# Resiliency modeling must capture the dynamics of California's decarbonized future

Conventional IRP practices understate weather variability and the role of emerging technologies

- **Weather variability is a key driver of resiliency challenges in high-renewable, electrified grids**

  - Hourly, seasonal, and year-to-year variability in weather must be captured in resource planning

  - Conventional resource planning methods (e.g. time sampling, single weather year) understate this variability

- **Emerging technologies, such as multi-day storage (MDS), are essential resiliency solutions for California**

  - MDS provides dispatchable energy reserves during grid stress events

  - Conventional models fail to capture the operational benefits of MDS, such as seasonal energy shifting

2045 CAISO portfolio dispatch during winter renewable lull (gas retirement scenario)
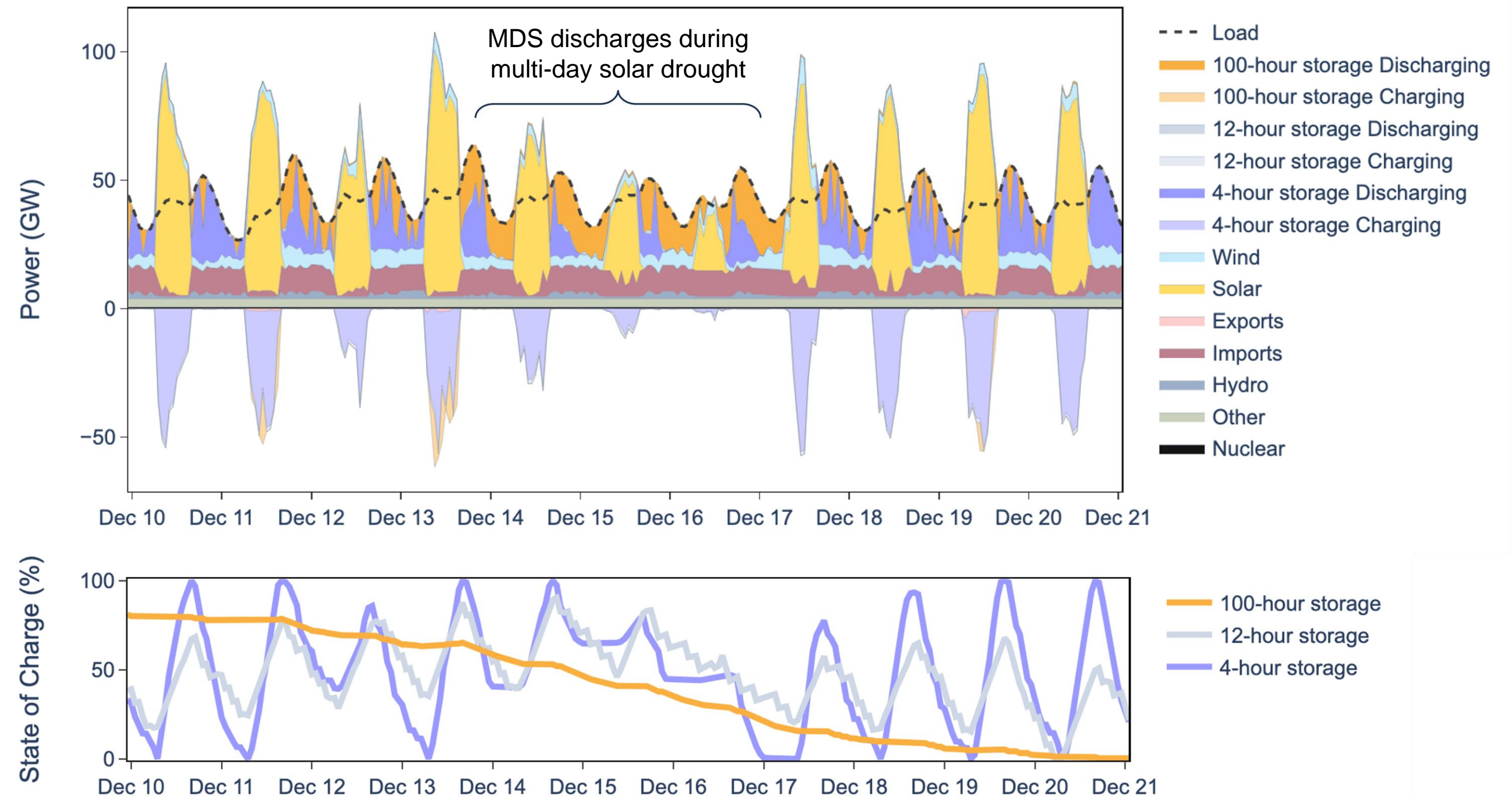
Source: CEC EPC-19-056, Assessing the Value of Long Duration Energy Storage

Best practices in resource planning can improve California's grid resiliency

1 **Implement an 8760 hour optimization horizon in capacity expansion modeling**

Captures variability in resource operations and demand across all hours of the year

2 **Model a wide range of weather years**

Ensures resource portfolio is robust against a diverse set of weather conditions

3 **Utilize weather-correlated load and renewable profiles (from the same weather year)**

Accounts for realistic net load events that drive the system's resiliency needs

Example: multi-weather year analysis for CAISO 2045 resource planning

MDS build allowed

Capacity (GW): 400, 300, 200, 100, 0

No MDS build

Capacity (GW): 400, 300, 200, 100, 0

Modeled weather year: 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, Co-optimized

Legend:
- Inter-year spread of resource requirements
- 100-hour storage
- 12-hour storage
- 6-hour storage
- 4-hour storage
- Offshore Wind
- Wind
- Solar
- Hydro
- Geothermal
- Biomass
- Nuclear

Source: CEC EPC-19-056, Assessing the Value of Long Duration Energy Storage