DOCKETED	
Docket Number:	20-MISC-01
Project Title:	2020 Miscellaneous Proceedings.
TN #:	238885
Document Title:	Katherine Rinaldi Comments - Research Brief - Wind and Solar Resource Droughts in California Highlight the Benefits of Long-Term Storage
Description:	N/A
Filer:	System
Organization:	Katherine Rinaldi
Submitter Role:	Public
Submission Date:	7/14/2021 7:16:05 PM
Docketed Date:	7/14/2021

Comment Received From: Katherine Rinaldi
Submitted On: 7/14/2021
Docket Number: 20-MISC-01

Research Brief - Wind and Solar Resource Droughts in California Highlight the Benefits of Long-Term Storage

Additional submitted attachment is included below.

Key points for decision making:

1) **California experiences multi-day calm and cloudy periods over the whole state each year that will substantially limit renewable electricity generation at those times.** Over a period of 39-years, California experienced rare but severe weather-related resource droughts, with the longest solar drought lasting six days and the longest wind drought lasting ten days.

2) **To make 100% renewable, reliable electricity in California more affordable, include long-duration energy storage and/or increase use of wind and solar generation from the Western Interconnect.** Long-duration energy storage cost-effectively fills the gaps between supply and demand during periods of resource drought. Aggregating resources over larger areas reduces the frequency and duration of resource drought events.

Ameliorate issues of wind and solar variability and availability with long-duration storage or greater grid integration

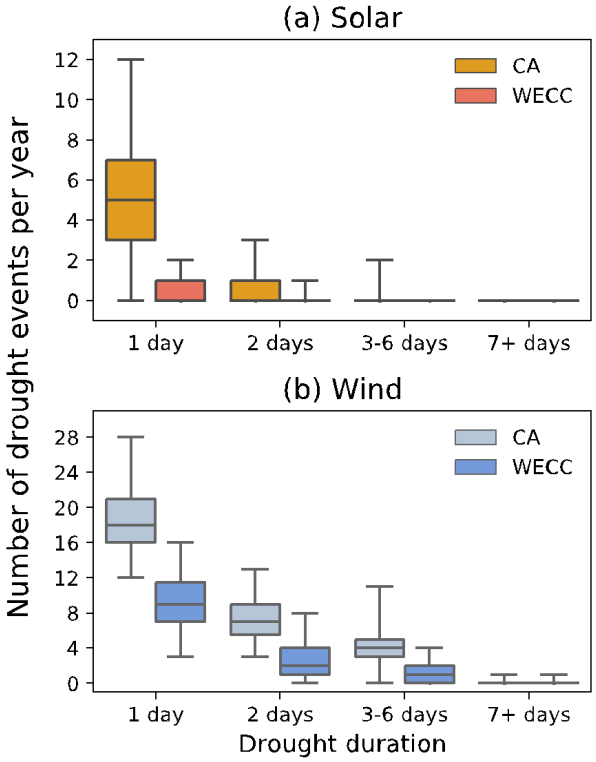
California Senate Bill 100 (SB100) mandates that 100% of retail in-state electricity sales must derive from eligible renewable or zero carbon resources by 2045. As the reliance on renewable resources such as wind and solar power increases, so does the importance of understanding how variability in these resources affects the feasible, cost-effective ways of supplying electricity services to this region. Multi-decadal datasets reveal the potential for weather-related lapses in generation from wind and solar resources and provide an understanding that can be used to inform stakeholders in future electricity systems.

Historically, California experiences rare but prolonged periods of resource drought in which the potential electricity generated from wind and/or solar is far lower than expected. Single day resource droughts occur relatively frequently with a median value of 5 and 18 single-day solar and wind droughts per year, respectively, over the 39-year period. Within the multi-decadal dataset the longest drought periods for California lasted for 6 consecutive days for solar and 10 consecutive days for wind. Aggregating resources over the larger region of the Western Interconnect reduces the frequency and duration of these resource droughts but does not eliminate them.

Long-duration energy storage can compensate for these periods of prolonged resource drought. In an idealized wind-solar-battery electricity system at current asset costs, meeting California electricity demand with generation resources from the entire Western Interconnect reduces costs by 9% compared to constraining resources entirely to California. Adding long-duration storage to systems that use California generation resources to meet California demand lowers costs by 21%.

Summary

Wind and solar are renewable sources of clean energy, but also experience issues of variability and availability. Reliable systems based on variable renewables can not plan for the average behavior but must accommodate the weather extremes of nature. Rare but severe periods of resource droughts when the sun does not shine and the wind does not blow over the entire state of California for multiple consecutive days must be planned for to insure reliability. Aggregating resources over larger geographical regions, such as the Western Interconnect, reduces the frequency and duration of these resource droughts and can reduce costs in 100% reliable, renewable electricity systems. Adding long-duration energy storage also reduces costs and makes it more cost-effective for California to meet its own electricity needs without heavily relying on out-of-state infrastructure.



Frequency and duration of solar and wind resource droughts in California and the Western Interconnect. Resource droughts were defined as days when the daily power from each resource was less than half of the 39-year daily mean for that day of the year. Both California and the Western Interconnect (WECC) experience low-power periods in both the wind and solar resource. These drought periods occur more frequently and last longer in California than in the Western Interconnect.