Energy Storage in the Day-Ahead Market Enhancements (DAME) Initiative

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CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

Agenda

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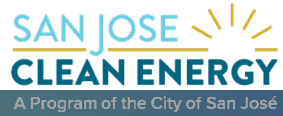
- **Other Storage Matters**

About CESA

The mission of CESA is to make energy storage a mainstream resource to advance a more affordable, efficient, reliable, safe, and sustainable electric power system for all Californians.

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Background

- **In DAME, the CAISO proposes introducing two new products:** Imbalance Reserves (IR) and Reliability Capacity (RC)

- **In prior revisions of the proposed policy, the CAISO had declined to develop a means to estimate the potential impacts of IR on storage state of charge (SOC)**

- **The CAISO's Draft Revised Final Proposal:**

  - Adds a resource adequacy (RA) day-ahead must-offer obligation (MOO) for IR

  - Establishes a $247/MWh bid cap for IR

  - Proposes new requirements that govern the amount of state of charge (SOC) a storage resource must hold to support IR awards via the envelope equations

    - In addition, proposes modifying the ancillary service (AS) SOC constraint to include imbalance reserves

CAISO's Envelope Equations

- **The day-ahead market will generate an upper and lower bound, or envelope, for state of charge**
  - The envelope could constrain operation for storage resources
  - The initial upper and lower bounds will be set to the initial day-ahead state of charge
  - The initial multiplier attached to the imbalance reserves in the envelope equation will be 0.2

$$SOC_{i,t}^{(u)} = SOC_{i,t-1}^{(u)} - EN_{i,t}^{(+)} - \eta_i \, EN_{i,t}^{(-)} + \eta_i \, AIRD_t \, IRD_{i,t} \leq \overline{SOC}_{i,t}$$

$$SOC_{i,t}^{(l)} = SOC_{i,t-1}^{(l)} - EN_{i,t}^{(+)} - \eta_i \, EN_{i,t}^{(-)} - AIRU_t \, IRU_{i,t} \geq \underline{SOC}_{i,t}$$

CAISO's Envelope Equations

- **The day-ahead market will generate an upper and lower bound, or envelope, for state of charge**

  - Once the hypothetical state of charge reaches the lower/upper limit of the resource, then the market will schedule the resource to charge prior to scheduling any additional imbalance reserves that could potentially cause the hypothetical value to exceed the limit

  - This policy also notes that no explicit changes are being proposed to the state of charge formulation

$$SOC_{i,t}^{(u)} = SOC_{i,t-1}^{(u)} - EN_{i,t}^{(+)} - \eta_i\, EN_{i,t}^{(-)} + \eta_i\, AIRD_t\, IRD_{i,t} \leq \overline{SOC}_{i,t}$$

$$SOC_{i,t}^{(l)} = SOC_{i,t-1}^{(l)} - EN_{i,t}^{(+)} - \eta_i\, EN_{i,t}^{(-)} - AIRU_t\, IRU_{i,t} \geq \underline{SOC}_{i,t}$$

Implications of CAISO's Proposal

- **CESA is concerned with the envelope equations concept proposed by the CAISO as it does not build upon the common understanding stakeholders have developed as part of the Energy Storage Enhancements (ESE) initiative and the efforts to better represent the impacts of Regulation on SOC**

  - The CAISO's proposal adds further complexity to the myriad of formulae that are currently utilized for SOC management

  - The CAISO's proposal does not further alignment among the different formulae used for SOC management (AS SOC constraint, SOC calculation)

  - The CAISO's proposal could be considered beyond the limits applied by FERC relative to SOC management under their storage participation policy (*see* FERC Order 841 at 251)

CESA's Proposal

- **Ideally, the ISO should seek to modify and align the state of charge calculation and ancillary service (AS) state of charge constraint formulae for the day-ahead (DA) and real-time (RT) timeframes**

  - Today in DA (See Market Operations BPM version 78, Section 6.6.2.3.)

    - **DA SOC Calculation:** $SOC_{i,t} = SOC_{i,t-1} - (P_{i,t}^{(+)} + \eta_i P_{i,t}^{(-)})$

    - **DA AS SOC Constraint :** $\underline{SOC_{i,t}} + (SR_{i,t} + RU_{i,t} + NR_{i,t}) \leq SOC_{i,t} \leq \overline{SOC}_{i,t} - \eta_i RD_{i,t}$

  - Today in RT (See Market Operations BPM version 82, Section 7.8.2.5.)

    - **RT SOC Calculation:** $SOC_{i,t-1} - (P_{i,t}^{(+)} + \eta_i P_{i,t}^{(-)}) \frac{\Delta T}{T}$

    - **RT AS SOC Constraint:** $\underline{SOC_{i,t}} + (SR_{i,t} + RU_{i,t} + NR_{i,t}) \frac{30'}{T} + FRU_{i,t-1} \frac{\Delta T}{T} \leq SOC_{i,t} \leq \overline{SOC}_{i,t} - \eta_i RD_{i,t} \frac{30'}{T} - \eta_i FRD_{i,t-1} \frac{\Delta T}{T}$

CESA's Proposal

- **CESA understands that pursing modifications to all the aforementioned formulae might be challenging given the timeline of this initiative, as such, CESA recommends that within the present initiative the CAISO commits to, *ad minima*, incorporate the following changes:**
  - Modify the DA SOC Calculation as follows:
  - $SOC_{i,t} = SOC_{i,t-1} - (P_{i,t}^{(+)} + \eta_i P_{i,t}^{(-)} + \mu_{i,t}^{(+,RU)} RU_{i,t} + \mu_{i,t}^{(+,IRU)} IRU_{i,t-1} + \mu_{i,t}^{(-,RD)} \eta_i RD_{i,t} + \mu_{i,t}^{(-,IRD)} \eta_i IRD_{i,t-1})$
    - Initially, equate the multipliers used for IRU and RU, and IRD and RD
      - Commit to update this as more data is available
    - Commit on moving toward resource specific values as data allows
  - Commit to consider more significant modifications in the AS SOC Constraint initiative, like the ones include in CESA's proposal above
    - This is partially addressed by the Draft Revised Final Proposal, although the CAISO AS SOC proposal does not include Regulation
  - Commit to testing prior to implementation scenarios that would identify whether any inefficient or infeasible awards result from different multipliers in the SOC calculation than in the AS SOC constraint

DAME and RA

- **The CAISO has put forth a proposal to introduce a three-year "opt-in" transitional resource adequacy true-up mechanism whereby entities can choose to have the CAISO settlement system true-up specific imbalance reserve and reliability capacity payments that overlap with RA capacity**

  - The transitional RA true-up mechanism allows load serving entities (LSEs) in agreement with the RA supply resource to have RA capacity shown on the LSE monthly RA plan and procured through the day-ahead market for imbalance reserve and/or reliability capacity to settle with both the LSE and the generator

  - Any portion of RA capacity that overlaps with either the imbalance reserve awards or reliability capacity awards will considered overlapping RA capacity potentially subject to the RA true-up mechanism

  - The CAISO will compensate the LSE for "opt-in" RA capacity at the respective imbalance reserve capacity price and/or reliability capacity price while also compensating the RA resource for the same overlapping RA capacity at the respective imbalance reserve opportunity cost

  - Furthermore, the CAISO will compensate the RA resource for any overlapping RA capacity that has not elected to "opt-in" to the RA true-up mechanism, as well as non-RA capacity procured for imbalance reserve or reliability capacity at the respective marginal imbalance reserve price or marginal reliability capacity price

DAME and RA

- **As CESA has previously stated, the ISO should remove all features of the imbalance reserve product (be it the "opt-in" mechanism, a claw back, or a means for SC trading) that are intended to account for the mistaken idea that the imbalance product will cause a double payment under existing RA contracts**

- **CESA and several other stakeholders have clearly stated the position that IR is neither part of RA, nor an "RA successor" product**