

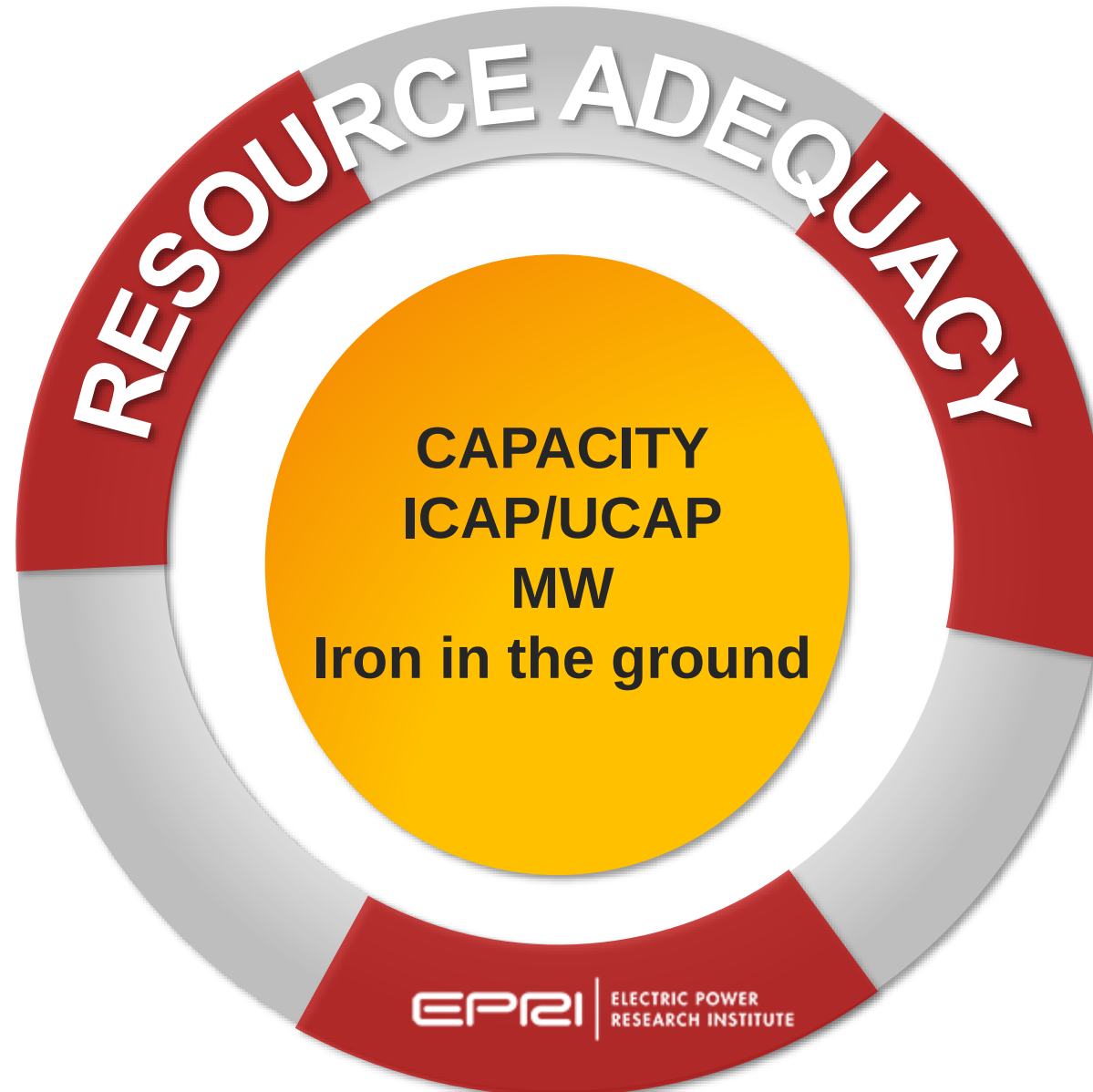
Resource Adequacy and Rolling Blackouts

RA Evolution and R&D

Erik Ela, Eamonn Lannoye, Aidan Tuohy, Daniel Brooks
ESIG Spring Webcasts
April 2021

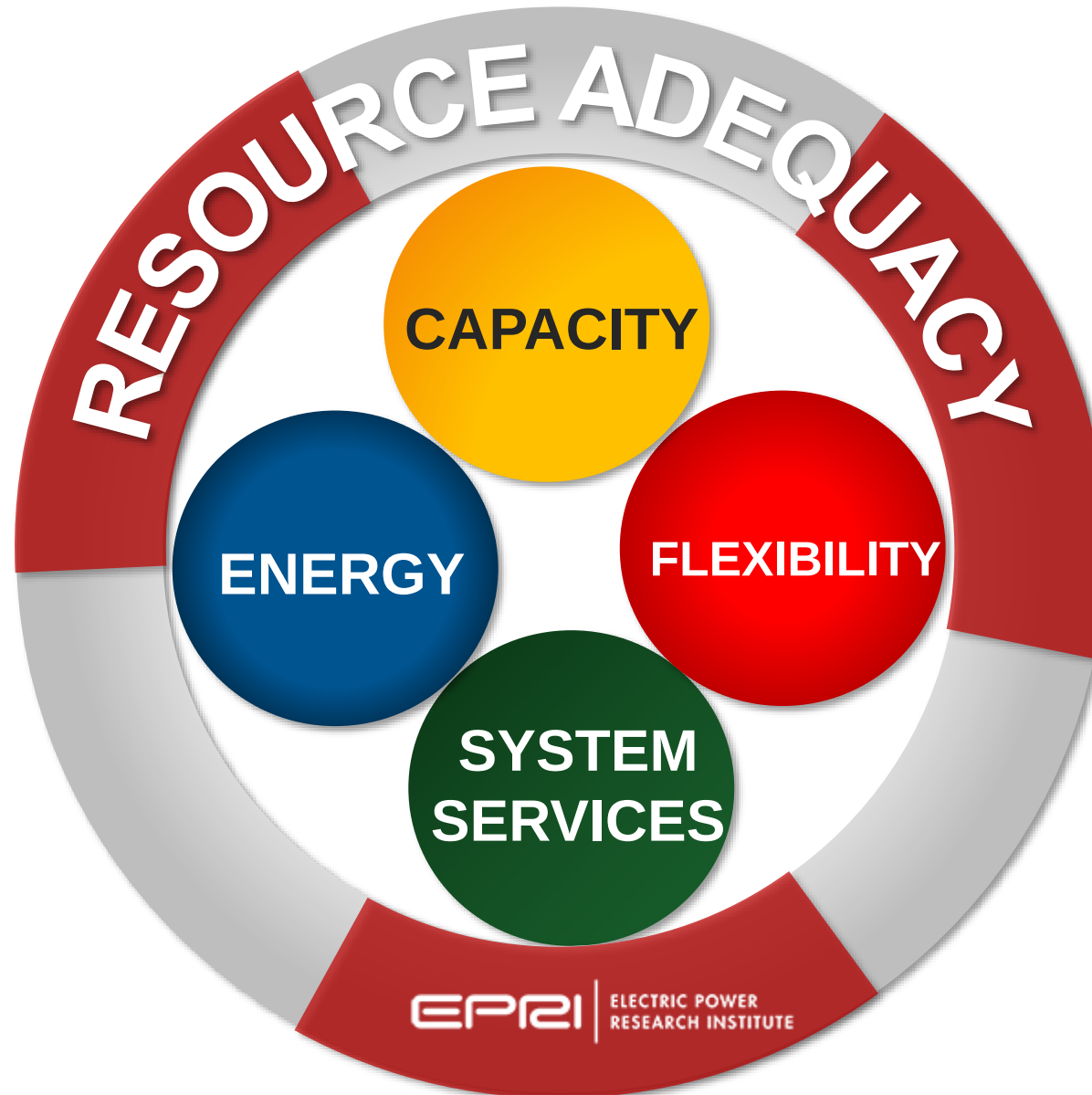


What does it mean to have adequate resources?

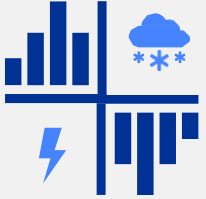


What does it mean to have adequate resources?

An adequate supply fleet is not just the installed MW in the ground. The capacity must have energy to sustain during critical time periods, flexibility to accommodate condition changes, and sufficient reliability services to provide when necessary



Feb. 2021 Polar Vortex: RA Improvements Indicated



Historic Winter Peak Demand

- 10 GW (13%) > prior winter peak
- 10% > extreme winter plan level



Unprecedented Supply Outages

- ≈50% of supply capacity unavailable
- Equipment and fuel supply limits
- Common-mode failures across systems



Load Shed to Prevent Blackout

- ERCOT shed an estimated 800 GWh (27 GW peak)
- SPP, MISO, and Cenace also shed load

- Scenario planning includes future trends (climate, etc.)
- Metrics reflect magnitude and duration of events
- Design criteria reflect future system consequences
- Resource performance in future context considered
- Impacts of common mode and interdependent impacts considered

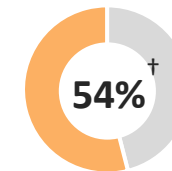
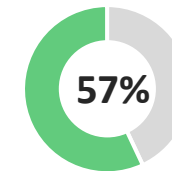
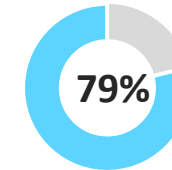
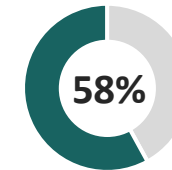
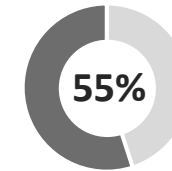
RA assessment methods and tools must evolve to ensure resiliency.

2021 Winter SARA

Seasonal Assessment of Resource Adequacy* (SARA) vs. Actual Generation

Performance vs. SARA

ERCOT Electricity Generation vs. Seasonal Expected Availability Feb. 15-18



* ERCOT's Seasonal Assessment of Resource Adequacy (SARA) attributes an expected available capacity to each generation type, considering seasonal factors.

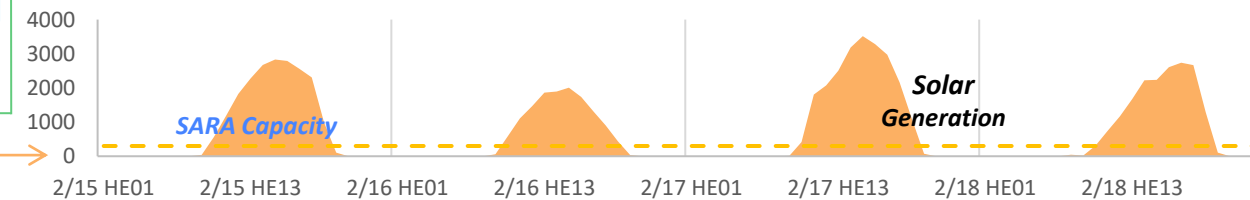
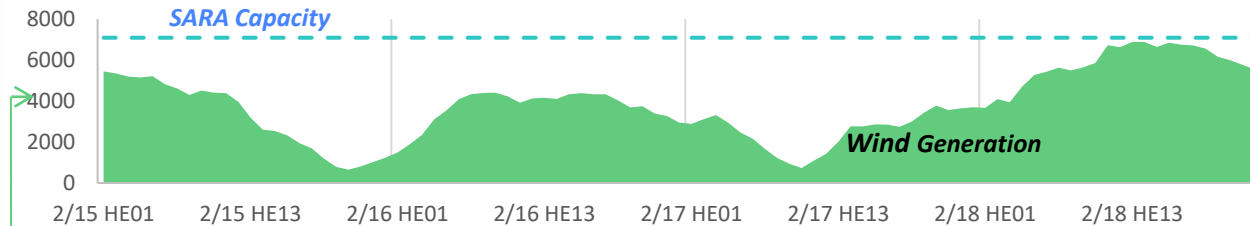
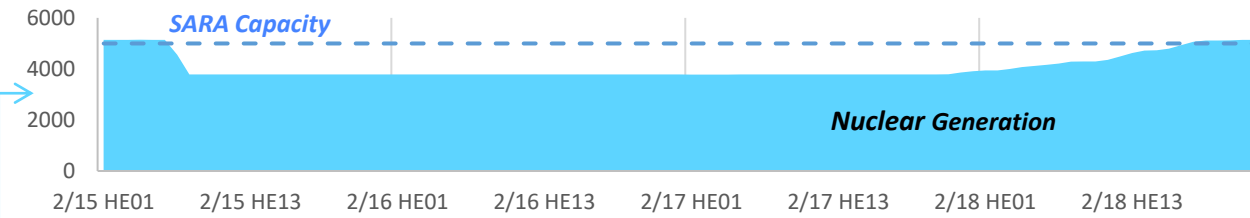
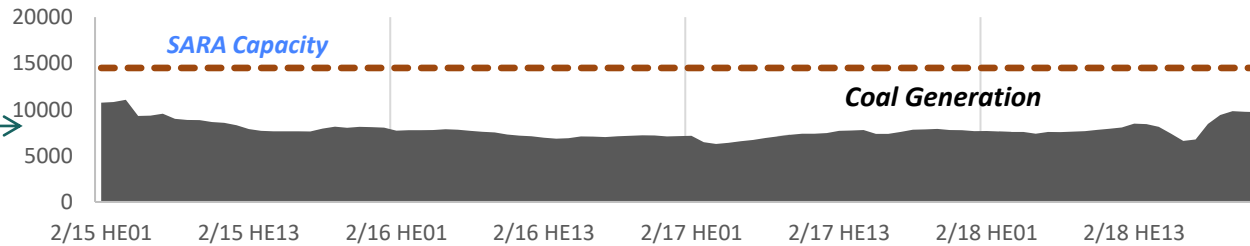
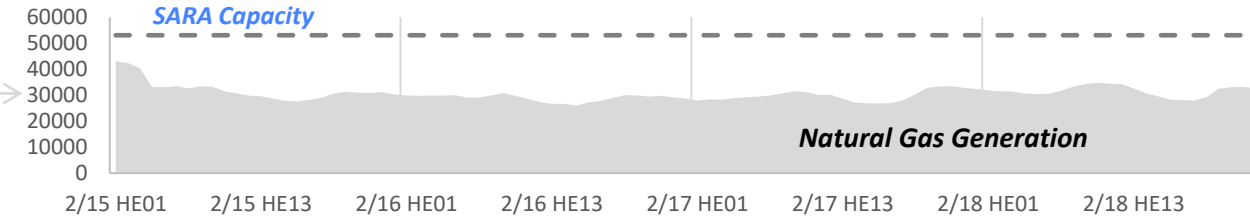
Data Sources:
[Winter '21 SARA](#)
[Daily Balancing Authority Report](#)

[†]During peak demand (18-23h)
Over all hours: 259%

Natural Gas



55,663 MW (66%)



Coal



13,630 MW (16%)

Nuclear



5,153 MW (6%)

Wind



7,100 MW (8%)

Solar



300 MW (0%)

Projecting event probabilities

- Climate change is resulting in more frequent extreme weather events
- Historical probabilities do not capture these extremes, making forecasting or projecting future disruptive events difficult

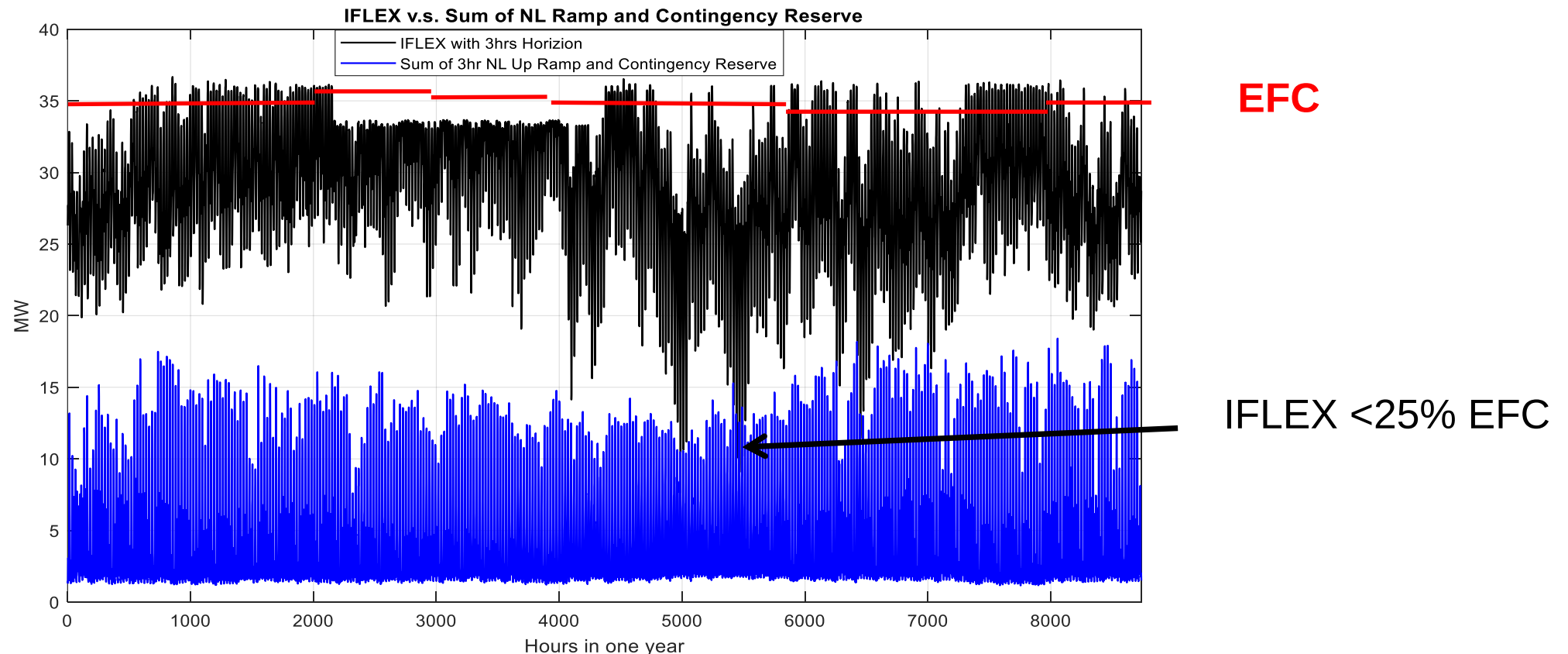
Type of Extreme Weather	Frequency	Intensity	Geographic Extent
Extreme Heat Events	↑	↑	↑
Drought	↑	↑	↑
Wildfires	↑	↑	↑
Extreme Precipitation/ Flooding	↑	↑	↑
Hurricanes/ Tropical Storms	↔	↑	↑
Cold Events	↑	↓	
Heavy Snow Events	↔	↔	
Severe Weather (e.g., tornados, hail)	↔	↔	

Exploring the Impacts of Extreme Events, Natural Gas Fuel and Other Contingencies on Resource Adequacy, 2020 (Product ID 3002019300)

<https://www.epri.com/research/products/000000003002019300>

The historical probabilities of weather events need to be adjusted to take climate trends into account

Operations may affect resource adequacy



Flexibility Assessment for the California ISO, EPRI, Palo Alto: 3002013725, 2019. <https://www.epri.com/research/products/000000003002013725>

The amount of “feasible installed flexibility” can be far less than the apparent installed flexibility.

Market design and clearing software

- Market clearing software “tests” for extreme conditions
- Would capacity market have made a difference? A “winterization product”?
- Who decides RA contribution (counting) for different resources and technologies?
- What should consumers pay during excessive outages?

ERCOT Software:

- AS prices of \$27,000/MW-h
- LMP of \$1,000/MWh when massive load shed present
- ORDC Adder

After reviewing the performance of the day-ahead market for August 14, the CAISO determined that a market enhancement that was made to the RUC process in prior years was masking the effects of load under-scheduling and convergence bidding. This enhancement provides necessary functionality for other market processes, but in the RUC process it erroneously signaled that more exports were physically supportable than actually were.

A blue-tinted photograph of four people, two men and two women, standing in a row. They are all wearing white lab coats with the EPRI logo on the left chest. The woman on the far right is also wearing a white hard hat. They are all smiling and looking towards the camera. The background is a solid blue color.

Together...Shaping the Future of Electricity