SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead℠

Energy Storage Participation in the CAISO Markets

Battery Storage Availability as a System Resource

June 27, 2019

SCE EXTERNAL

Outline

- Introduction
- Dispatch of batteries in the CAISO markets for energy
- The motivation for battery participation in the energy markets
- Tradeoffs resource owners/operators make about resource availability
- Summary of key drivers of resource availability

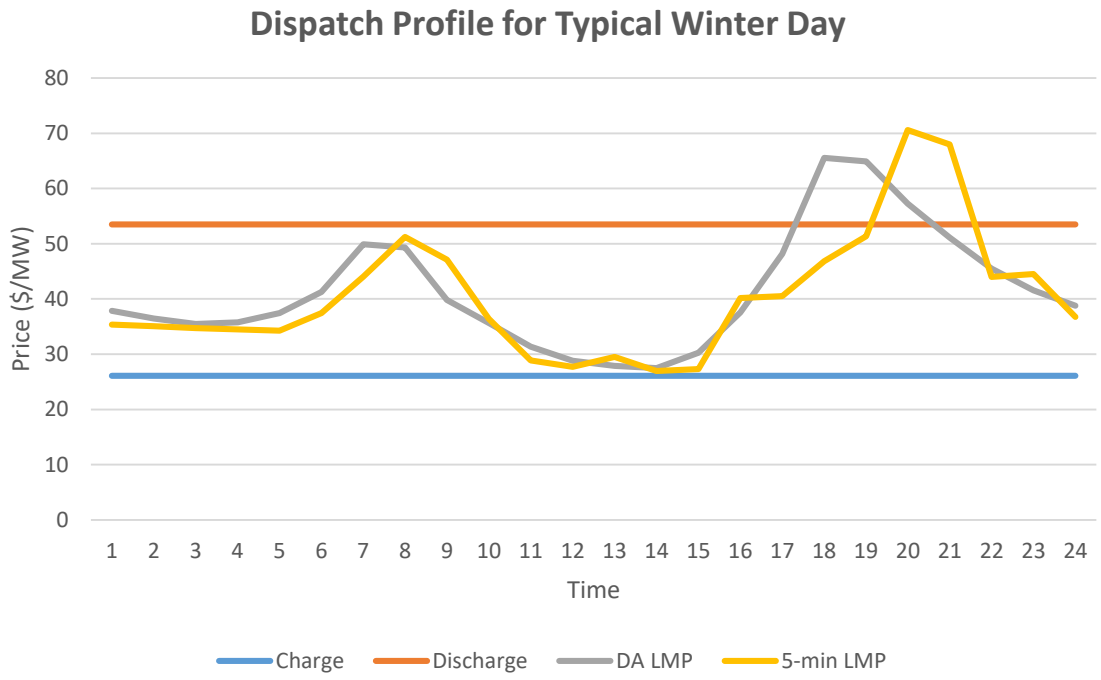
Dispatch of Batteries

- Dispatch for charging or discharging supported by economic or uneconomic bids.
- States of operation:
  - Charging
  - Discharging
  - Idle

- Battery operators offer their resources consistent with their price expectations
  - forward price curve
  - variable O&M costs
    - Expected charge rate
    - Expected number of cycles
    - Aging cost of the resource – cycling not calendar
  - Opportunity cost

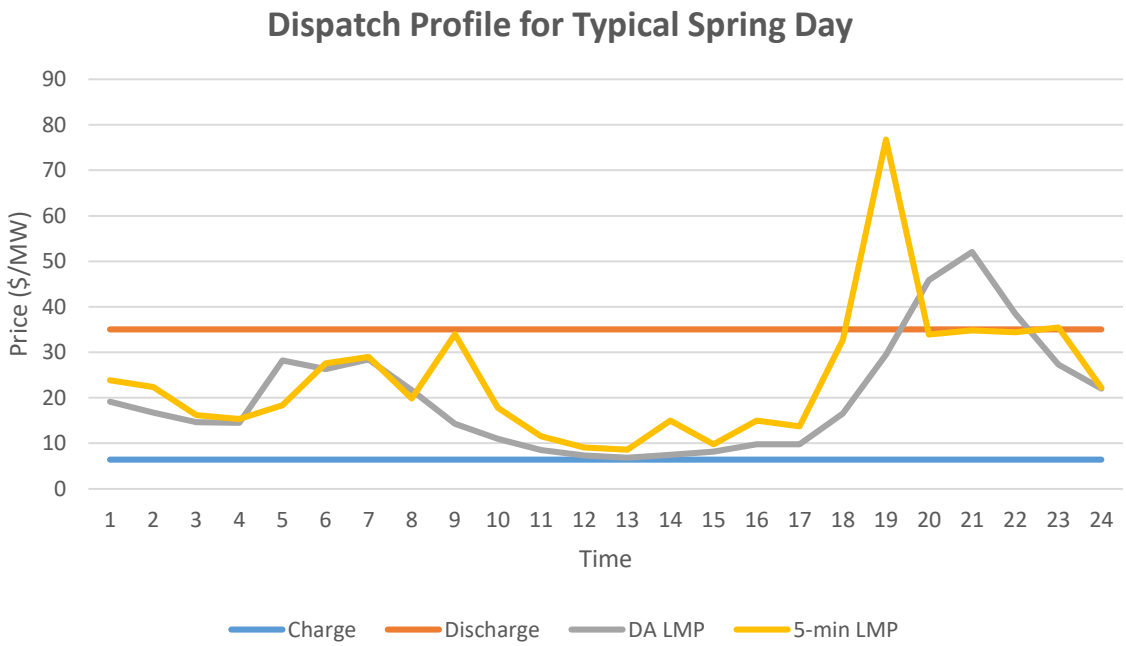
Example of A Typical Winter Day Dispatch

- Winter – if resource is charged, then discharge occurs HE19-21



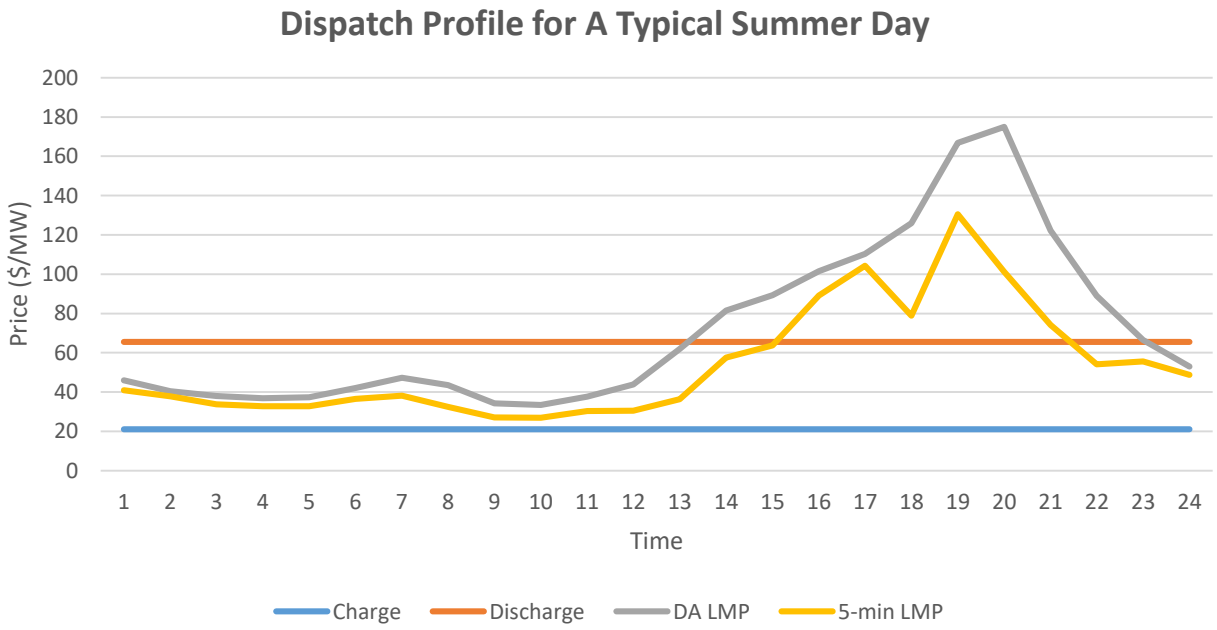
Example of A Typical Spring Day Dispatch

- Spring – discharge may be possible during HE-18-20 or is forgone for later discharge



Example of A Typical Summer Day Dispatch

- Summer – resource may charge between HE 1-12 and discharge between HE 18-21



Motivation for Market Participation

- Potential to recover variable cost of operations plus a reasonable contribution to fixed costs
- Willingness to make resource available when uneconomic requires
  - Reasonable compensation for costs incurred to operate
- Ability to offer the resource consistent with its physical characteristics and known performance
- If mitigated, the default energy bid truthfully reflects the operation costs for batteries of that vintage and technology type
- Consumption of energy supply when prices no longer reflect the variable operating cost of the least expensive dispatched resource

Tradeoffs for Resource Decisions

- Resource availability
  - Which products are to be supplied? When?
- Charging
  - When to charge?
  - How long to charge? Shallow; deep
  - Should uneconomic charging be considered?
- Discharging
  - When to discharge?
  - How long to discharge? Shallow; deep
  - Should the full discharge that is economic be provided? – depth of discharge and cycle considerations
- Are the decisions considered economic/physical withholding?

Summary

- Resource availability is not guaranteed when:
  - operation is unprofitable
  - the trade-off between calendar life and cycling life compromises end of life – premature retirement
  - the default energy is not cost reflective of the technology
  - the resource operator fails to account transparently for the resource's variable O&M costs