



California ISO

Energy Storage Enhancements – Straw Proposal

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The ISO is considering significant enhancements to the existing storage models through this process

- Replacement tool for the minimum state of charge requirement
 - Will provide opportunity cost compensation for batteries instructed to 'hold' state of charge in the real-time market
- New considerations for storage with AS awards
- Enhanced exceptional dispatch tools for operators using storage
- Allow storage resources to have variable charging rates

The ISO is considering significant enhancements to the existing storage models through this process

- Allow for storage to submit multiple bids, for use at different state of charge values
- Introduce a storage model with transition times
- Allow pseudo-tie resources to be co-located
- Compensation for investment tax credit losses while grid charging
- Enhance co-located model to prevent grid charging

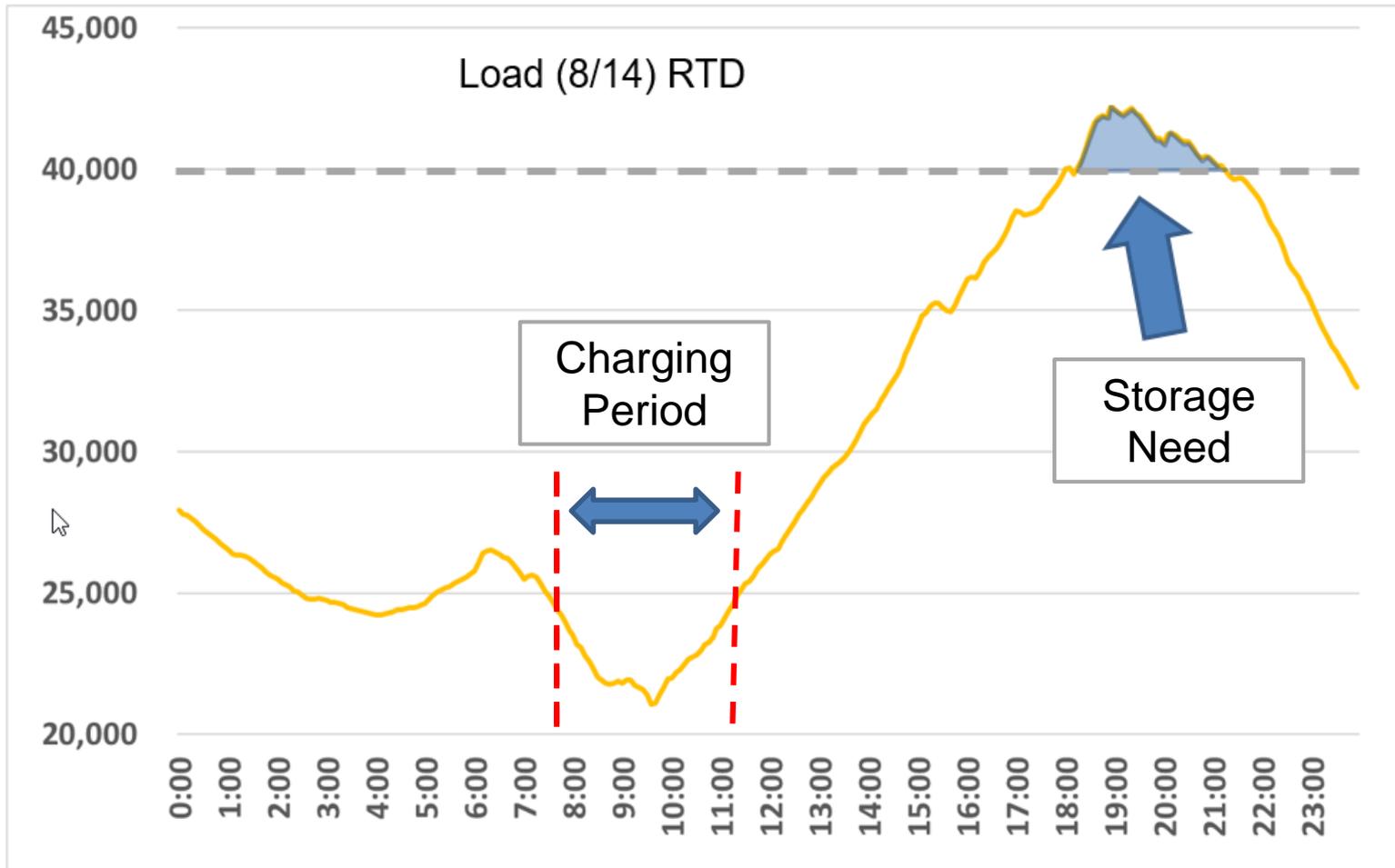
The ISO is proposing a new real-time product to replace the minimum state of charge requirement

- Minimum state of charge requirement does not include compensation for resources precluded from discharging
 - ISO has 2 years of tariff authority for use of this tool
- Hourly **state of charge product** will be implemented in the real-time market for storage
- Upon implementation, the current minimum state of charge requirement will be retired
- Bids for product are due 75 minutes prior to the start of the hour
 - RA storage resources will be required to bid the state of charge product
 - Bids will compensate resources for opportunity costs of holding state of charge

The ISO is proposing a new real-time product to replace the minimum state of charge requirement

- Procurement targets will be based on periods when loads exceeds non-storage generation (i.e. hours ISO is critically reliant on storage)
 - Targets will only be enforced on days when these conditions are met
 - ISO anticipates that these requirements will be enforced infrequently initially
- Procurement targets will be set prior to needs when conditions are best for charging
 - Targets will be graduated, to account for time the storage resource fleet takes to charge
- Awards will be made on an hourly basis, and awards will imply requirements on state of charge

The ISO will procure state of charge when non-storage generation cannot meet net-loads



An example illustrates how this product might work

- The ISO may determine that 3 GWh of energy is needed from storage resources to maintain grid reliability
 - This determination is made by summing the area under the load curve and above the expected non-storage generation curve (shaded)
- The storage fleet can charge at 1,200 MWh per hour
 - Actual charging capability indicates that the fleet will take just under 3 hours to charge to 3 GWh
 - Charging prices may be lowest in hours ending 11, 12 and 13; this is when the ISO will first begin imposing aggregate state of charge targets
 - Requirements are in place until and begin decreasing at HE18

HE	11	12	13	14	15	16	17	18	19	20
Req (GWh)	1.2	2.4	3.0	3.0	3.0	3.0	3.0	2.5	1.5	0.3