

Energy Storage and Market Integration – State of Play

Regional Issues Forum

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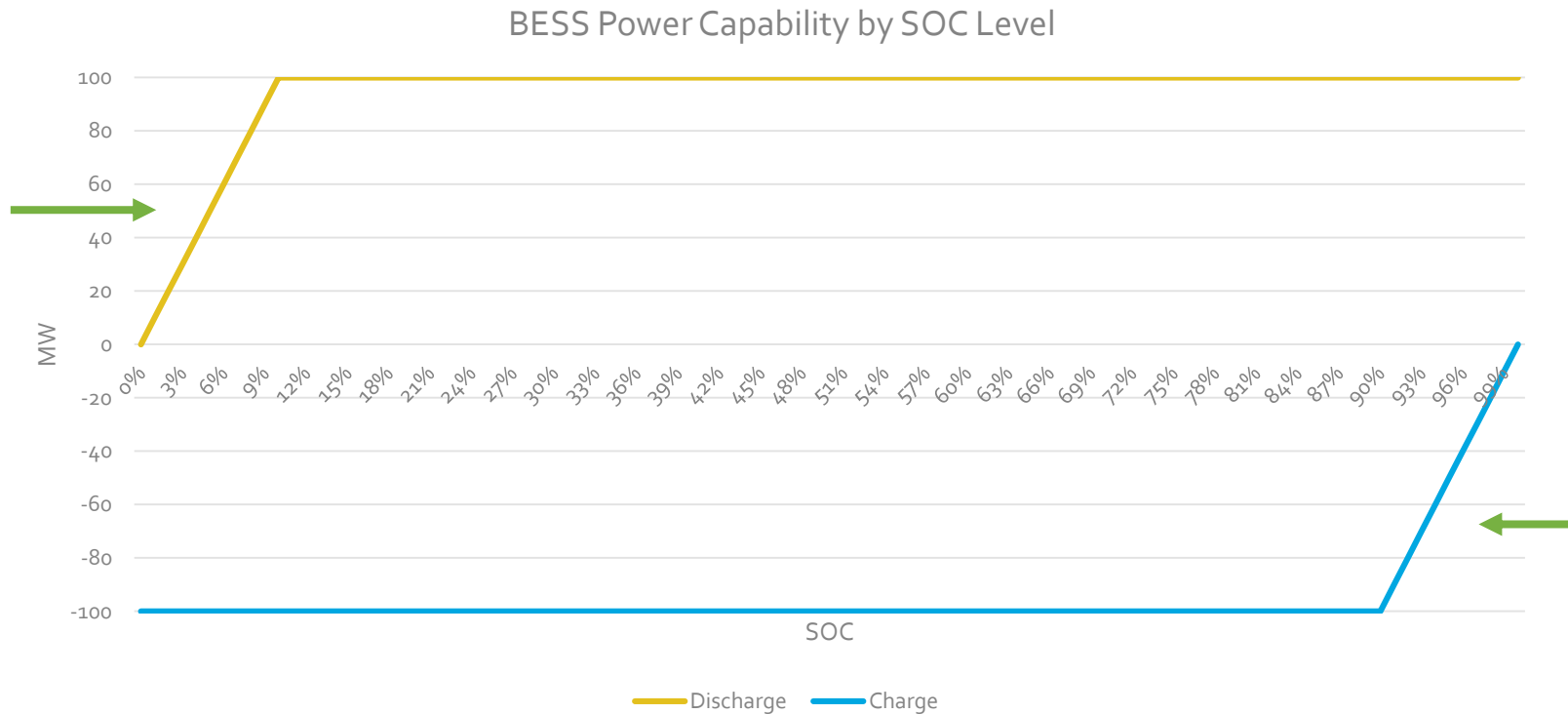
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CESA 2024 Strategic Objectives - CAISO

- **Markets – Design and Operation**
 - Improve storage optimization and dispatch in day-head and real-time energy & ancillary service market model
 - Improve hybrid resource and co-located resource participation
 - Ensure fair, efficient, and transparent price formation
 - Explore better hedging tools – CRR enhancements or other trading options that meet storage needs & profile(s)
 - Explore energy storage as a transmission resource at CAISO
- **Transmission Interconnection & Deliverability**
 - Improve transmission level interconnection and deliverability processes

Resource Modeling + Accurate Cost = Optimal Scheduling

Depth of discharge has higher operating cost



Rate of charge/discharge changes

Different storage technologies need to model differences in operational characteristics

Resource's real-time dispatch was 52% lower than day-ahead in the 4 highest priced hours



8GW storage fleet is exposed to this potential outcome

Additional enhancements in catalog based upon growing experience with storage operations

- Long-Duration Energy Storage Modeling
- Ancillary Service Deliverability and Real-Time Re-optimization
- Ancillary Service State of Charge Constraint
- Incremental Ancillary Service Award Improvements
- Automatic Generator Control Enhancements
- Variable Energy Resources and Storage Dispatch Enhancements
- Energy Storage Daily Use Limitation Modeling Improvements
- Real-time Storage Availability Improvements
- Energy Storage Outage Management Issues
- Energy Storage Outage Reporting Rule Clarifications
- Resource Adequacy Must-Offer Obligations for Co-Located or Hybrid Resources

Recommendations

- Allow storage (NGR) resources to bid up to \$2,000/MWh during high price conditions.
 - Implement before Summer 2024
- Improve operational characteristics, cost modeling, and mitigation of storage
 - Commence Energy Storage Enhancements initiative currently on the 2024 Roadmap
- Accelerate price formation working group transition to design proposals
 - Phase 1: Scarcity pricing
 - Phase 2/3 items have yet to be discussed