Battery Storage in California

EIA, Long-term outlook for battery storage in the US

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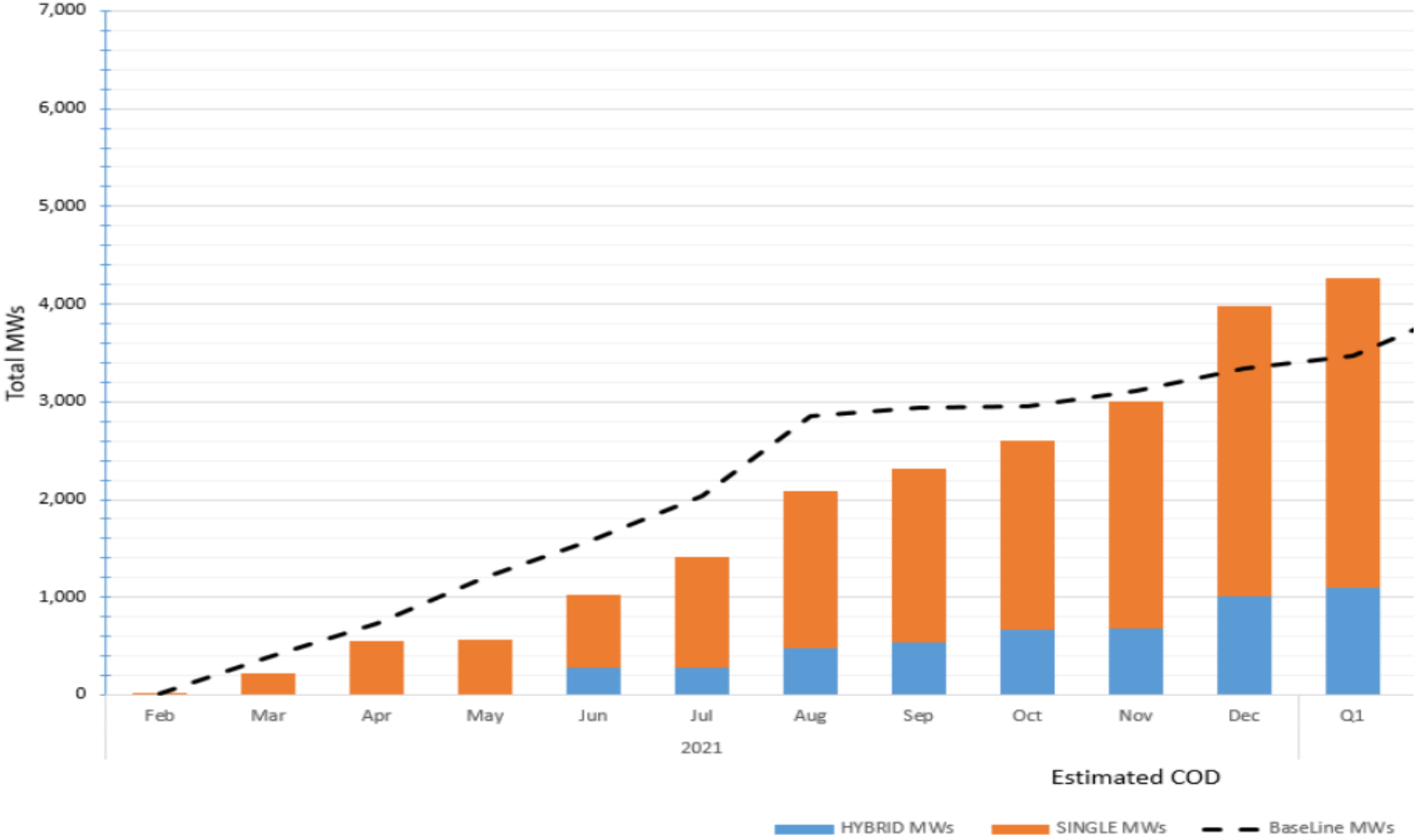
The California market is rapidly growing and many new storage resources are integrating

- CAISO peaks in the summer at just under 50,000 MW
- We had 500 MW of storage 1 year ago, today we have about 2,100 MW of utility scale storage installed
  - Most storage is 4 hour duration lithium-ion
  - Most are locating at existing or new solar facilities
- We expect significant additional storage in future years
  - 3,300 MW of required procurement by 2023 from CPUC mandate
  - 11,500 MW of procurement by 2026 from CPUC mandate
- Storage poses some challenges to grid operation
  - Storage resources must be charged to provide energy to the grid
  - Local storage may need to hold state of charge for reliable operation
  - Eventually will need storage for multi-day events

Storage in California is growing rapidly today and is expected to continue for many years into the future



The makeup of the grid will change significantly during the next 10 to 20 years

- California has a goal for 100% greenhouse gas neutral electricity generation by 2045
  - Modeling shows deep penetrations of renewables and storage
  - California will rely on significantly larger solar generation
- Most challenging times will shift to the winter months
  - Hours immediately prior to sunrise will be most challenging
  - Multi-day/week storage will be necessary to address multiple days of low solar and slack wind
- Long duration storage will be necessary to operate the future grid
  - Resources may need to be 100+ hour duration
  - Likely will not be today's lithium-ion technology
  - May require new market products and methods for compensation