Overview of NERC TPL-008 Reliability Standard (Under Development)

WECC Modeling and Validation Subcommittee Meeting

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Disclaimer

The contents presented in this presentation are currently in the conceptual stage and are subject to potential revisions. The contents are provided for informational purposes, and adjustments may be made as part of the collaborative development process. Your valuable feedback and input are crucial. Thank you for your understanding and active participation in this discussion

FERC Order 896

On June 23, 2023, FERC issued Order 896 directing NERC to develop a new or modified Reliability Standard no later than 18 months to address reliability concerns pertaining to transmission system planning for extreme heat and cold weather events that impact the Reliable Operation of the Bulk-Power System.

https://www.federalregister.gov/documents/2023/06/23/2023-13286/transmission-system-planning-performance-requirements-for-extreme-weather

In response, NERC developed a Standard Authorization Request (SAR) in response to the FERC Order

https://www.nerc.com/pa/Stand/Project202107ExtremeColdWeatherDL/2021-07%20Extreme%20Cold%20Weather%20Grid%20Operations%2C%20Preparedness%2C%20and%20Coordination%20Cold%20Weather%20SAR_112221.pdf

- **NERC Project 2023-07 addressing FERC Order 896**
  - Regulatory deadline December 2024
  - Directives:
    - Develop New or Modified Standard
    - Develop Benchmark Events and Planning Cases Based on Major Prior Extreme Heat and Cold Weather Events and/or Meteorological Projects.
    - Define “wide-area”
    - Entities Responsible for Developing Benchmark Events and Planning Cases, and for Conducting Transmission Planning Studies of Wide-Area Events
      - Entity Responsible for Establishing Benchmark Events
      - Entities Responsible for Development of Planning Cases and Conducting Transmission Planning Studies of Wide-Area Events
    - Coordination Among Registered Entities and Sharing of Data and Study
    - Concurrent/Correlated Generator and Transmission Outages

- Directives Continued:
  - Conduct Transmission System Planning Studies for Extreme Heat and Cold Weather Events
    - Steady State and Transient Stability Analyses
    - Sensitivity Analysis
    - Modifications to the Traditional Planning Approach
  - Implement a Corrective Action Plan if Performance Standards Are Not Met

Historic Events – Extreme Cold

Event	Region	Unavailable Generation*	MW of Load Lost	Reference
February 1-5, 2011	Southwest	14,702 MW	5,412 (7.5 hours)	https://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx
January 6 – 8, 2014 Polar Vortex	Midwest, South Central and East Coast	9,860 MW	300 MW (3 hours)	https://www.nerc.com/pa/rrm/January%202014%20Polar%20Vortex%20Review/Polar_Vortex_Review_29_Sept_2014_Final.pdf
January 15-19, 2018	South Central	15,600 MW	900 MW	https://www.ferc.gov/sites/default/files/legal/staff-reports/2019/07-18-19-ferc-nerc-report.pdf
February 13-17, 2021 Winter Storm Uri	Southwest and South Central	65,622 MW	Total: 23,418 MW ERCOT: 20,000 MW (70 hours) SPP 2,718 MW (4 hours) MISO South 700 MW (2 hours)	https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and
December 21-26, 2022 Winter Storm Elliott	Central, Midwest, Southeast and Northeast	90,500 MW, or 13% of EI generation capacity	Total: 5,400 MW Including: TVA: 3,000 MW (7 hours) DEC:1,000 MW (3 hours) DEP: 961 MW (4 hours)	https://www.ferc.gov/media/winter-storm-elliott-report-inquiry-bulk-power-system-operations-during-december-2022

*Total MW capacity unavailable due to freezing issues, natural gas supply issues

Historic Events – Extreme Heat

Event	Region	Unavailable Generation	MW of Load Lost	Reference
September 9-11, 2013	Midwest, mid-Atlantic		None reported	
August 14-19, 2020	California, Desert Southwest	475 MW trip	1,000 MW (1.5 hours)	http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf
June 26-30, 2021	Pacific Northwest	250 MW trip	None reported	https://www.oregonencyclopedia.org/articles/heat-dome-2021/

TPL-008

- **High-level Overview of TPL-008-1 Standard**
  - SDT is working with EPRI, NOAA and other DOE agencies with regards to statistical analysis needed to determine applicable benchmark events.
  - EPRI engaged to assist in developing the process to translate benchmark event data into benchmark planning cases used in TPL-008-1 studies.
  - New TPL-008-1 Standard will focus on the specific requirements and measures for PCs and TPs.
    - A framework process to select benchmark events, develop benchmark planning cases, and scope studies for impacted study areas drafted in Attachment 1 of TPL-008-1 standard.

Key Elements of TPL-008

Selecting extreme heat and extreme cold benchmark events

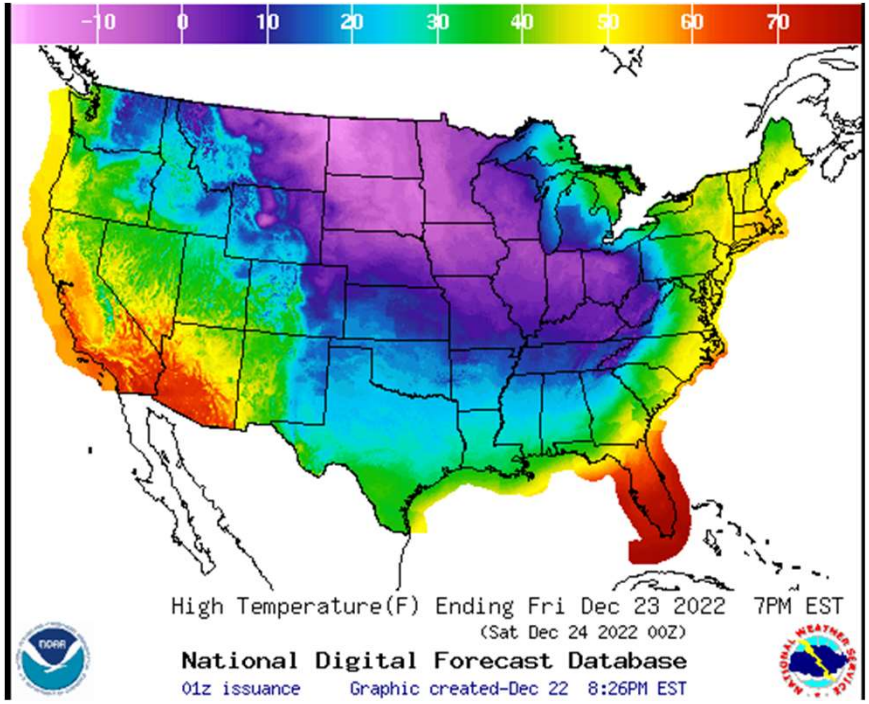
Developing **initial benchmark powerflow case, benchmark planning cases** and sensitivity cases

Contingency analysis

Corrective Action Plans

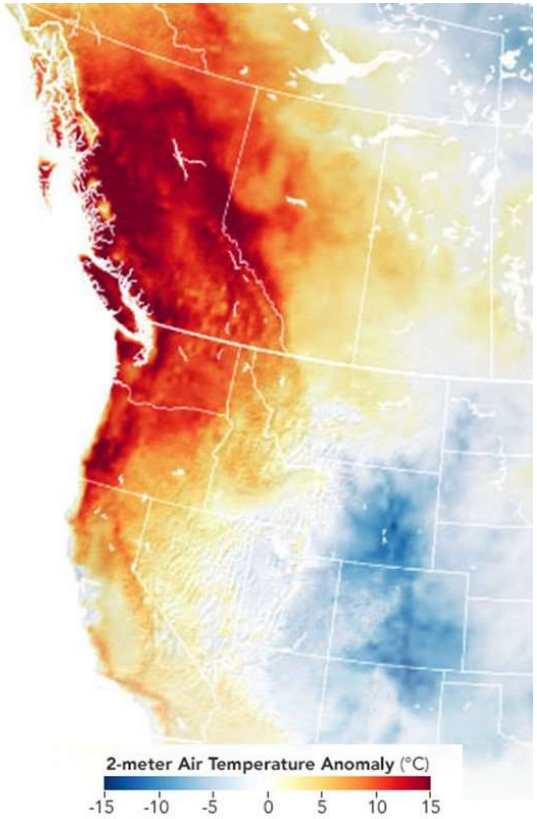
Selecting Benchmark Weather Events

- A team of climate experts including National Labs and EPRI will compile a library of extreme cold and extreme heat wide-area events that meet the NERC-specified target criterion
  - The criterion for extreme heat and extreme cold benchmark events will be established, e.g. 3-day heatwaves, that exceed the 95th percentile of climate normal temperature during daytime hours
- PC or a group of PCs, in consultation with NERC and Regional Entities (TRE, MRO, NPCC, WECC, SERC, RF), will select benchmark weather events to be studied



Source: NOAA

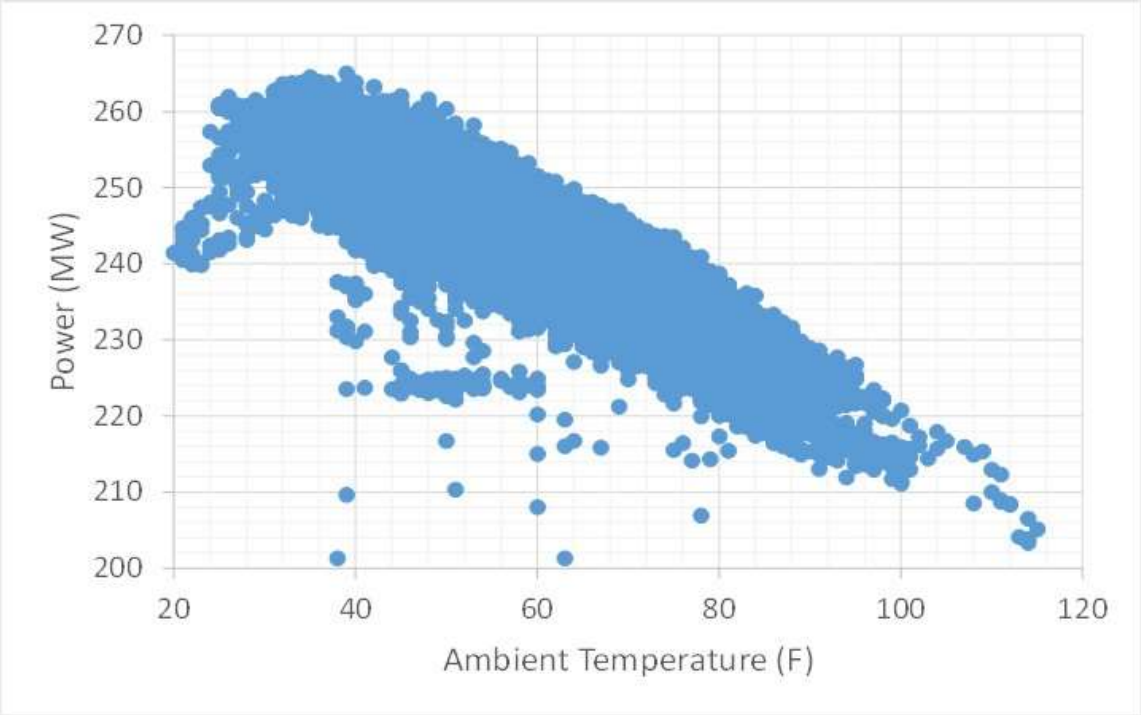
Developing Benchmark Powerflow Base Case



- **Initial benchmark powerflow** base cases are developed for the selected extreme heat and extreme cold events
  - Adjust load MWs and MVArs anticipated for extreme temperatures
  - Use applicable transmission Facility Ratings for the modeled ambient temperature conditions
  - Represent temperature-dependency of generating resources (see next slide)

- **Benchmark planning cases** will consider concurrent / correlated generation and transmission outages during extreme heat and extreme cold conditions, e.g.:
  - Thermal plant outages or generation de-rates due to constraints in natural gas availability
  - Output of Variable Energy Resources

Temperature-Dependent Gas Power Plant Capacity



Example: power output of a 250-MW gas-powered combined cycle plant as a function of ambient temperature

- Gas-powered plants experience reduction in power output at extreme temperatures
  - Combustion engine efficiency decreases at warmer ambient temperatures
  - Gas plant auxiliary loads usually increase at extreme cold temperatures

Contingency Analysis

Benchmark Planning Case

- P0 and P1 contingencies
  - Secure system
  - CAP required
- P2, P4, P5, P7 contingencies
  - No cascading, instability or controlled separation
  - CAP is not required

Sensitivity Cases

- CAP is not required