Overview of current storage and hybrid default energy bid proposals

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PUBLIC

REVISED STRAW PROPOSAL ON STORAGE DEFAULT ENERGY BIDS

Background – Market power mitigation and default energy bids

- Today, the ISO may replace a resource's bid with a previously agreed upon default energy bid
- This process seeks to limit the ability of market power to affect market outcomes
- The default energy bid is meant to reflect the resource's marginal costs
  - The cost of producing one additional unit of electricity

Background – The current storage default energy bid

$$Discharge\ Default\ Energy\ Bid = Max\left\{\left[Max\left(En_{\delta/\eta}, 0\right) + \rho\right], PB_OC_{\gamma}\right\} * Multiplier$$

$$Charge\ Default\ Energy\ Bid = Max\left\{\left[Max\left(En_{\delta/\eta}, 0\right)\right], PB_OC_{\gamma}\right\} * Multiplier$$

Where:

- *En*: Energy Cost
- *η*: Round-trip efficiency
- *δ*: Energy charging duration
- *γ*: Energy discharge duration
- *ρ*: Variable operations cost
- *PB_OC*: Price-based opportunity cost
- *Multiplier*: 110% multiplier

Background – Problem statements and guiding principles

Current storage default energy bid relies on day-ahead market runs:		New storage default energy bid should:
Day-ahead values may be stale when used in real-time	→	Consider scaling that reflects differences between day-ahead and real-time
Regional resources that are not part of the day-ahead market cannot use	→	Be usable across WEIM
Single real-time storage default energy bid may over- or under-estimate opportunity costs at different times of the day	→	Reflect changing real-time opportunity costs, ensure correct placement in the bid stack under mitigation, and minimize risks posed by charging side mitigation

Background – September Revised Straw Proposal

1. **Includes a scaling step that captures differences between day-ahead and real-time to address the use of "stale" price proxies**
2. **Eliminates energy costs and adds a gas floor**
   - Approximates the cost of serving load with a marginal gas-fired resource when stored energy is discharged
   - Aligns with hydro default energy bid
3. **Introduces a >1 multiplier for hours before the later of either (1) the earliest of the Nth highest priced day-ahead LMPs, or (2) hour ending 18 (only in real-time)**
   - Reflects changing opportunity costs and supports state-of-charge management efforts
4. **Retains a 1.1 multiplier for the price-based opportunity cost component**
5. **Redefines the charge default energy bid as discharge default energy bid minus variable operating costs**

Background – September Revised Straw Proposal

$$DA\ Discharge\ DEB = Max(Variable\ Operations\ Cost * 1.1, \boldsymbol{PB_OC} * \mathbf{1.1}, Gas\ Floor * 1.1)$$

$$DA\ Charge\ DEB = (DA\ Discharge\ DEB - Variable\ Operations\ Cost)$$

$$RT\ Discharge\ DEB = Max(Variable\ Operations\ Cost * 1.1, \boldsymbol{PB_OC} * \mathbf{1.1}, Gas\ Floor * 1.1) * TOD\ Multiplier$$

$$RT\ Charge\ DEB = (RT\ Discharge\ DEB - Variable\ Operations\ Cost)$$

Where:

$Variable\ Operations\ Cost$: Represents cycling and other operational costs

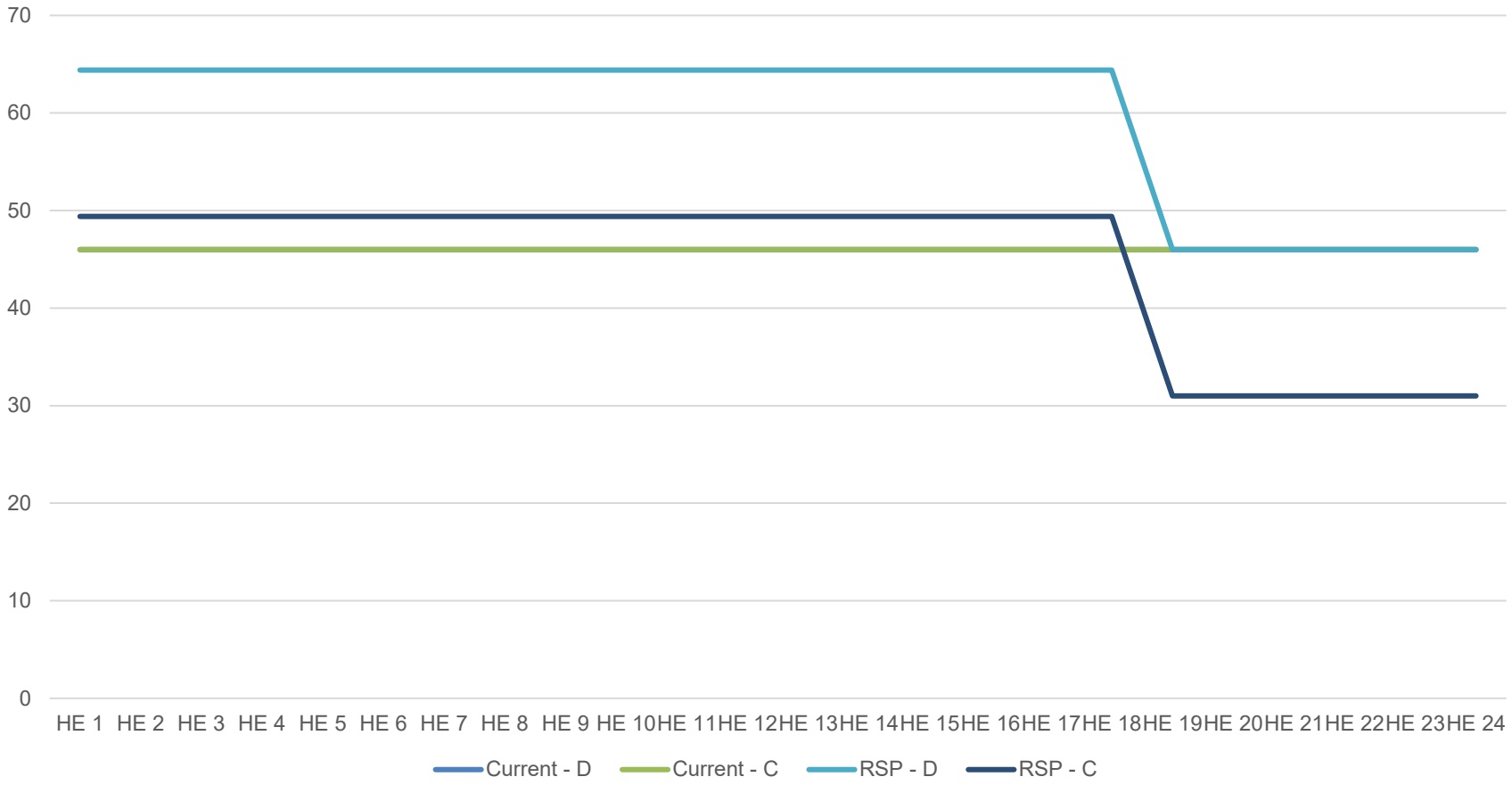
PB_OC: Price-based Opportunity Cost

- In DA for EDAM, calculated by scaling the MPM outputs based on differences relative to DA LMPs
- In RT for EDAM, calculated by scaling DA LMPs based on differences relative to RT LMPs
- In RT for WEIM, calculated by scaling DGAP based on differences relative to RT LMPs

$TOD\ Multiplier$: A value of 1.4 before the hour that sets the price-based opportunity cost and 1 **after the later of either (1) the earliest of the Nth highest priced day-ahead LMPs, or (2) hour ending 18 (only in real-time)**

$Gas\ Floor$: 11,068 MMBtu/MWh * Fuel region gas price

Background – September Revised Straw Proposal



Several stakeholders commented on the value of the multiplier applied to the price-based opportunity cost component

- In the revised straw proposal, the ISO acknowledges that, while the 1.4 value would align the storage default energy bid with its hydro counterpart, the proposed time-of-day storage default energy bid also includes additional upward adjustments

- Given the inclusion of additional upward adjustments in the time-of-day framework, the revised straw proposal reverts to the current 1.1 multiplier for the price-based opportunity cost component

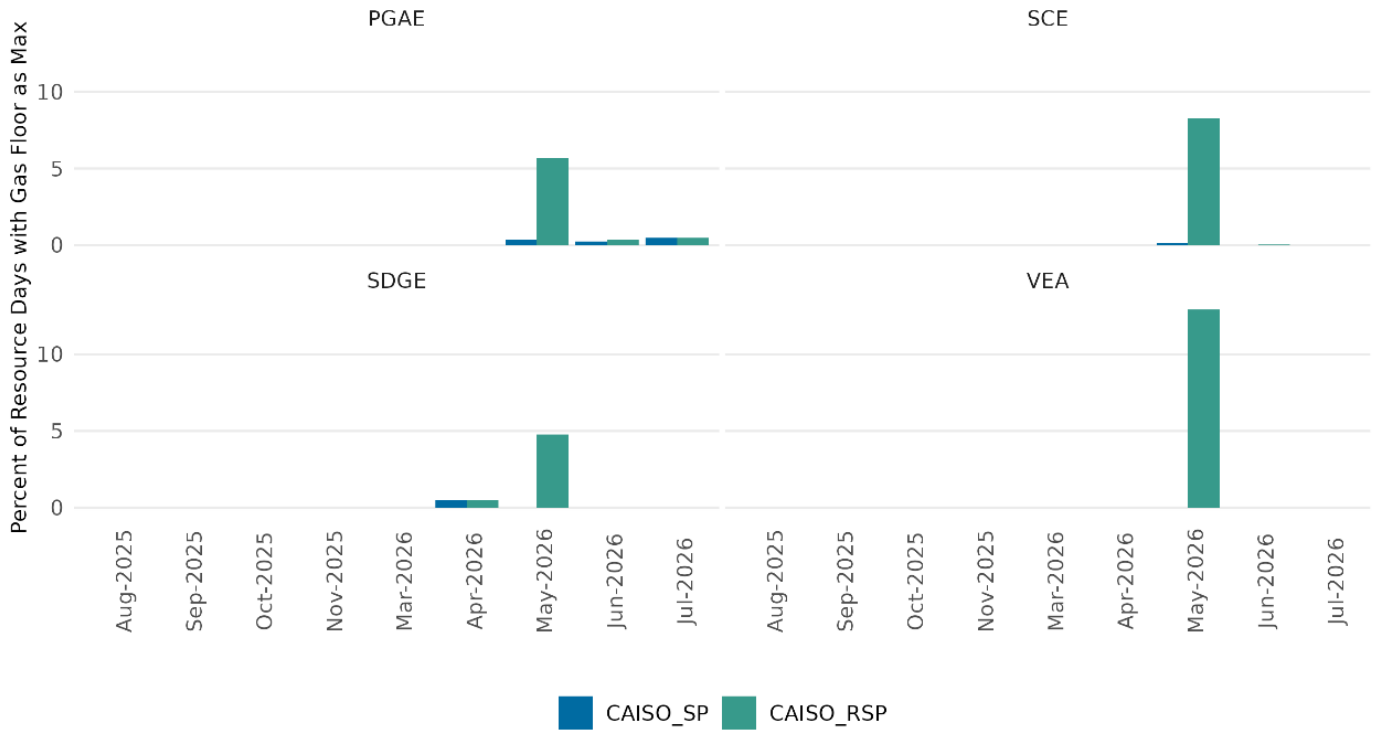
The Revised Straw Proposal retains the gas floor provision to better evaluate how often it would determine the storage default energy bid

- The gas floor is only one component in a maximizing function and is unlikely to be the binding factor in most cases because gas-price impacts are often already reflected in LMP-based opportunity costs

- The gas floor would mainly affect situations where it is material for both hydro and storage resources, helping ensure consistent treatment of energy-limited resources when mitigated

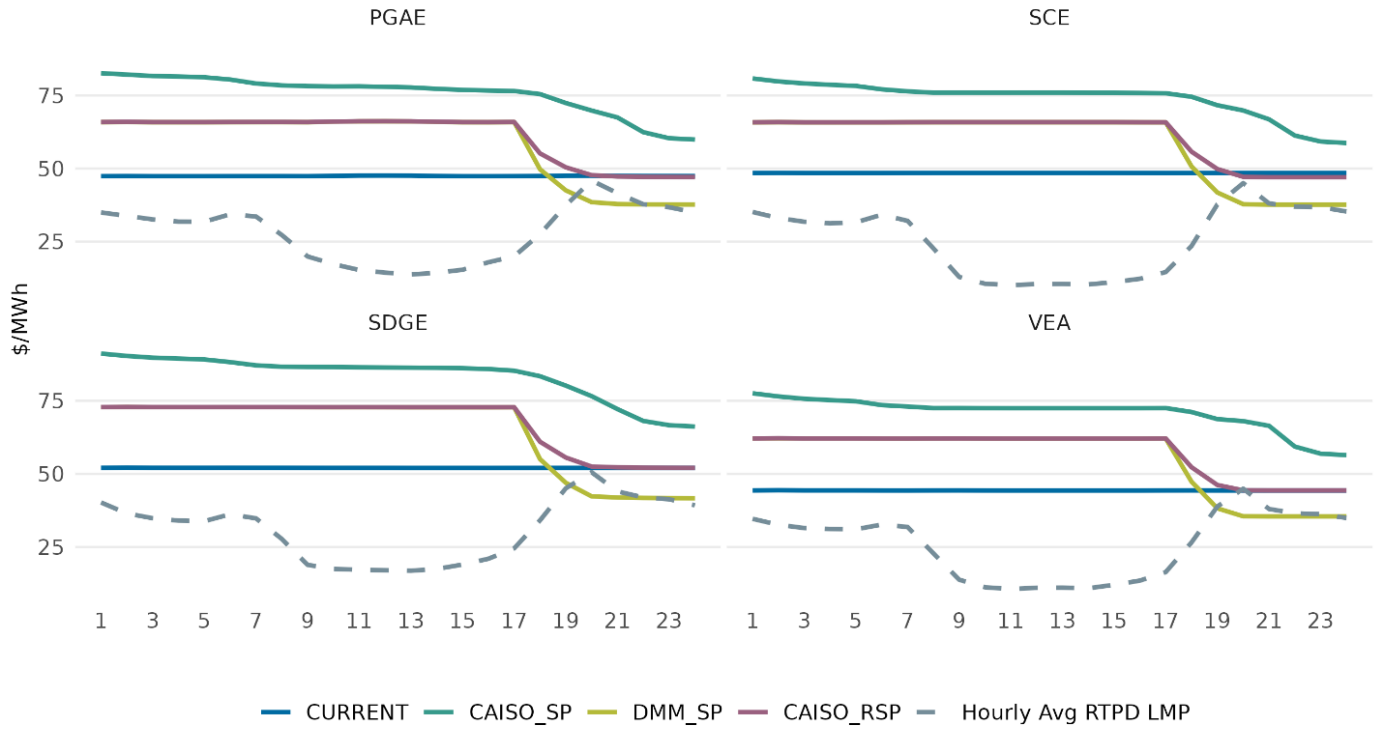
- The ISO sought stakeholder feedback on whether maintaining the gas floor provides sufficient value despite its expected limited impact

The gas floor would have had limited impact on the DEBs



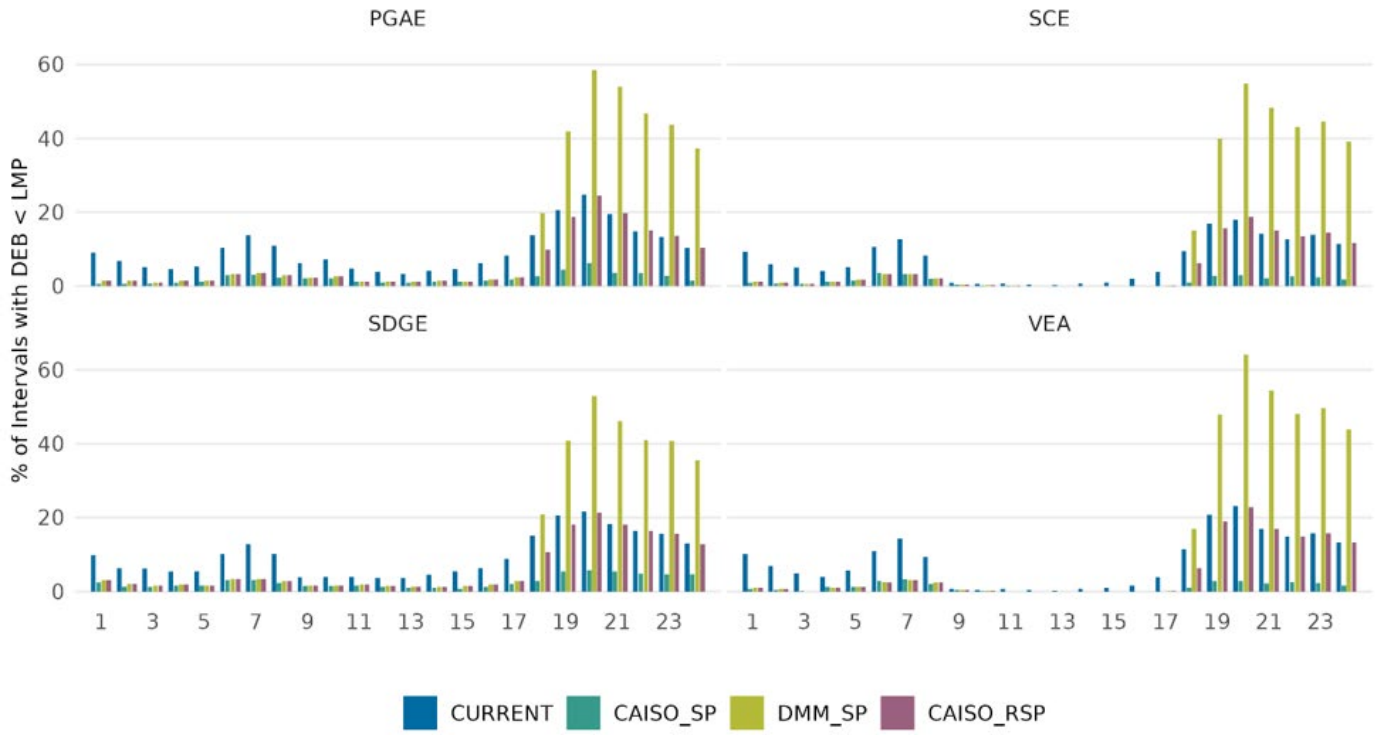
- Gas floor is relatively higher than other components in Revised Straw Proposal as price-based opportunity cost multiplier is lowered to 1.1
- Price-based opportunity cost component appropriately places battery fleet appropriately in the bid stack relative to gas fleet

The Revised Straw Proposal strikes a balance between the Straw Proposal and the DMM proposal



- Compared to the DMM proposal, the Revised Straw Proposal recognizes the value of stored energy at the end of the day by ensuring the real-time default energy bid is not lower than the day-ahead default energy bid

The Revised Straw Proposal would lower the potential for dispatch in midday hours relative to the current storage default energy bid



- Highest potential for mitigation during midday hours is in current storage default energy bid, but still low frequency of mitigation impact

The Revised Straw Proposal does not adversely impact battery resources' revenue efficiency

UDC	CURRENT	CAISO_SP	DMM_SP	CAISO_RSP
PGAE	97.4	99.6	97.9	99.1
SCE	98.7	99.84	98.35	99.6
SDGE	96.2	99.0	96.6	98.2
VEA	99.0	99.9	98.5	99.7

- Revenue efficiency for batteries under the current storage default energy bid is lowest, but still above 96%
- Straw Proposal has the narrowest impact to revenue efficiency

Stakeholder comments showed broad support for the revised straw proposal, including the time-of-day multiplier and the use of a 1.1 multiplier for the price-based opportunity cost component

- There are two primary remaining disputes:

1. The inclusion of the gas floor
   - The gas floor is only one component in a maximizing function and is unlikely to be the binding factor in most cases because gas-price impacts are often already reflected in LMP-based opportunity costs
   - The gas floor would mainly affect situations where it is material for both hydro and storage resources, helping ensure consistent treatment of energy-limited resources when mitigated
   - The Draft Final Proposal will provide additional data on the frequency and magnitude of this addition

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- There are two primary remaining disputes:

2. Whether the time-of-day multipliers should fall below 1.0 during and after peak hours

    - Some stakeholders noted the time-of-day concept could overestimate opportunity costs in some days/hours since the higher multiplier would be applied daily
    - Stakeholders also noted that the value and timing of the time-of-day multiplier could need annual updating as grid conditions change

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- There are two primary remaining disputes:

2. Whether the time-of-day multipliers should fall below 1.0 during and after peak hours

    - In this context, some stakeholders asked the ISO to consider an alternative where the higher default energy bid does not occur every day, but is triggered by a real-time condition
    - In the Draft Final Proposal the ISO provides an overview of this alternative and its relative tradeoffs

REVISED STRAW PROPOSAL ON HYBRID DEFAULT ENERGY BIDS

Background – Topic developments

- In the 2020 Hybrid Resources initiative, the ISO noted a hybrid default energy bid would be developed in a future initiative
- Wellhead presented a “greater-of” methodology during scoping
- The ISO presented 3 approaches in straw proposal
  - Greater-of with minimum share (ISO-preferred)
  - Largest component
  - Weighted average
- Almost all commenters expressed support for continued development of the greater-of approach with minimum share

Background – Straw proposal, greater-of methodology

- A hybrid resource's default energy bid would be equal to the greater-of the default energy bid values applicable to each of the components that make up that hybrid resource
  - Ensures hybrid resources are similarly positioned in the bid stack to resources with similar costs
- A component must represent at least __% of the hybrid resource's installed capacity for its default energy bid value to be considered as part of the greater-of approach
  - Ensures hybrid resource default energy bids reflect the marginal cost characteristics of a significant portion of the resource

Almost all commenters expressed support for continued development of the greater-of approach

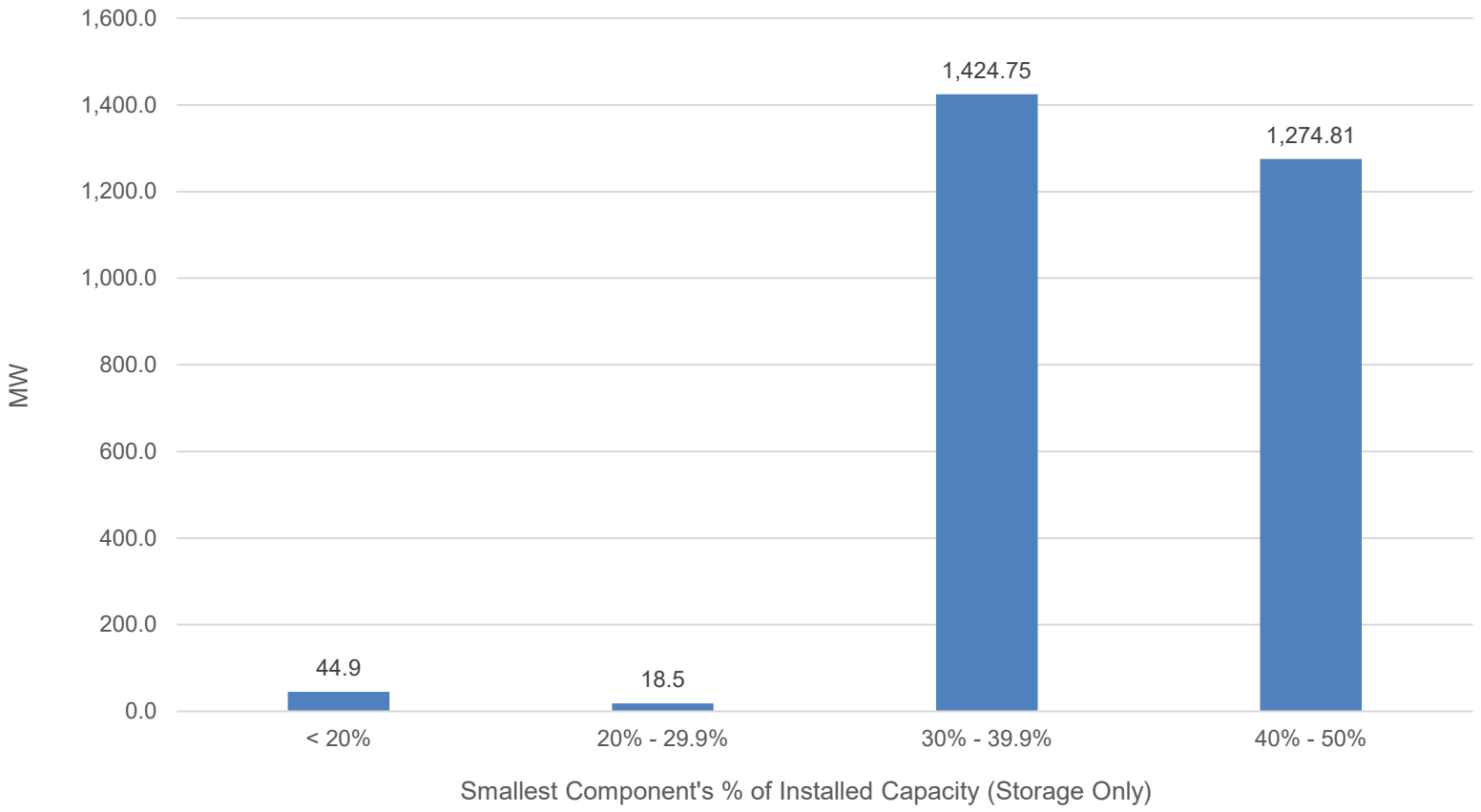
- Support: ACP-California, AES, CalCCA, CESA, DMM, Cal Advocates, PG&E, PacifiCorp, SDG&E, SCE, Vistra, and WPTF

- Most commenters requested analysis on hybrid fleet composition for developing a minimum share threshold

The ISO analyzed the current hybrid fleet to inform setting a minimum share requirement

- As of August 4, 2026:
  - All 42 hybrid resources contained a storage component
  - 40 of 42 resources had storage as the smaller component
  - 7 hybrids had storage components that accounted for less than 30% of the resource's installed capacity
    - 17% by count
    - 63 MW (< 3%) of total hybrid storage capacity

Storage MWs by smallest component % of installed capacity, excluding resources with non-storage smallest component



Considering hybrid fleet data, the ISO proposed a 30% minimum share threshold

- A hybrid component must represent at least 30% of the hybrid resource's total installed capacity for its default energy bid value to be considered under the greater-of approach
  - Ensures hybrid resource default energy bids reflect the marginal cost characteristics of a significant portion of the resource
  - Consistent with 83% of hybrid configurations today
- If none of the components were to meet the greater-of approach's minimum share requirement, the largest component's default energy bid value would be leveraged for the hybrid resource

Almost all commenters expressed support for continued development of the greater-of approach

- Many stakeholders advocated for modifications to how the proposed 30% minimum-share requirement would affect existing resources
  - Some stakeholders favor some form of grandfathering or accommodation for existing facilities, while other stakeholders generally support moving forward with the proposal as drafted
    - Some stakeholders advocate for the ISO to apply the requirement prospectively so that existing facilities are allowed to use the higher default energy bid for any technologies currently installed at the facility

Stakeholders also asked how the share of each component would be calculated

- In the Draft Final Proposal, the ISO seeks feedback on how to determine the share a component constitutes

  - **Sum of all PMax:** A component must represent at least 30% of the hybrid resource's sum of all components PMax for its default energy bid value to be considered as part of the greater-of approach

  - **The point of interconnection's service capacity:** A component must represent at least 30% of the hybrid resource's point of interconnection's service capacity for its default energy bid value to be considered as part of the greater-of approach

Stakeholders also asked how the share of each component would be calculated

- In the Draft Final Proposal, the ISO seeks feedback on how to determine the share a component constitutes
  - **Sum of all PMax:** 141 out of 156 mixed fuel resources in the queue, representing 94% of mixed fuel PMax capacity would have all components eligible
  - **The point of interconnection's service capacity:** 144 mixed fuel resources in the queue, representing 92% of mixed fuel net to grid MWs, would have all components eligible