rate rather than excluding the affected energy range from the market optimization. These commenters emphasized that a modeled solution would preserve access to physical energy while cleanly separating resource adequacy validation from operational dispatch. They urged the ISO to prioritize internal discussions on technical design and feasibility to achieve implementation by Fall 2026.

In contrast, DMM and the CPUC's Public Advocates Office (Cal Advocates) supported narrowing the state-of-charge range available for market optimization to the range unaffected by foldback. These commenters acknowledged that this clarification could reduce available energy within the optimization but argued that it would improve data quality, resource adequacy accreditation consistency, and reliability. While supportive of the clarification, DMM and Cal Advocates recognized the need for longer-term improvements to storage modeling. Cal Advocates, similar to PG&E, noted that REV's proposal offered a promising technical foundation worth further evaluation.

Given commenter feedback, the ISO indicated during the January 2026 stakeholder meeting that it would no longer pursue the proposed clarification that had been discussed in the November and

December meetings. While no longer pursuing that clarification, the ISO underscored that this decision does not represent a change in underlying policy expectations. The ISO reiterated that, under current rules, if foldback behavior prevents a resource from fulfilling its resource adequacy obligations, that underperformance remains generally subject to RAAIM prior to the implementation of a modeled solution.

In addition, the ISO acknowledged the value of pursuing a modeled approach that would allow the market to reliably access the foldback range. The ISO affirmed a modeled solution as the appropriate long-term direction for addressing nonlinearity within the non-generator resource framework. However, the ISO also noted that, given current and anticipated development priorities and system constraints, a modeled solution relying on new Master File data fields could be implemented at the earliest by Spring 2027.

Following the January 2026 stakeholder meeting, ACP-California, CalCCA, NV Energy, Portland, REV, SDG&E, SCE, and CESA all expressed support for CAISO's decision to abandon the proposed clarification and instead pursue a modeled solution to accurately represent the foldback experienced by non-generator resources using Master File parameters. In comments, Portland and REV proposed exploring breakpoints based on state-of-charge percentages rather than fixed MWh thresholds to better reflect degradation, outages, and varying conditions.

Ahead of the release of materials detailing the proposed modeled solution, Portland, SCE, NV Energy, REV Renewables, and SDG&E called for clarity around implementation and cross-market applicability. Portland urged CAISO to define how new Master File parameters would be validated, updated, and applied consistently across timeframes. PG&E requested clarity on whether breakpoints would be static or resource-specific and whether outage cards could be used under the proposal. PG&E also requested clarity on whether foldback modeling should apply in the day-ahead market and whether the current level of day-ahead infeasibility or strategic behavior justifies the added modeling and computational complexity. Finally, SCE requested details on how the modeled solution would interact with current RAAIM policy.

### 5.3. Second Revised Straw Proposal and Near-Term Guidance

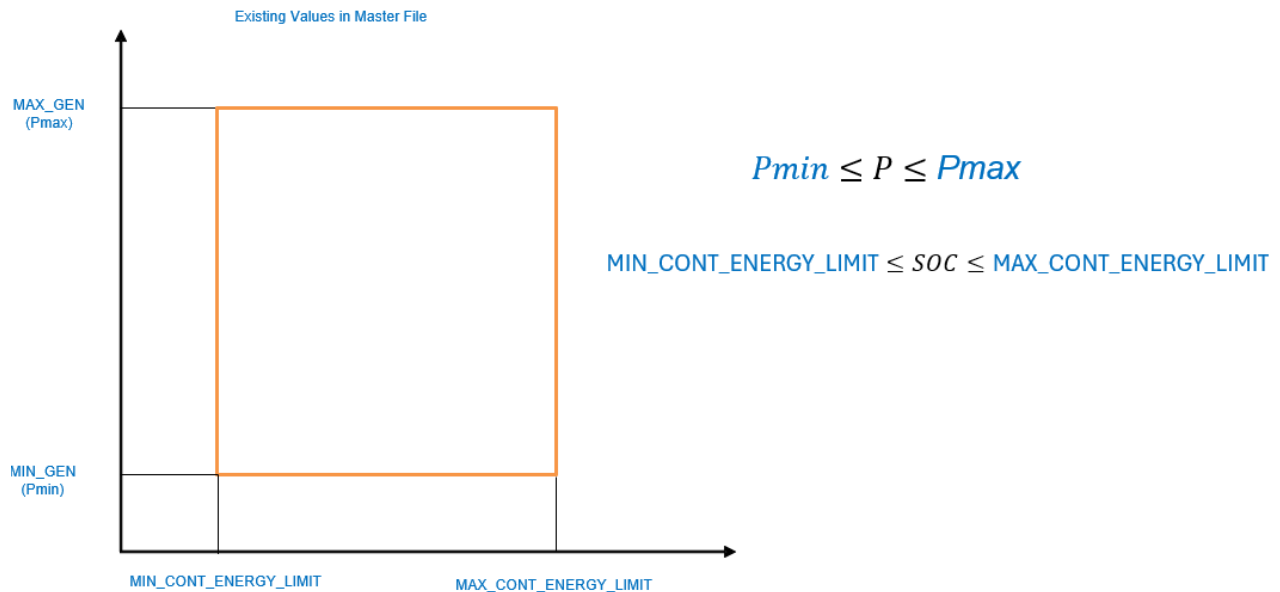
The ISO believes that an effective modeled solution for capturing nonlinearity should be grounded in information provided through the Master File by each scheduling coordinator. This approach would allow the market to accurately represent the unique operating characteristics of individual storage resources. While some commenters have suggested the use of dynamic or bid-based parameters to reflect nonlinearity, the ISO believes that a Master File-based approach offers the most viable, robust, and reliable pathway at this time.

First, a Master File-based approach minimizes implementation complexity relative to a path that would leverage biddable parameters. Second, such an approach limits the potential for undue use. If the state-of-charge levels at which nonlinearity affects maximum charging or discharging capabilities could be updated in real-time, the ISO would likely need to closely police the use of such functionality to ensure

updates are not leveraged to artificially withhold energy or avoid using outage cards when needed. In contrast, an approach based on Master File parameters does not pose the same concerns regarding real-time unavailability and outage reporting. Finally, a Master File–based approach incentivizes maintenance and operations that address the drivers of foldback, such as voltage imbalance. While the prevalence and impact of foldback may change over an asset’s lifetime, certain operating and maintenance practice can minimize these changes over time in a manner that Master File field updates can capture without the need for real-time biddable parameters.

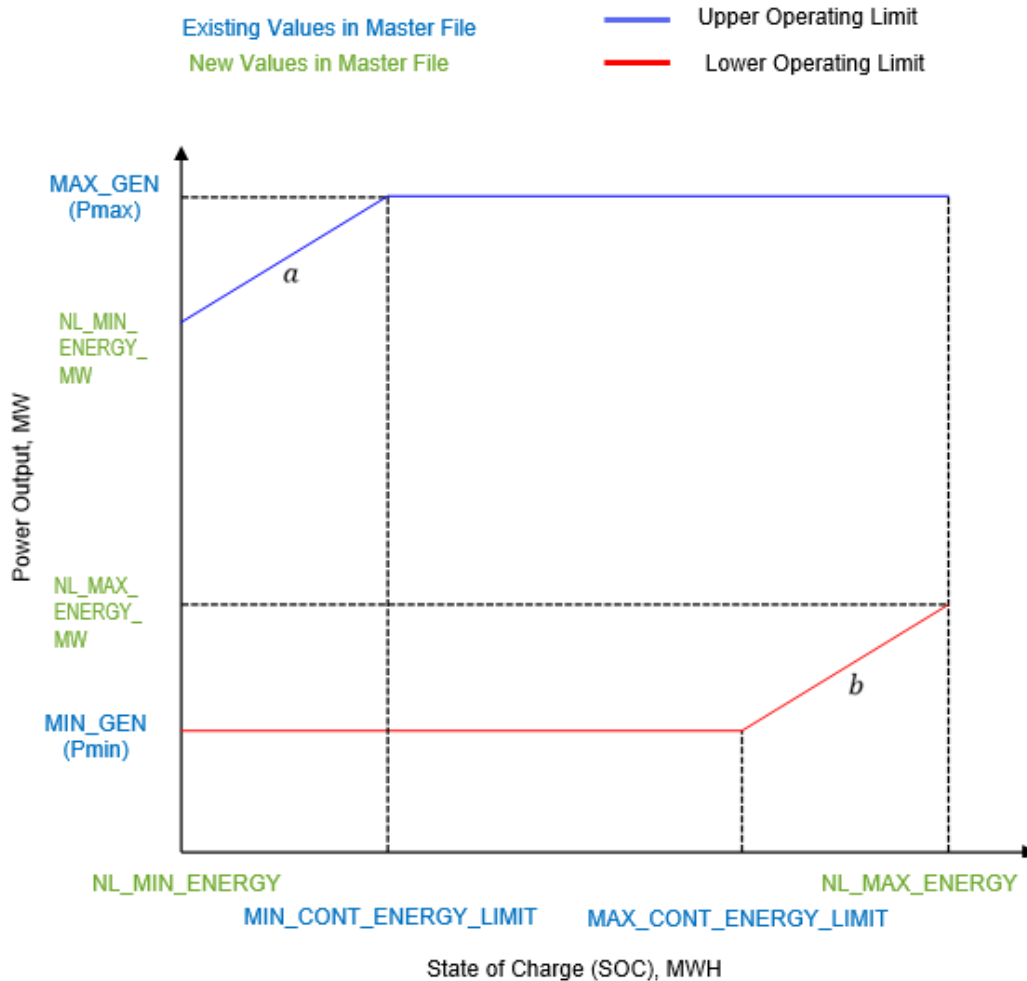
Under the current market design, non-generator resources are represented using two primary pairs of Master File fields: the minimum and maximum continuous energy limits (MIN\_CONT\_ENERGY\_LIMIT and MAX\_CONT\_ENERGY\_LIMIT, respectively) and the minimum and maximum power values (MIN\_GEN [Pmin] and MAX\_GEN [Pmax], respectively). These four Master File fields, together, define a rectangular feasible operating region. This structure does not capture the physical operating region that emerges as a resource approaches the upper or lower bounds of its state of charge to the extent a resource includes any portion of the energy capacity that affects the upper and lower power capability.

**Figure 3: Current Definition of the Feasible Operating Region and Associated Constraints**



The proposed modeled solution would introduce additional Master File fields and associated constraints to reshape this feasible region from a rectangle into an irregular hexagon. This enhanced representation would reflect the reduction in minimum power output as the state-of-charge approaches its upper limit, as well as the reduction in maximum power output as the state-of-charge approaches its lower limit. With this enhanced representation, the market model would more accurately reflect the operational realities of storage resources and their nonlinear behavior near state-of-charge boundaries. This conceptual approach is largely consistent with the proposal presented by REV Renewables at the November 11, 2025 stakeholder meeting.

Figure 4: Proposed Definition of the Feasible Operating Region and Associated Constraints



To implement these additional constraints, the ISO would request that storage scheduling coordinators submit four new data fields within the Master File. These would include the minimum and maximum nonlinear energy limits (NL\_MIN\_ENERGY and NL\_MAX\_ENERGY) and the values that will define the end points to define a linear reduction of the power output the resource can achieve as the state of charge moves between the continuous energy limits and the non-linear energy limits.

Under the proposed modeled approach, the current minimum and maximum continuous energy limits (MIN\_CONT\_ENERGY\_LIMIT and MAX\_CONT\_ENERGY\_LIMIT, respectively) would bookend the range unaffected by nonlinearity. In other words, with the modeled solution in place, the minimum and maximum continuous energy limits would serve as the megawatt-hour threshold at which nonlinearity begins to affect minimum and maximum power outputs. Together, all these eight data points would allow the market optimization to explicitly model foldback behavior and ensure feasible dispatch outcomes. Any updates to these new Master File fields would follow the same currently applicable process for Master File modifications.

The ISO proposes to incorporate the constraints associated with the modeled solution in both the day-ahead and real-time markets. While the ISO recognizes that the challenges related to nonlinearity affecting the feasibility of dispatch instructions are more prevalent in the real-time timeframe, the consistent application of the associated constraints across both day-ahead and real-time markets is both viable and desirable. First, the application of the associated constraints in both day-ahead and real-time markets is not expected to pose significantly higher implementation burden compared to incorporating these constraints only in the real-time market. Second, minimizing differences in the variables and constraints leveraged across all markets produces more consistent results across markets and limits financial arbitrage.

Ahead of the release of a modeled solution, market participants can limit their risk of entering the nonlinear range and receiving infeasible dispatch instructions by only reflecting the state-of-charge range unaffected by foldback. If market participants do not do so, any unavailability impacts due to nonlinearity on their charge and discharge capabilities should be conveyed via plant trouble outage card submissions to prevent infeasible dispatches prior to the modeled solution implementation. This is consistent with the guidance discussed by the ISO during the January 2026 stakeholder meeting; namely, the ISO decision to hold off on pursuing the clarification related to the minimum and maximum continuous energy limits does not represent a change in underlying policy expectations. As such, resources that experience unavailability related to the impacts of nonlinearity must convey it via OMS by leveraging the plant trouble nature of work in their outage cards. If foldback behavior prevents a resource from fulfilling its resource adequacy obligations, that underperformance remains generally subject to RAIM prior to the implementation of a modeled solution. Once more, the ISO reminds resources that they can manage their exposure to entering the nonlinear range by using Master File parameters and economic bidding as the means to manage their state of charge and its boundaries.

Once the modeled solution is in place, there will be a significant reduction in the need for market participants to submit outage cards to reflect the impacts of nonlinearity as long as limitations are accurately reflected by the non-linearity model and the registered Master File values. Outage cards may still be necessary to represent limitations not reflected in the model. In addition, because the market will consume the bid curves submitted by resources for the full Pmin to Pmax range and the optimization will limit dispatch instructions to feasible levels given the state-of-charge, market participants will be able to fulfill their must-offer obligations regardless of whether nonlinearity manifests and impacts their charging or discharging capabilities. In this context, the ISO does not expect that the modeled solution's ability to limit dispatch instructions to feasible megawatt values will have interactions with RAIM as it is currently defined. Given that bids can be submitted to fulfill the must-offer obligation and no outage is recorded, the modeled solution would not carry RAIM implications. Currently, the RAIM paradigm is currently being reevaluated within the ISO's RAMPD initiative. As a result, further conversations on the interaction between the modeled solution and any future RAIM-successor paradigm will take place within the RAMPD initiative.

The ISO seeks stakeholder feedback on this proposal so as to finalize its details and seek implementation no earlier than Spring 2027. Following this feedback, the next steps for this item will focus on revising the applicable BPM language once implementation has been completed. The ISO will submit any

necessary updates to the BPM language as proposed revision requests in the BPM Change Management process, where continued discussion will take place. Stakeholders seeking to further engage with the potential BPM changes relative to these two prioritized OMS enhancements should refer to the BPM Change Management process.

## 6. Governance Classification

The second revised straw proposal does not propose any amendments to the CAISO tariff; it discusses only changes to BPMs, automation of business processes, and enhancements to OMS and other systems. Therefore, it is not necessary to analyze the decisional classification at this time.

## 7. Next Steps

The ISO will hold a stakeholder meeting to discuss this revised straw proposal on May 18, 2026. Written comments on this revised straw proposal and the May 18, 2026, meeting will be due June 1, 2026.