



**BREAKTHROUGH LOW-COST, MULTI-DAY ENERGY STORAGE**

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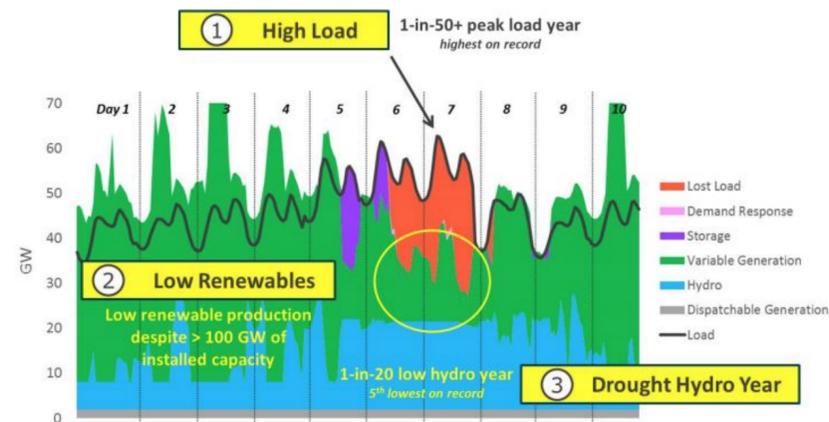
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# Multi-day reliability in deeply decarbonized grids is a serious concern

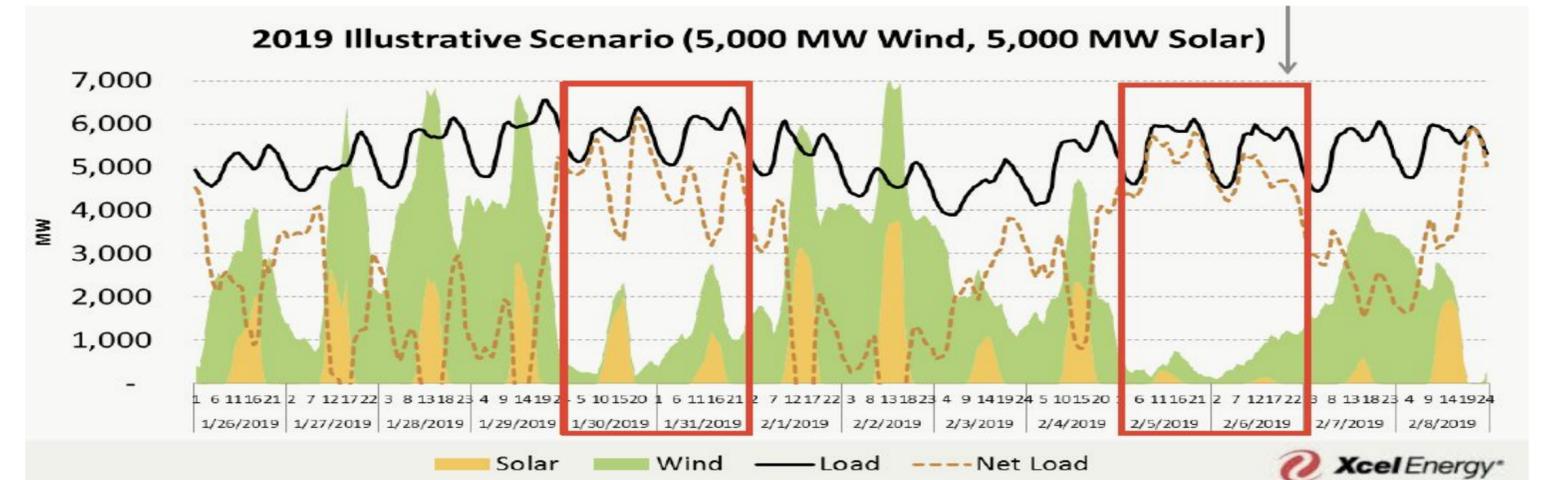
## Multi-Day Weather Event in Sample Week (PNW, 2050)

Figure 20: Loss-of-load Example in a Sample Week



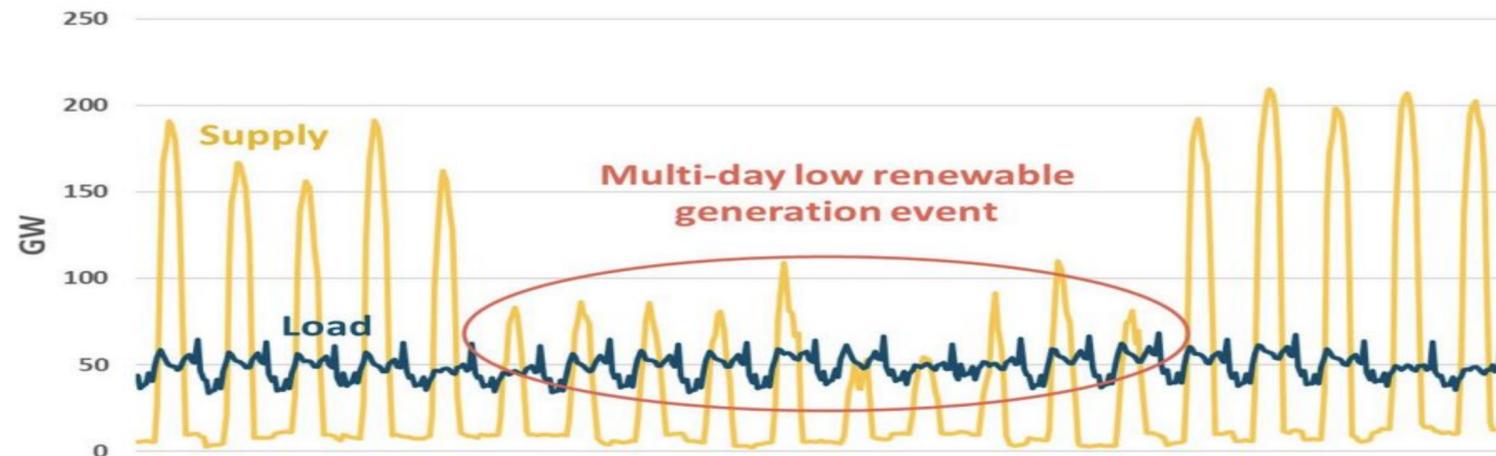
Source: E3, [Resource Adequacy in the Pacific Northwest](#)

## Multi-Day Weather Event in Winter (Upper Midwest, 2019)



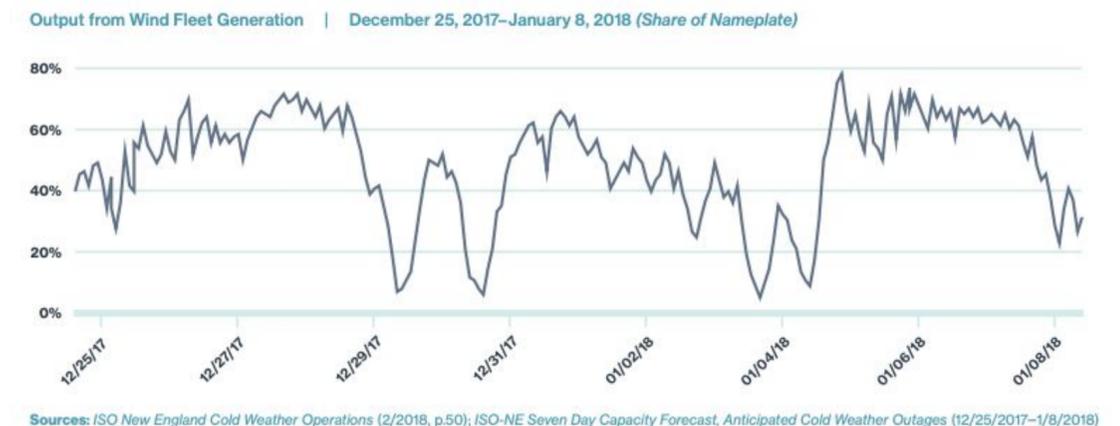
Source: [Xcel Energy](#) 2020-2034 Upper Midwest Resource Plan, May 20, 2019 Workshop

## Multi-Day Weather Event in Winter (California, 2050)



Source: E3: [Long-Run Resource Adequacy Under Deep Decarbonization](#)

## Extended Renewable Energy Gap (New England, 2017)



Source: [2020 New England Electricity Outlook](#)

# Influential studies and early procurements signal the need/desire for long-duration storage solutions

ENERGY STORAGE

## California Could Need 55GW of Long-Duration Storage to Meet Its 2045 Carbon-Free Grid Goal

A new study calculates a drastically higher need for long-duration storage than state officials had recognized.

JULIAN SPECTOR | DECEMBER 09, 2020



As solar comes to dominate California's electricity supply, long duration storage will become increasingly valuable, a new study contends.

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## The First Major Long-Duration Storage Procurement Has Arrived

California's community-choice aggregators are moving ahead of the traditional utilities.

JULIAN SPECTOR | OCTOBER 16, 2020



Pumped hydro will compete with newfangled technologies to supply 500 megawatts to California communities.

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# Multi-day storage: Value drivers

Color Coding

Long-term goals

Immediate needs

Value Driver	Ideal Situation	Examples
<b>Deep decarbonization goal</b>	State, utilities, large C&I have committed to binding, deep decarbonization goals by mid century or sooner; renewables (wind and PV) are the most cost effective resources	30 states (>50% of Americans) that have enacted or proposed 100% targets. RE100 C&I
<b>Long-term planning</b>	Entities adopt a long-term planning horizon. Multi-day reliability in high renewable futures is recognized as a critical concern	California, Pacific Northwest
<b>Forward-looking procurement</b>	Long-term needs are recognized in incremental procurement volumes starting in 2025	California
<b>Fossil fuel retirements (coal/gas) and reliability concerns</b>	Fossil fuel retirements driven by economic or regulatory pressure create a vacuum in terms of dispatchable resources and reliability	Midwest, Southwest, Pacific Northwest
<b>Extended weather events / system disruption</b>	Extended weather events (polar vortex, PSPS) cause multi-day price spikes and/or load shedding at the system or local level	Upper Midwest, Northeast, California
<b>Transmission/distribution constraints - Congestion</b>	T&D capacity expansion chronically lags behind renewables buildout, large amounts of renewables are at risk of curtailment	Wind belt US, United Kingdom
<b>Transmission/distribution constraints - Local reliability</b>	T&D constraints require local peakers to continue to operate to supply local load. Peakers are in EJ areas, there is a strong desire to retire, if possible	NYS long-run peakers
<b>High gas prices / pipeline constraints</b>	Gas pipeline constraints limit supply at times of high demand (cold weather), electricity prices spike for extended times and/or load shedding risk emerges	Pacific Northwest, Northeast