

CAISO Storage Design & Modeling Initiative

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Submission 1: Standalone Make-Whole Payment for BESS

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Problem Statement

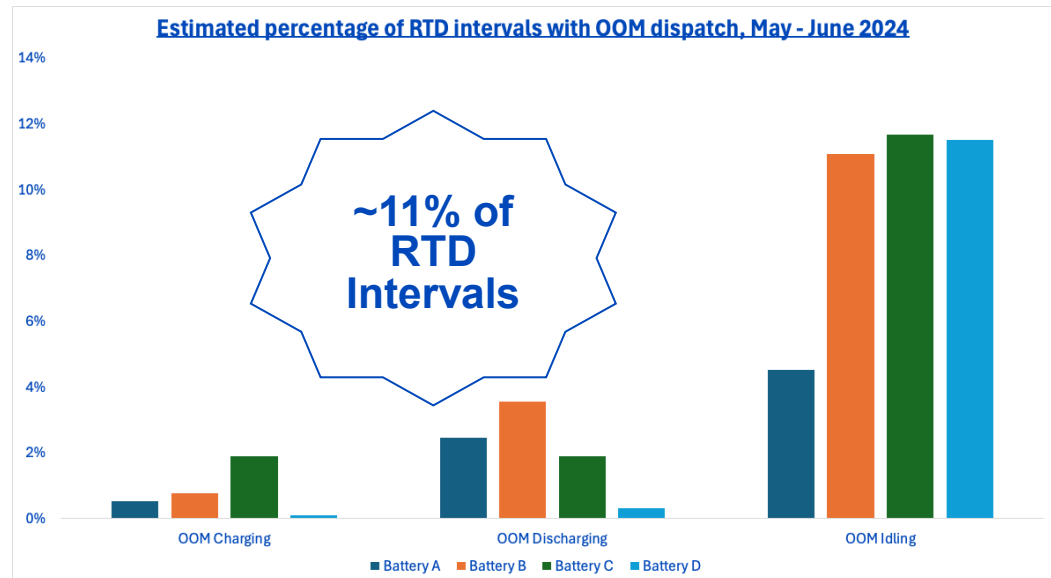
- Multi-interval optimization (MIO) sometimes results in resources being dispatched out of merit (OOM) (relative to their RT energy offer curves) in the binding interval based on anticipated advisory prices for future intervals
- When these forecasted advisory prices fail to materialize, OOM dispatch can become sub-optimal and erode BESS daily RT energy revenues
- Even if MIO benefits the storage fleet overall, financial losses at individual BESS units due to sub-optimal OOM dispatch are largely beyond BESS' control and should not be brushed aside as the “cost of doing business”
- CAISO's primary uplift mechanism, Bid Cost Recovery (BCR), is only available when resources realize a net loss for the trade date
- New make-whole payment (separate from BCR) is therefore needed to help mitigate this revenue erosion outside of trade dates with net losses

Current BCR framework is insufficient for holding BESS harmless to sub-optimal dispatches produced by MIO

Submission 1: Standalone Make-Whole Payment for BESS

MIO-Driven OOM Dispatch Happens Frequently

- NextEra Energy Resources (NEER) observations of OOM dispatch at 4 batteries over Summer 2024⁽¹⁾
 - OOM idling occurred ~ 11% of all RTD intervals
 - Hard to determine whether these intervals had a net positive or negative impact on daily revenues



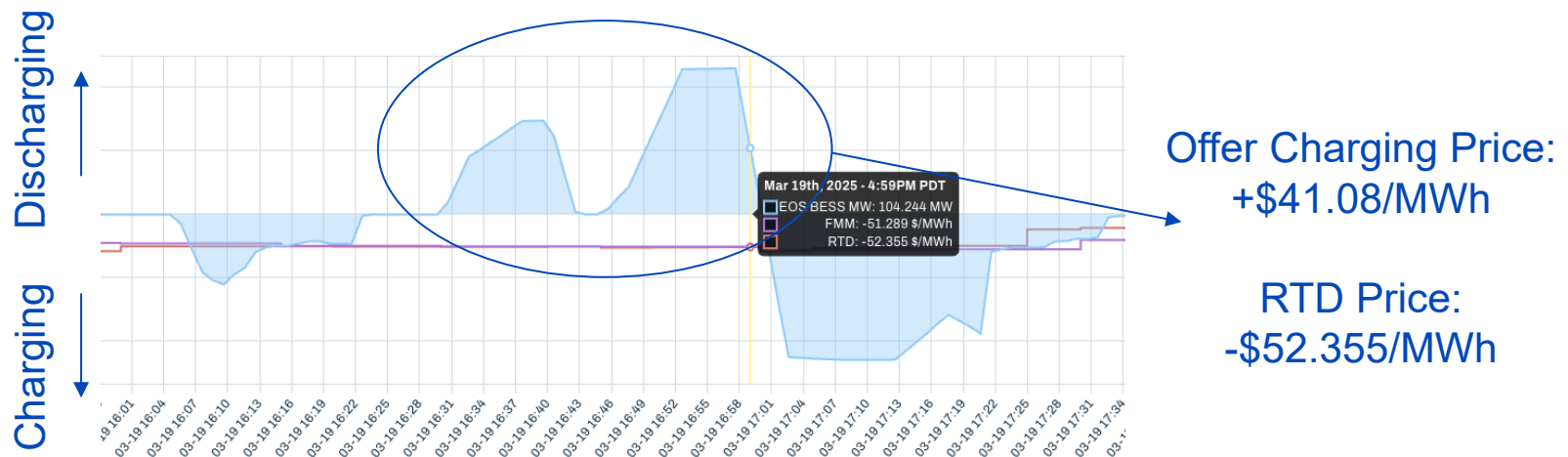
NextEra Analytics findings indicate OOM dispatch occurs frequently enough to warrant further investigation

1) Excludes intervals with Flexible Ramp Product awards and where OOM dispatch may be attributable to the RT Ancillary Service SoC constraint pre-positioning the BESS to ensure deliverability of upcoming A/S awards.

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In Some Instances, OOM Dispatch is Harmful

- NEER battery was dispatched to discharge OOM during ~ -\$50 RTD LMPs despite having positive discharge offer prices
- Battery forced into *paying* to discharge rather than *getting paid* to charge
 - LMPs remained similar for the remainder of rolling hourly horizon



OOM dispatches to discharge during highly negative prices clearly indicate sub-optimal MIO outcomes

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MIO Lacks Transparency

- CAISO does not publish advisory prices, preventing market participants from identifying OOM dispatch intervals and generally understanding the accuracy of advisory pricing at their node(s) with certainty
 - CAISO's mission is, in part, to facilitate effective markets through the provision of timely and accurate information
- Market participants can only infer OOM dispatch by comparing bid costs from relevant offer curve segments against actual prices

OOM dispatch is difficult for market participants to identify

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CAISO Should Address Sub-Optimal Outcomes

- NEER requests CAISO undertake a policy initiative to address sub-optimal, harmful impacts of OOM dispatch created by MIO
- CAISO should address sub-optimal outcomes with proposed make-whole payment
 - For trade dates where CAISO identifies OOM dispatch for a BESS that realizes positive net revenue, CAISO would calculate counterfactual RT market revenues if there had been no OOM dispatches that day⁽¹⁾
 - If BESS would have earned more by being dispatched strictly according to its bid prices (all else equal), BESS receives make-whole payment
 - If OOM dispatch was a net benefit to the BESS for that day, no make-whole payment would be issued
 - If BESS realized a net loss for the day, no need for this make-whole payment because BCR should provide appropriate compensation

CAISO should develop policy to address suboptimal, harmful impacts of out-of-merit dispatch created by multi-interval optimization

1) This assumes CAISO would be able to exclude from settlement intervals where OOM dispatch occurred due to other market processes like Flexible Ramp Product awards or the RT ASSOC constraint.

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Proposal Leverages Exceptional Dispatch Settlement

- Following Energy Storage Enhancements Phase 1, CAISO revised its Tariff to settle BESS that receive Exceptional Dispatch instructions to hold SoC based on the difference between BESS' max potential RT energy revenues with and without the Exceptional Dispatch⁽¹⁾
 - Implemented as new RT settlement charge code⁽²⁾
- Proposed make-whole payment for BESS negatively impacted by OOM dispatch would similarly rely on a CAISO-calculated counterfactual
 - However, proposed make-whole payment would be calculated on daily basis rather than interval-by-interval like Exceptional Dispatch make-whole payments to limit over-payment and gaming issues

Counterfactual-based settlement for Exceptional Dispatches to hold SOC offers template for proposed make-whole payment

1) Tariff § 11.5.6.1.2.

2) CG PC RTM Net Amount, § 3.6.1.

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Other Potential Solutions Have Known Consequences

- Allow resources to opt out of MIO
 - NEER agrees with previous CAISO position that only considering a subset of bid stack in MIO could exacerbate market inefficiency and inhibit price formation
- Continue relying on BCR to mitigate extreme revenue impacts
 - Offers no relief to a BESS that realizes significantly-reduced-yet-still-positive profits for a given trade date due to OOM dispatch
 - Could create incentive problems for market participants manipulating offer spreads to avoid OOM dispatch
- Remove net loss eligibility criterion from current BCR framework
 - Modifying this fundamental element of CAISO market design could have unintended consequences

Other potential solutions for addressing OOM dispatch impacts fall short

Submission 2: Co-located BESS and VER “Follow DOT” Flag

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Problem Statement

- Variable Energy Resources (VERs) are required to follow their Dispatch Operating Target (DOT) whenever any co-located resources behind the same Aggregate Capability Constraint (ACC) or Sub-ACC receive ancillary service (A/S) awards⁽¹⁾
 - VER is not allowed to freely generate as available in RT
- This requirement unnecessarily discourages co-located BESS participation in A/S markets, inhibits price formation, and poses coordination issues when VER and BESS have different owners/operators
- CAISO should identify policy rationale for Follow DOT flag in this context and reevaluate whether it outweighs flag’s significant drawbacks for market participants

CAISO should revisit whether the “Follow DOT” flag remains necessary when co-located resources receive A/S awards

1) Market Operations BPM § 2.1.22.

Submission 2: Co-located BESS and VER “Follow DOT” Flag

Unclear Rationale for Follow DOT Flag

- To NextEra’s knowledge, CAISO has never provided a written policy rationale for triggering the Follow DOT flag for VERs when another co-located resource participates in A/S
 - Appears to have been introduced in Market Operations BPM v88 following the Hybrid Resources Phase 2b initiative (PRR 1471)
- ACC logic already ensures co-located resources’ combined output stays below point of interconnection (POI) limits, so flag does not appear necessary for POI management
- Unclear why flag would be needed to prevent VER output from “fighting” with BESS Regulation Up/Down deployment given that CAISO procures A/S on a zonal rather than nodal basis
 - How would this be different from a VER freely generating at one node and a standalone BESS providing Regulation at an adjacent node?
 - At a minimum, flag should not apply when co-located BESS carries Spin/Non-Spin awards given CAISO’s position that previous Tariff prohibition against co-located BESS deviating from DOT when providing *any* A/S was “overly broad”⁽¹⁾

1) FERC Docket No. ER23-2537-000, Transmittal at 7 n.26.

Submission 2: Co-located BESS and VER “Follow DOT” Flag

Flag Creates Financial and Operational Risks

- When a single market participant controls both the BESS and VER
 - Flag unnecessarily discourages BESS participation in A/S because the estimated value of bidding BESS into A/S markets is typically outweighed by foregone energy revenue due to VER following DOT
 - Flag forces VER to follow its 5-minute forecast rather than freely generate
 - Even when VER forecast is reasonably accurate, VER’s DOT will still be below its actual capability ~ 50% of the time, resulting in VER curtailments
 - Unnecessarily shrinks A/S supply stack, which inhibits price formation and could promote artificial scarcity (especially during tight supply conditions)
- When a market participant only controls the VER
 - Flag unnecessarily penalizes VER due to BESS actions beyond VER’s control
 - Difficult for VER owner to isolate financial impacts from BESS participation in A/S vs. other potential drivers of VER curtailment
 - How often BESS participates in A/S
 - Quality of VER forecast
 - POI congestion due to deployment of upward A/S awards on BESS

Submission 2: Co-located BESS and VER “Follow DOT” Flag

Proposed Policy Initiative

- NEER requests CAISO undertake a policy initiative to consider eliminating current requirement for VERs to Follow DOT when co-located resources participate in A/S
 - Elaborate on policy rationale for current requirement

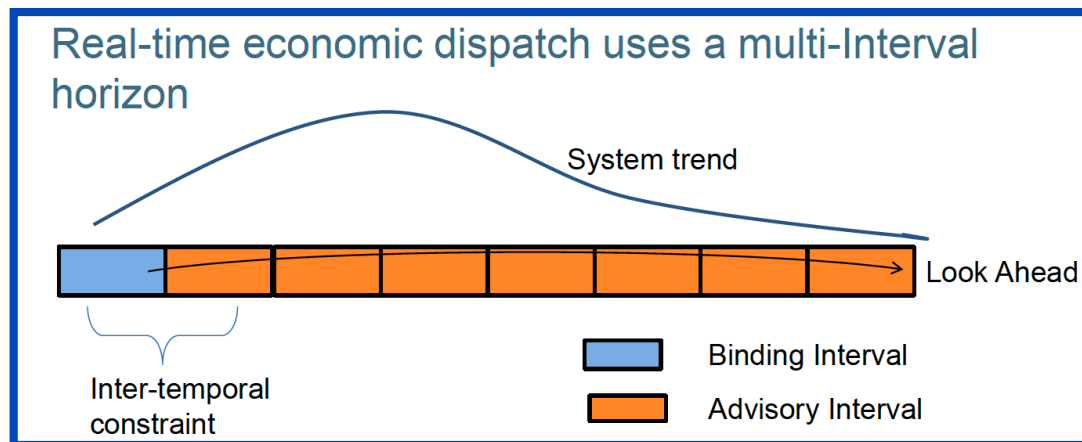
CAISO should revisit whether the “Follow DOT” flag remains necessary when co-located resources receive A/S awards

Appendix

Appendix: Background on MIO in Support of Submission 1

Background on MIO

- RT economic dispatch uses MIO to position resources to react to expected conditions within the MIO's one-hour lookahead⁽¹⁾
- MIO can result in “uneconomic” or “out-of-merit” (OOM) dispatches⁽²⁾
 - Dispatches to charge at LMP greater than min charging bid price
 - Dispatches to discharge at LMP less than max discharging bid price
 - Dispatches to idle at 0 MW despite being economic to charge/discharge



1) Rahul Kalaskar and Guillermo Bautista Alderete, Real-Time Dispatch Multi-Interval Optimization, October 2021 at 7 ([link](#)).

2) This presentation uses the term “out-of-merit” (OOM) dispatch because a dispatch that appears uneconomic over the next hour may appear economic over a longer horizon.

Appendix: Background on MIO in Support of Submission 1

Background on MIO

- MIO's ability to reach a more efficient market solution in the binding interval (even via OOM dispatch, if necessary) hinges on the accuracy of CAISO's advisory price forecast
 - When advisory prices materialize, OOM dispatch can benefit BESS by fully optimizing its limited charging/discharging capacity over the next hour (e.g., holding BESS with limited SoC back from discharging until anticipated LMP spike)
 - When advisory prices fail to materialize, OOM dispatch becomes sub-optimal and can erode daily revenues (e.g., forcing a battery to pay more than necessary for charging energy)

MIO can be helpful or hurtful to BESS

Appendix: Background on MIO in Support of Submission 1

Background on MIO

- CAISO has explained that MIO only results in OOM dispatch for BESS under certain conditions⁽¹⁾
 - BESS State of Charge (SoC) is less than 25% or greater than 75% (for a 4-hour battery)
 - Price spread between advisory and binding intervals exceeds spread between BESS charging and discharging offer prices (plus losses)

MIO only triggers under certain conditions

1) CAISO presentation at February 2015 Storage Design and Modeling working group ([link](#)).

Appendix: Background in Support of Submission 1

Complex Process to Infer OOM dispatch

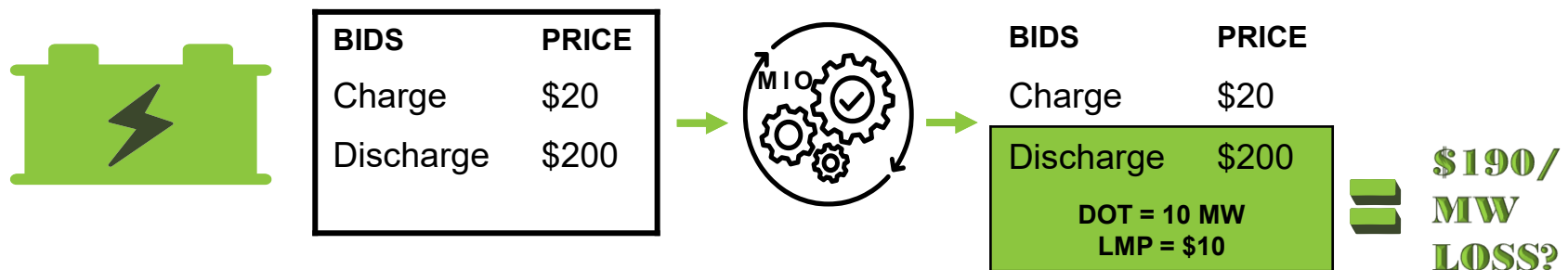
- Market participants can only infer OOM dispatch by comparing bid costs from relevant offer curve segments against actual prices
 - Requires market participants to filter out other market outcomes that present as OOM dispatch but may be due to other RT market processes
 - Flex Ramp Product reserves resource ramp capability for future intervals
 - RT ASSOC constraint ensures BESS has enough SoC/headroom to support deliverability of upcoming ancillary service awards (including via uneconomic dispatch if necessary)

OOM dispatch is difficult for market participants to identify

Appendix: Example in Support of Submission 1

Example – Infer but Cannot Quantify Harm

- Suppose a BESS has a \$20 maximum charging offer, a \$200 minimum discharge offer, and is OOM dispatched to discharge 10 MW at \$10 LMP
 - How to calculate financial harm?



- If the OOM discharging creates extra charging headroom during a later interval with highly negative prices, should that be considered an offsetting benefit?

OOM dispatch impacts are difficult for market participants to quantify

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