



Modeling Extreme Events in the Western Interconnection

June 13, 2024

Jon Jensen

WECC

Engineer, Reliability Modeling

Extreme Weather Events at WECC

- WECC 2023 Study Program:
 - [Year 10 Extreme Cold Event \(Year 2032\)](#)—Production Cost Model
 - [Year 20 Extreme Cold Event \(Year 2042\)](#)—Production Cost Model
 - [Year 20 Extreme Heat Event \(Year 2042\)](#)—Production Cost Model
 - [Year 20 Foundational Case](#)—Production Cost Model
 - Reference case for the Year 20 studies

Year 20 Extreme Cold Event

Scoping and Approach

- Identify vulnerabilities during an extreme cold weather event
 - Develop a Year 20 dataset
 - Define an extreme weather scenario
 - Translate extreme weather into a power system model

Year 20 Foundational Case

- Study Year 20 (2042)
- Started with 2032 Anchor Data Set Production Cost Model (2032 ADS)
- Used a linear annual load growth rate
- Added generation to achieve similar capacity margins as 2032 ADS
 - Benchmarked to NREL 2022 Standard Scenarios, EIA Annual Energy Outlook (2032), and the WECC Long-duration Energy Storage Assessment (2040)

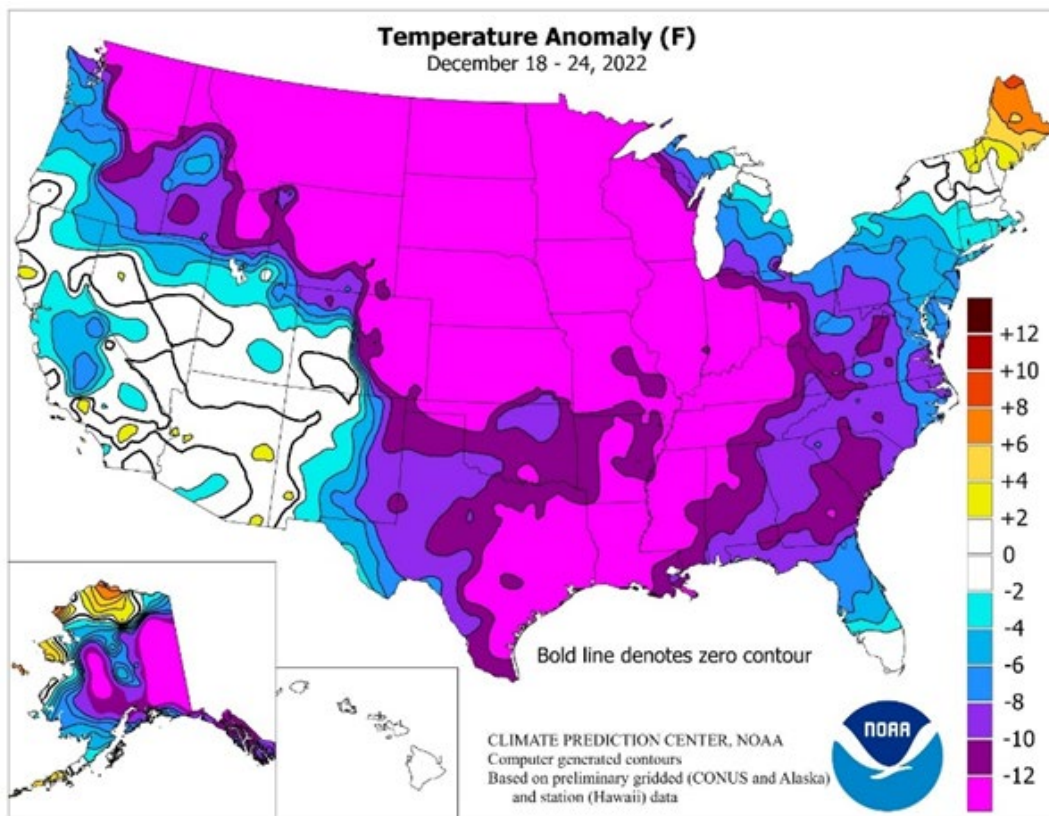
Weather Assumptions

- What does “realistic” extreme cold weather look like to the system?
 - Increased load (represent even colder/hotter temperatures)
 - Decrease generation output (wind, solar, gas)
 - Increased Forced Outage Rates

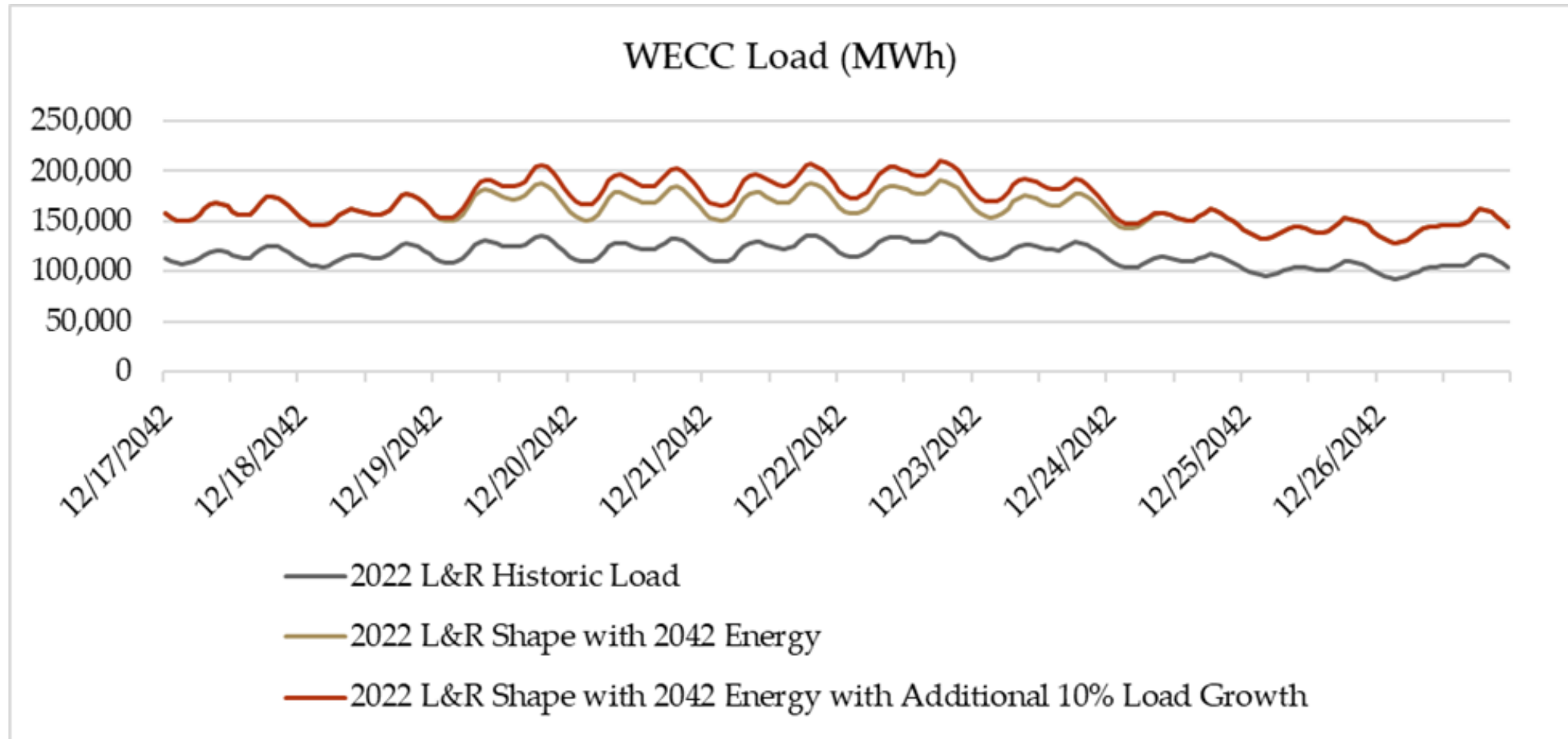
Goal—Y20EC

- Mimic Winter Storm Elliot for year 2042 (Dec 21–26, 2022)
 - Make more extreme until signs of unserved load

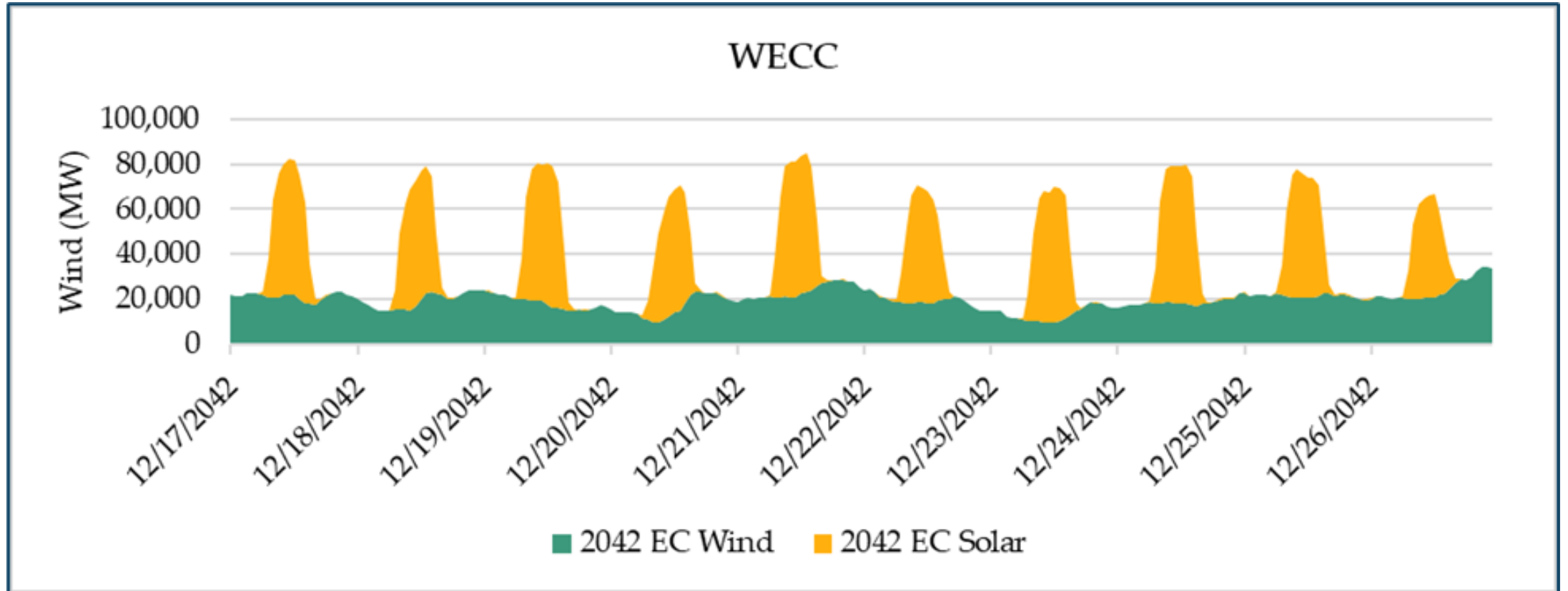
City	Temperature
Butte, Montana	-38° F
Casper, Wyoming	-42° F
Denver, Colorado	-18° F
Edmonton, Alberta	-40° F
Pullman, Washington	-20° F



Western Interconnection Loads



Wind and Solar



Forced Outage Rate

- Forced Outage Rate—doubled
- The highest forced outage rate in Texas during Winter Storm Uri in 2021 was three times greater than normal
- More winterizing in the Western Interconnection

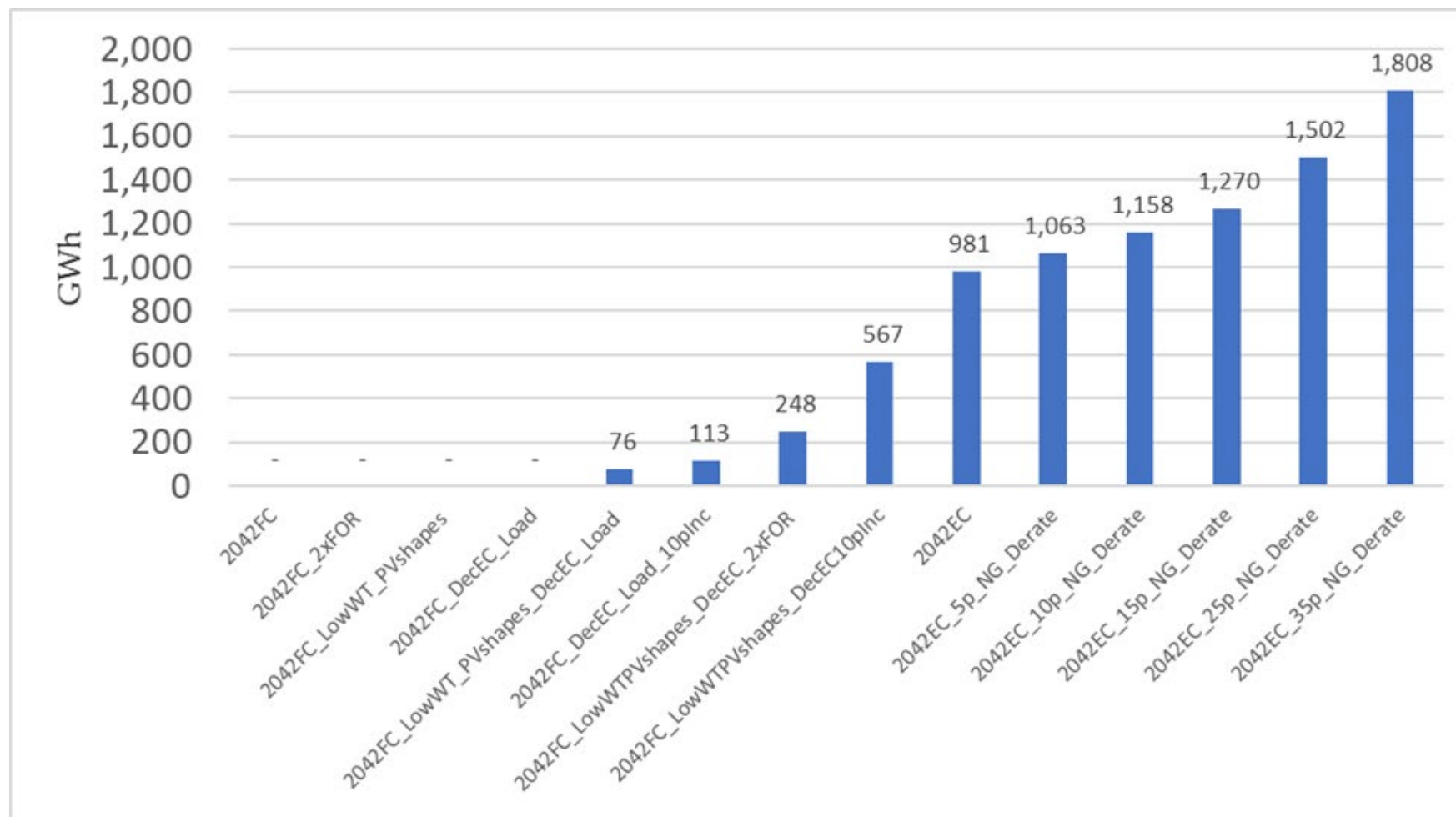
Natural Gas Generation Derate

- Derates start on Dec 19, hour 5, and end on Dec 23, hour 10
- Northern California is generally warmer than the northwestern WI; however, it uses the same natural gas pipelines and infrastructure; so, it may be affected but to a lesser degree

NG Derate Level Case	Canada, Northwest, Rocky Mountain, and Basin Regions	Northern California Region
15% Derate Case	15% Derate	7.5% Derate
25% Derate Case	25% Derate	10% Derate
35% Derate Case	35% Derate	17.5% Derate

Year 20 Extreme Cold Event Results

Unserved Load



Overview

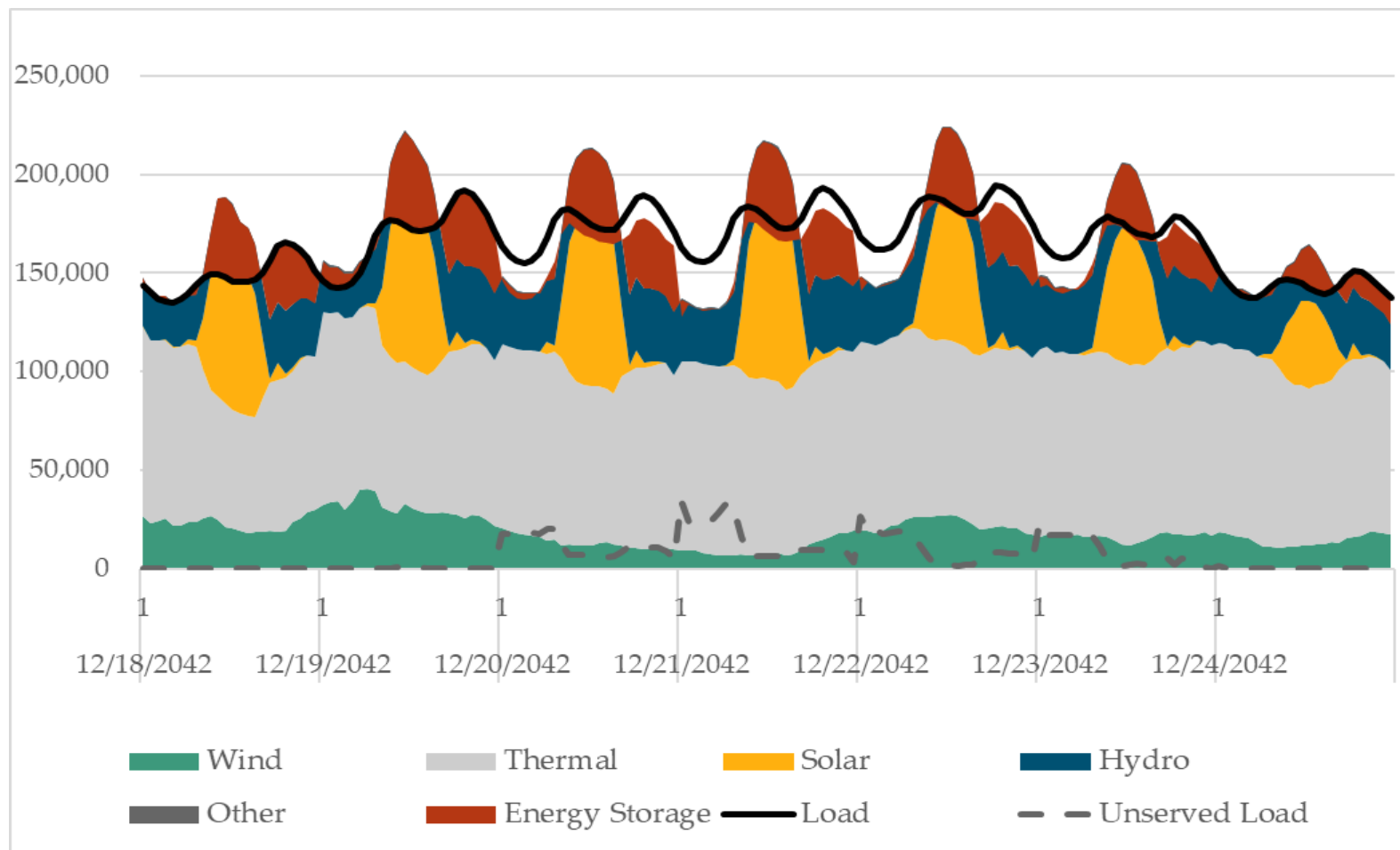
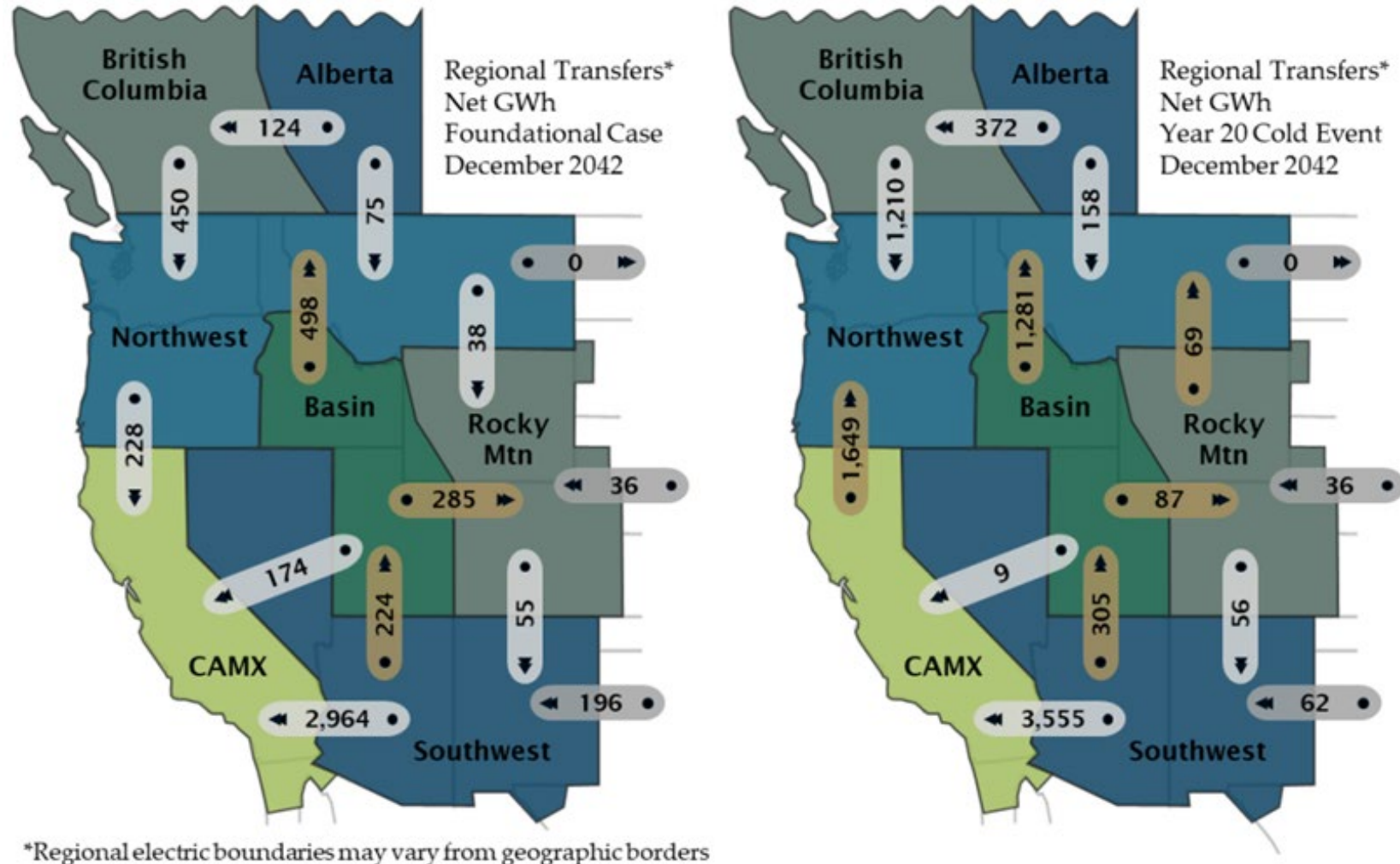
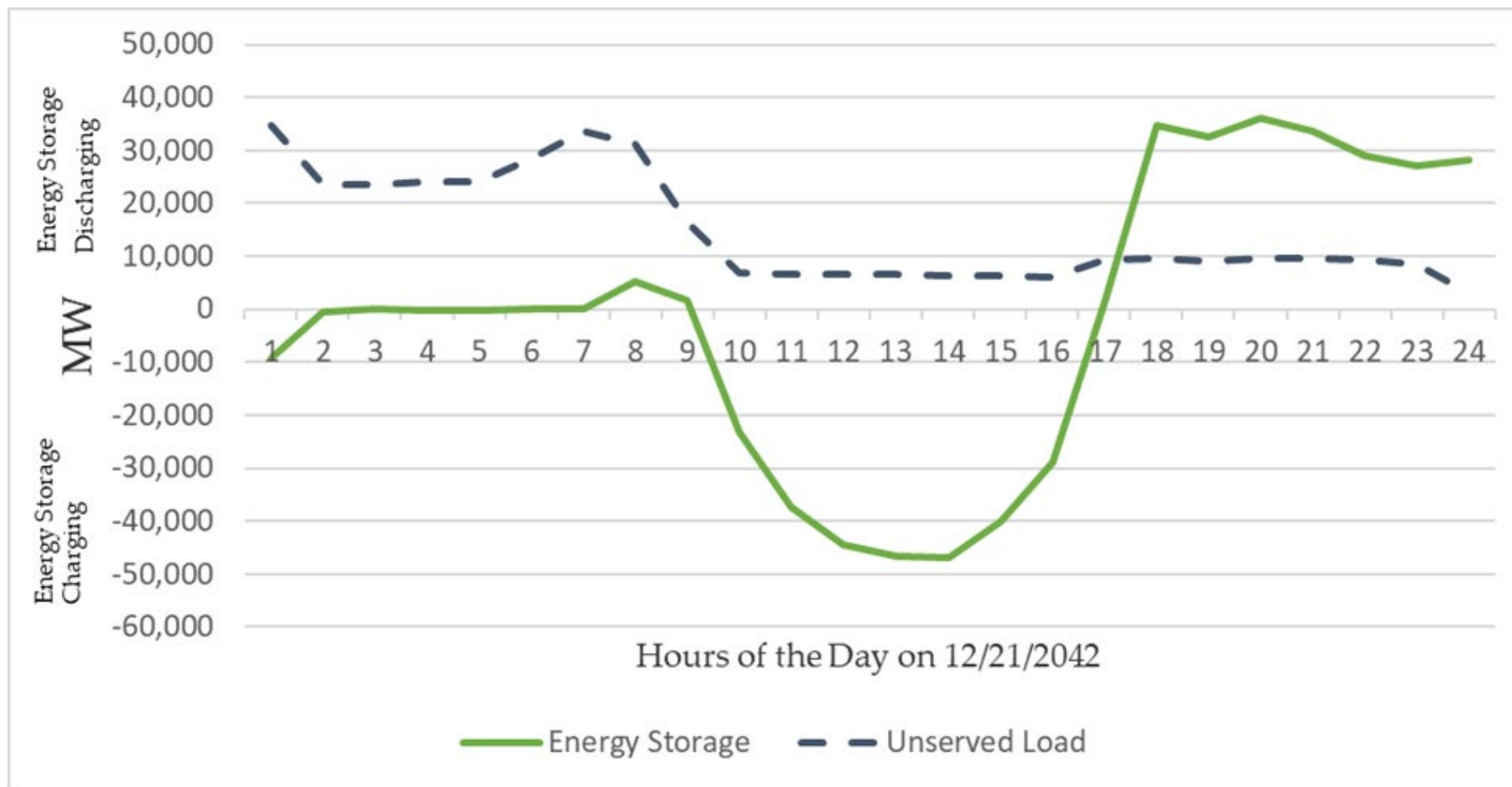


Figure 1: 2042EC_15% NG Derate Case Western Interconnection Subtype Hourly (MW)

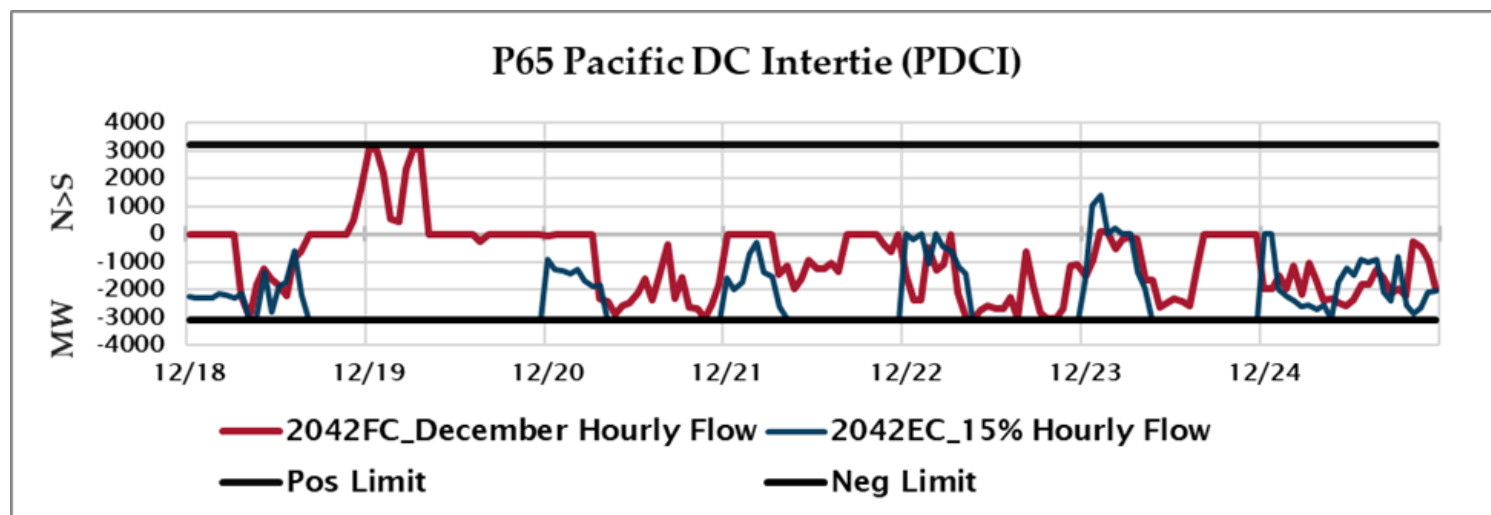
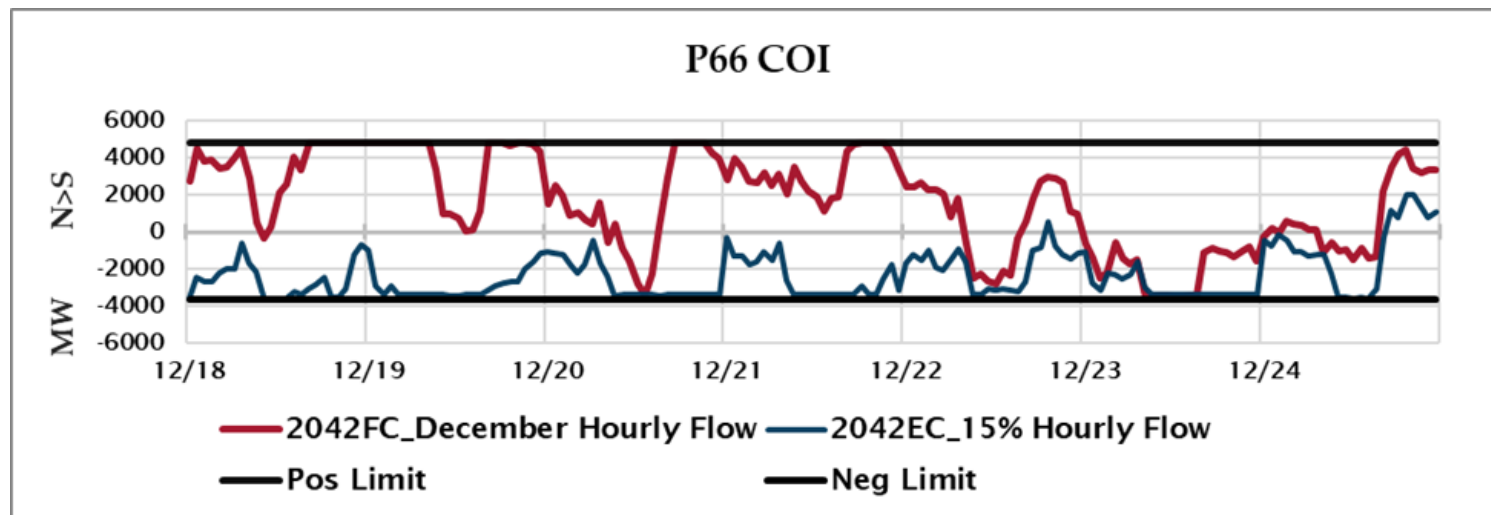
Net Regional Transfers FC vs. 15% NG Derate



Y20EC



Y20 Transmission



Contributors

- Year 10/20 Extreme Cold Weather Event Advisory Groups
- E3
- Others

Other Weather Involvement at WECC

- Probabilistic Planning for Tail Risk:
 - [Performance Analysis Work Group \(PAWG\) white paper](#)
- Situational Awareness/Operations Analysis:
 - [Wildfire dashboard](#)
 - Wildfire Season Outlook report
 - Winter Storm Uri/Elliot investigation
 - Winter Storm Gerri/Heather inquiry

