WECC

Modeling Extreme Events in the Western Interconnection

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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)

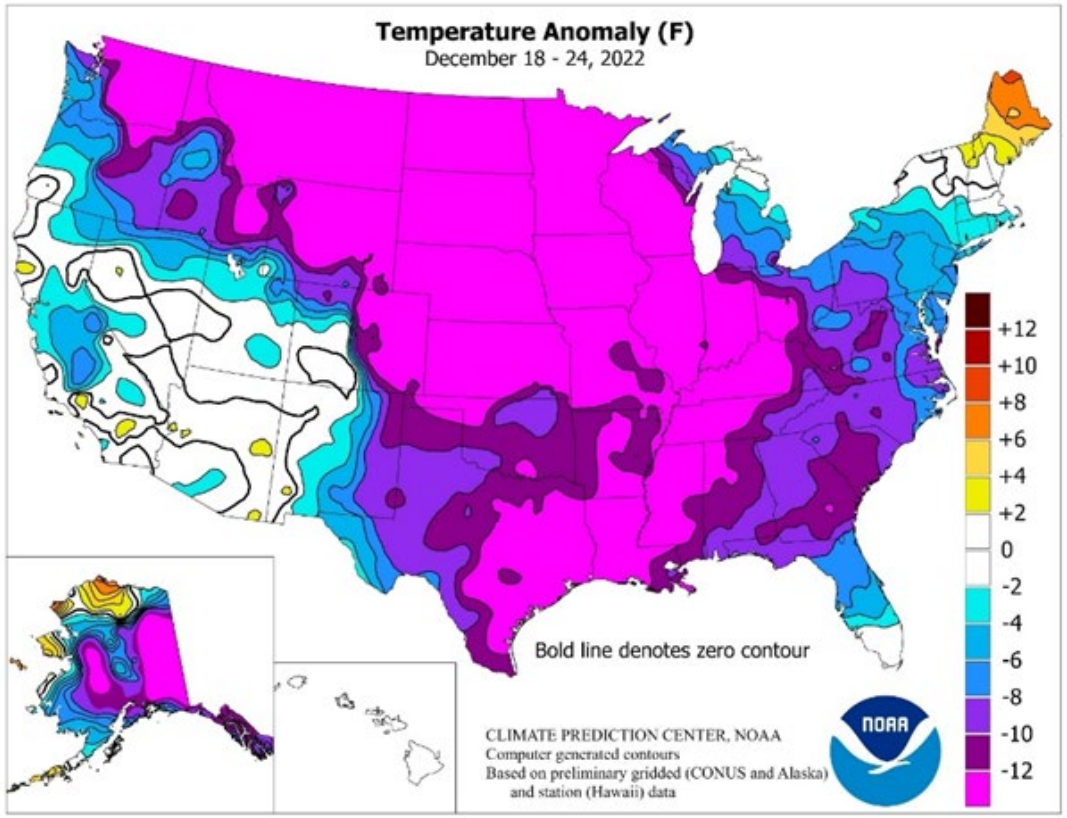
Weather Assumptions

- 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

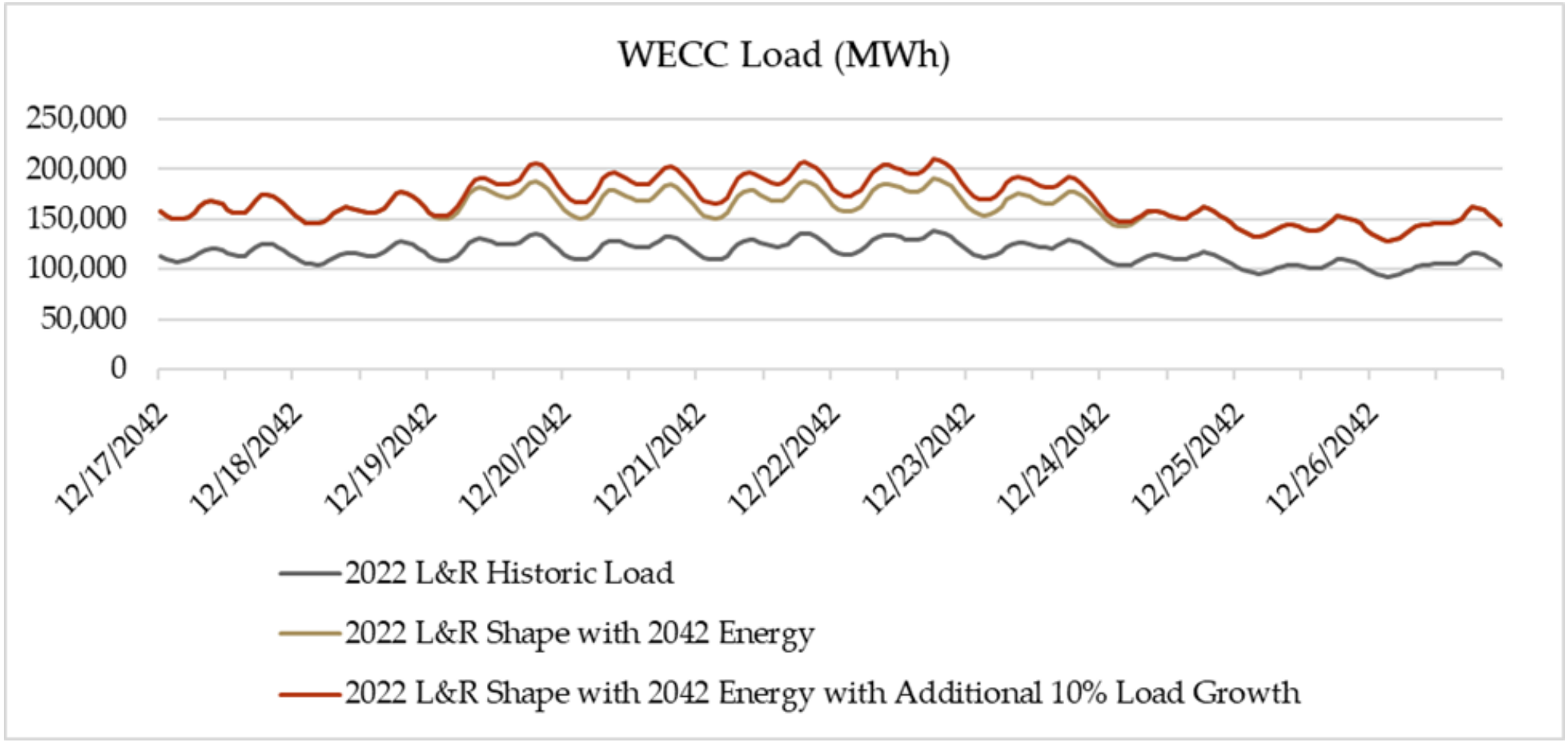
Goal—Y20EC

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

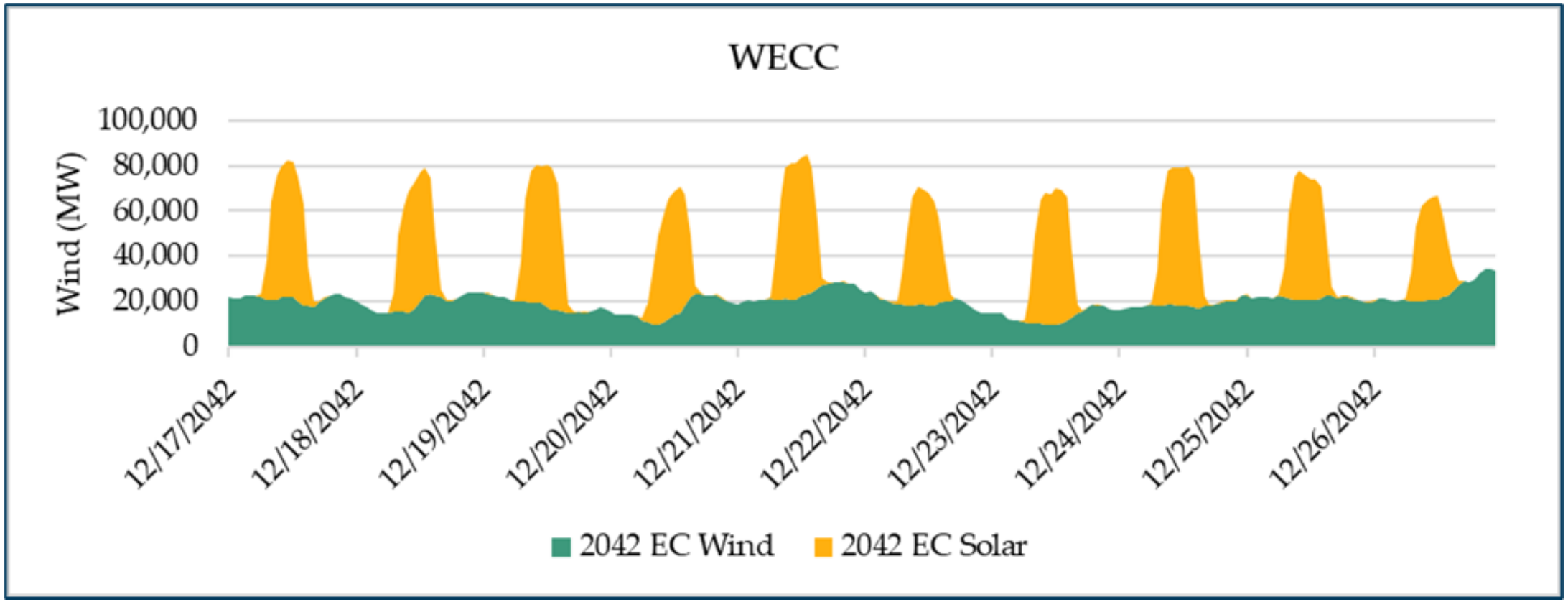
City	Temperature
Butte, Montana	-38° F
Casper, Wyoming	-42° F
Denver, Colorado	-18° F
Edmonton, Alberta	-40° F
Pullman, Washington	-20° F



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

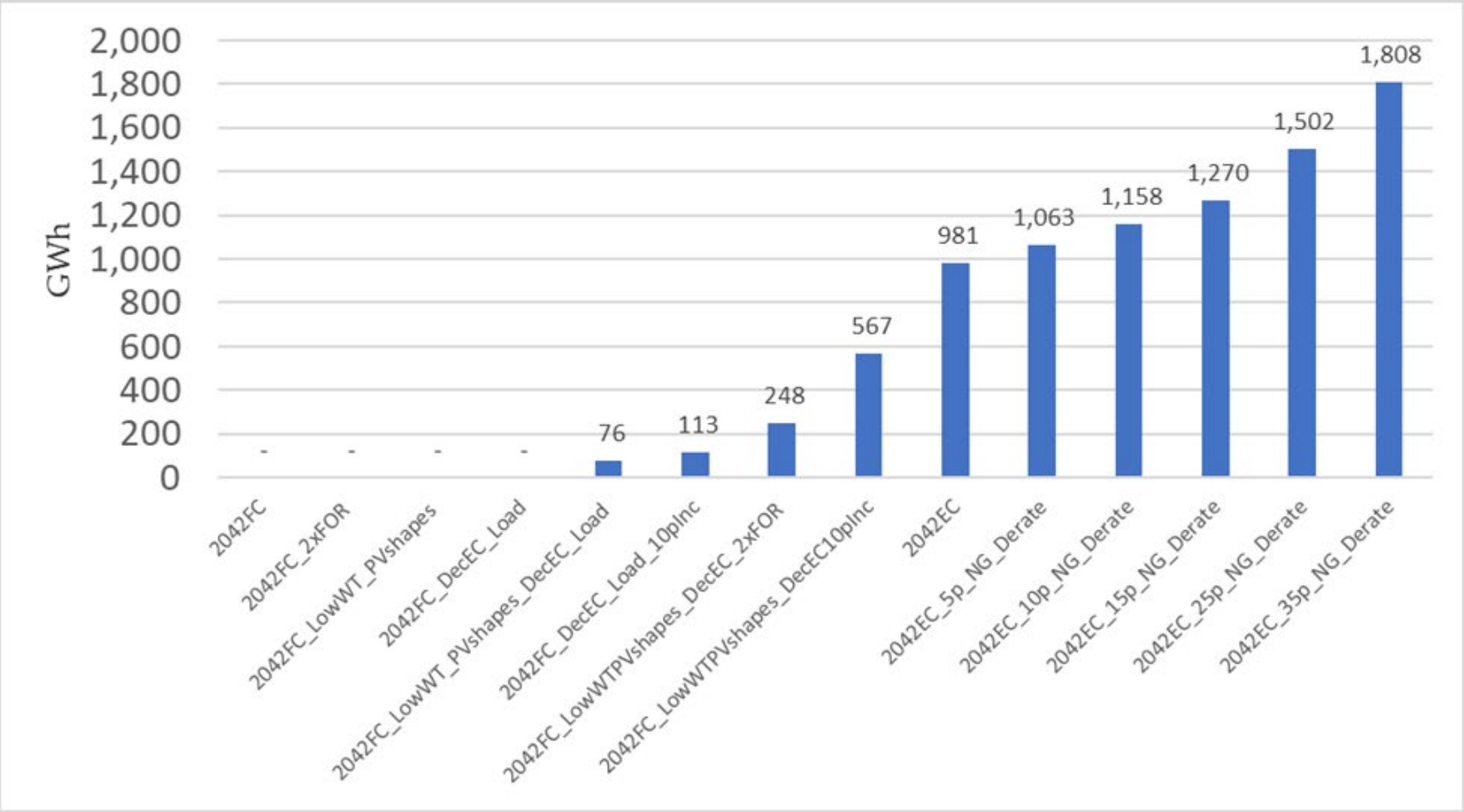
Natural Gas Generation Derate

- 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

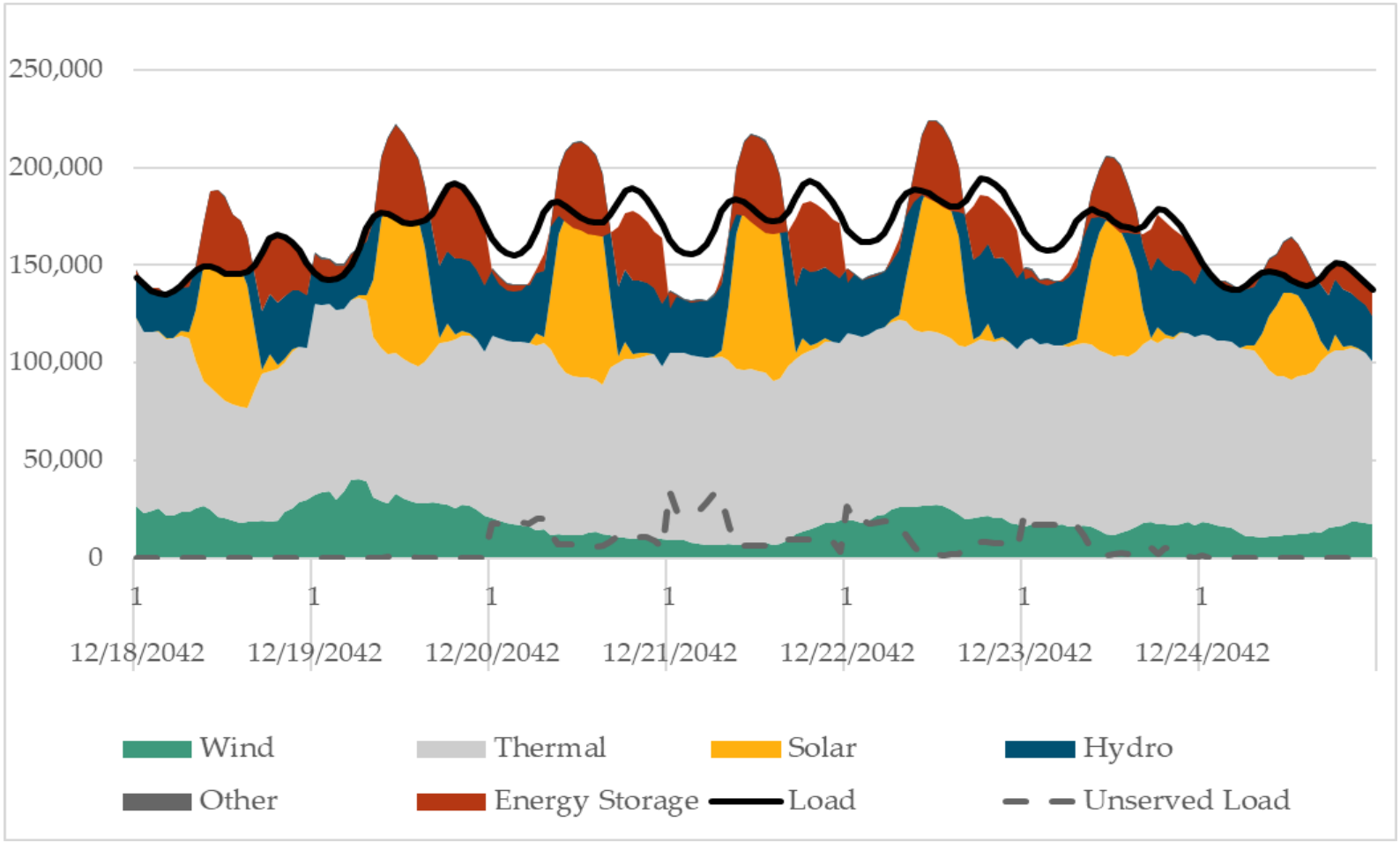
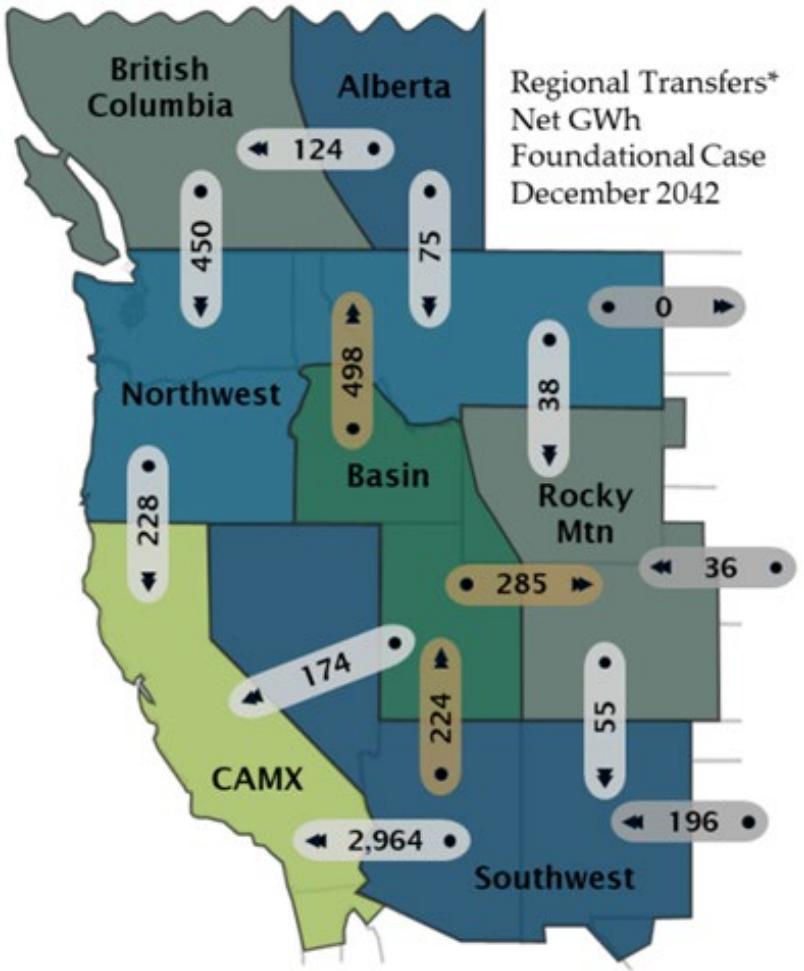
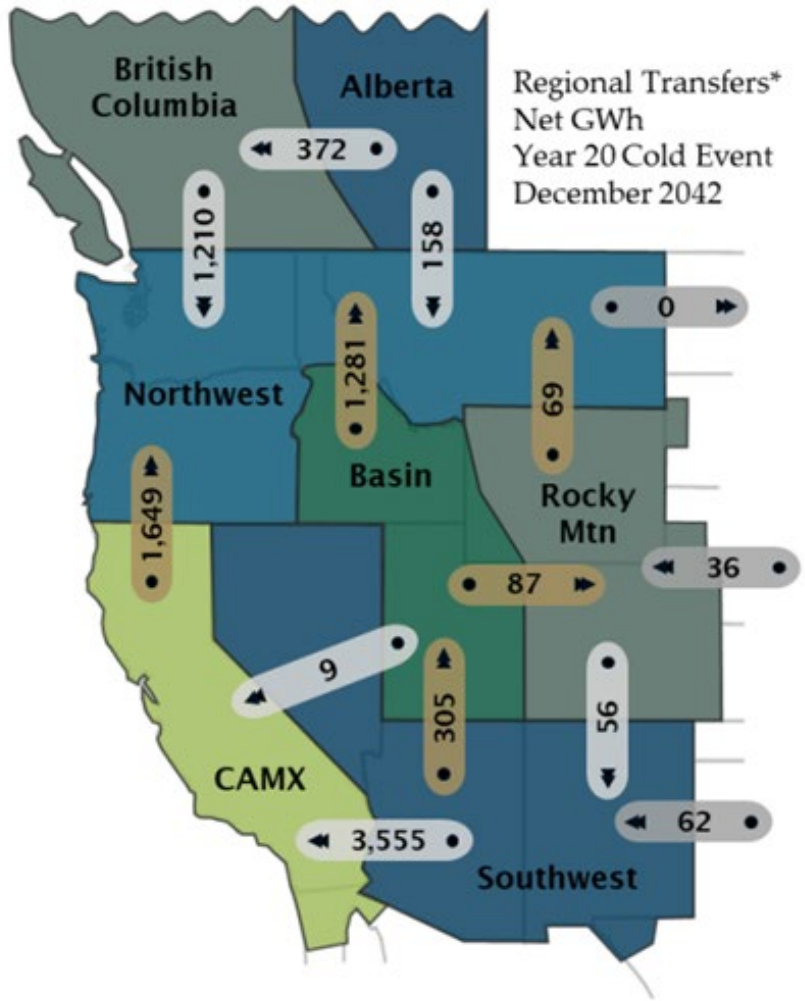


Figure 1: 2042EC_15% NG Derate Case Western Interconnection Subtype Hourly (MW)

Net Regional Transfers FC vs. 15% NG Derate





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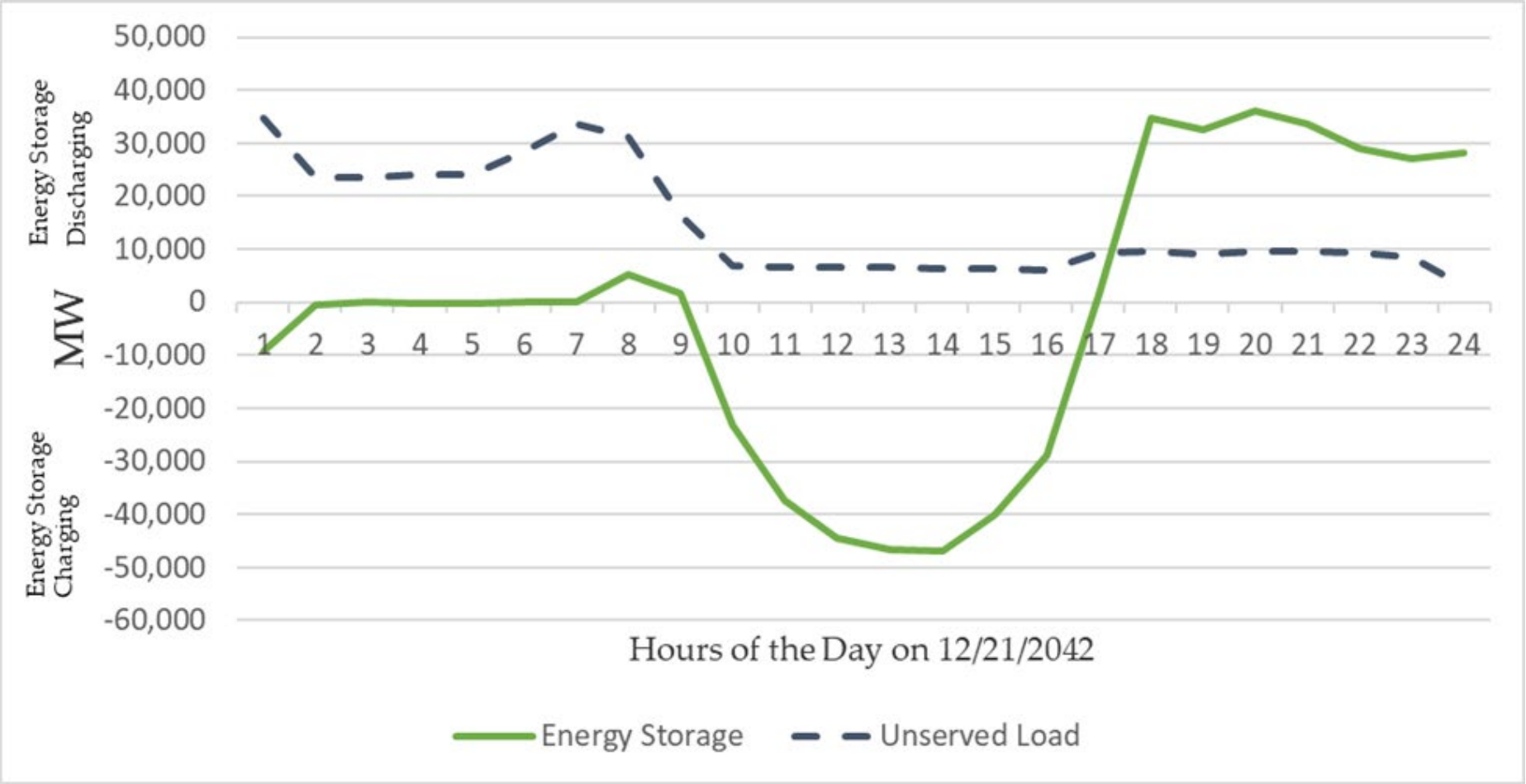
Y20EC



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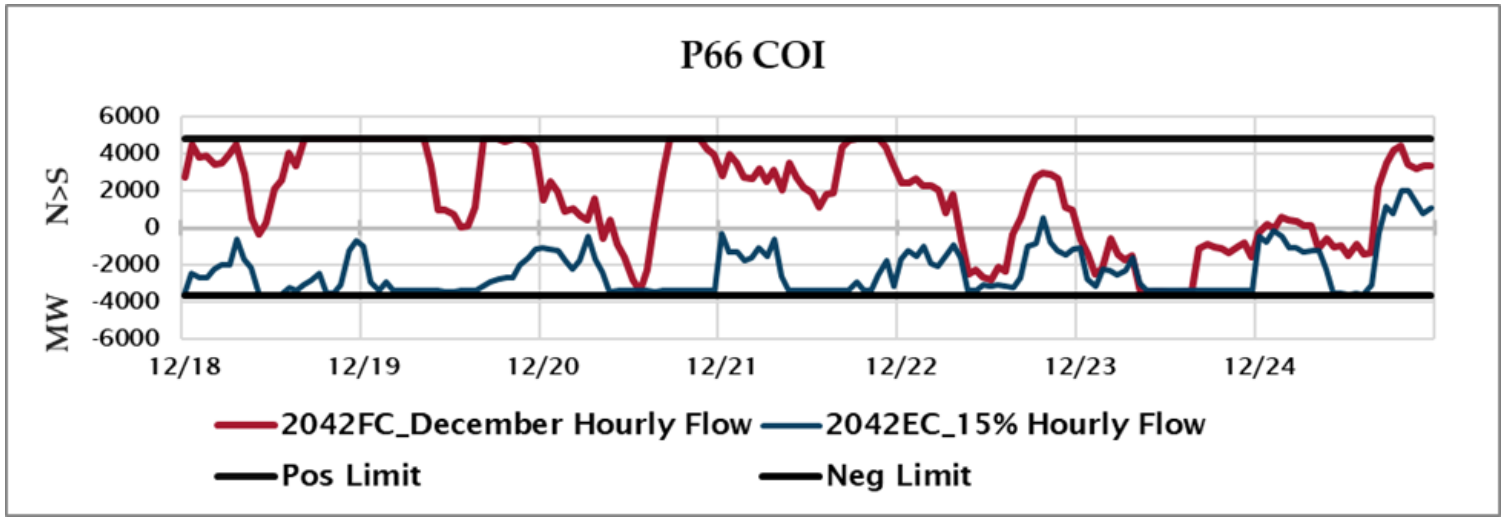
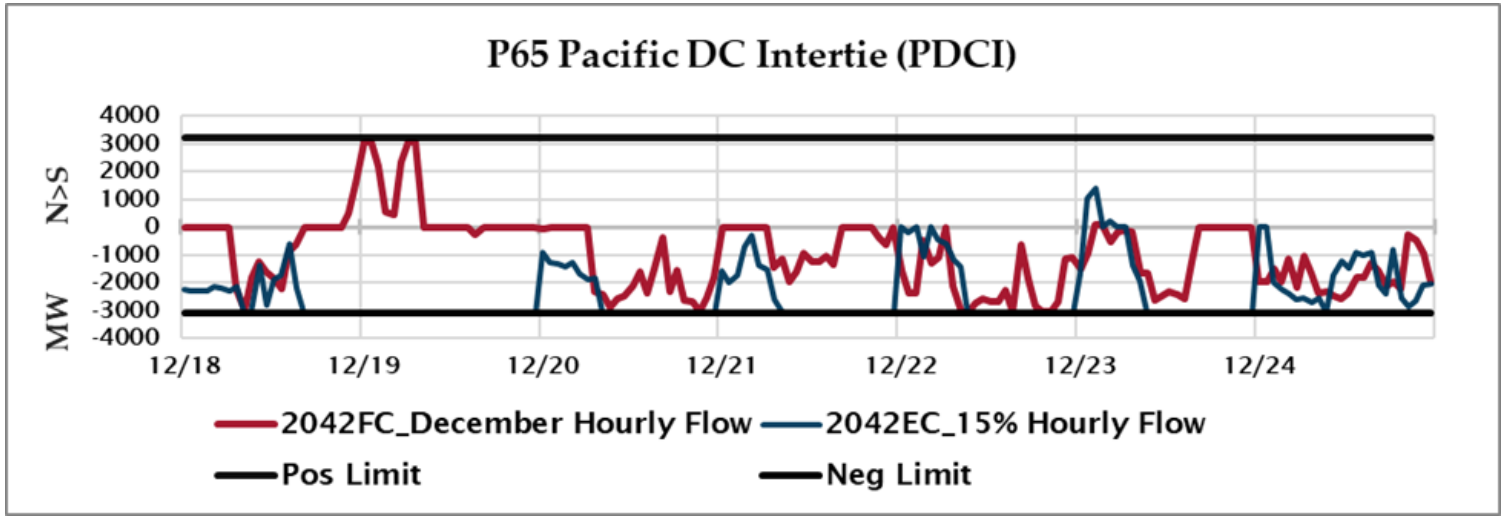
Y20 Transmission





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

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Electric Reliability and Security for the West

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