OVERVIEW OF TPL-008-1

WECC RAC MEETING
FEBRUARY 28, 2024

Acknowledgement:

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Agenda

- FERC Order 896 and TPL-008-1
  - Hayk Zargaryan (SCE)
- Developing Benchmark Planning Cases for Extreme Heat and Extreme Cold Weather Events
  - Dmitry Kosterev (BPA)
- High Level Process Flow, Corrective Action Plans, Possible Actions and Standard Drafting Team Next Steps
  - David Le (CAISO)

FERC Order 896 and TPL-008-1

Hayk Zargaryan, Southern California Edison
February 2024

FERC Order 896

- NERC Project 2023-07 addressing FERC Order 896
  - Regulatory deadline: December 15, 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 Projections
    - Define “Wide-Area”
    - Identify 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

FERC Order 896

- 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

NERC Project 2023-07 Drafting Team

Name	Entity
Evan Wilcox (Chair)	American Electric Power
Jared Shaw (Vice Chair)	Entergy Services
Josie Daggett	Western Area Power Administration
David Duhart	Southwest Power Pool
Michael Herman	PJM Interconnection
Tracy Judson	Florida Power & Light
Sun Wook Kang	ERCOT
Andrew Kniska	ISO New England
Dmitry Kosterev	Bonneville Power Administration
David Le	California ISO
Karl Perman	CIP CORPS
Meenakshi Saravanan	ISO New England
Kurtis Toews	Manitoba Hydro
Hayk Zargaryan	Southern California Edison

TPL-008-1

- **High-level Overview of TPL-008-1 Standard**
  - NERC staff is required to develop benchmark events and will maintain these events within an ERO library. NERC staff will be in discussion with the regions during the development.
  - NERC staff will continue to engage EPRI, NOAA, other DOE agencies, and Planning Coordinators to develop statistical analyses and criteria to be used in developing benchmark events on an ongoing basis.
  - NERC staff is committed to providing an initial set of events and will be establishing an open, transparent, and collaborative process for criteria evolvement and continual improvements.
  - EPRI is engaged to assist in providing guidelines and technical supporting material to be used in the development of benchmark planning cases used in TPL-008-1 studies.
  - New TPL-008-1 Standard requirements and measures will be applicable to Planning Coordinators (PCs) and Transmission Planners (TPs).

TPL-008-1

- **High-level Overview of TPL-008-1 Standard**
  - PCs and TPs to identify individual and joint responsibilities
  - Responsible entity to select one extreme heat and extreme cold benchmark event
  - Responsible entity to develop and maintain system models (consistent with MOD-032)
  - PCs to implement a process for coordinating benchmark planning cases (e.g., define study area boundary and modify case to include seasonal and temperature dependent adjustments)
  - Responsible entities to have performance criteria, as well as criteria or methodology for identifying instability, uncontrolled separation, or cascading
  - Responsible entities to identify contingencies and provide rationale
  - Responsible entities to perform Extreme Temperature Assessments in the Long-Term Planning Horizon at least once every 5 calendar years (including sensitivity analysis)
  - Responsible entities to develop CAPs (for P0 or P1 events) or possible actions (for P2, P4, P5, and P7 events)
  - Responsible entities to provide Extreme Temperature Assessment results to any functional entity that has a reliability related need and submits a written request

Developing Benchmark Planning Cases for Extreme Heat and Extreme Cold Weather Events

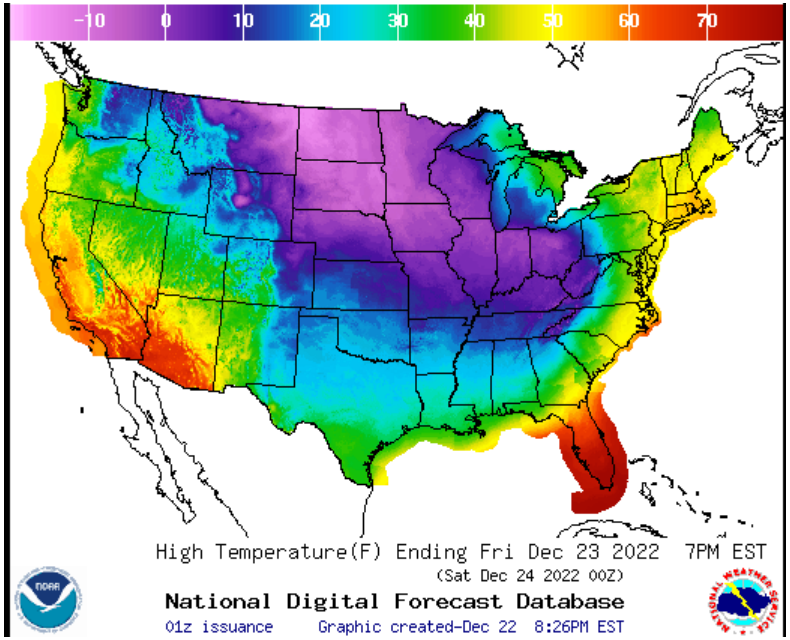
Dmitry Kosterev, Bonneville Power Administration
February 2024

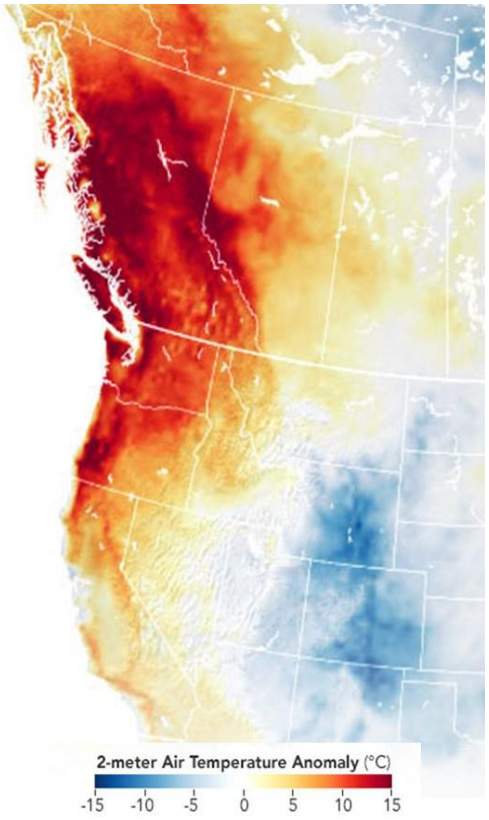
Event	Region	Voltage	Unavailable Generation*	MW of Load Lost	Reference
February 1-5, 2011	Southwest	345 kV (next worst contingency)	14,702 MW	5,412 (7.5 hours)	https://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx
January 6 – 8, 2014 Polar Vortex	Midwest, South Central and East Coast	Generation outage	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	345 kV (congestion)	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	345 kV (next worst contingency)	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	345 kV and 115 kV (transmission congestion, most likely on 345 kV and low voltages, most likely on 115kV)	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

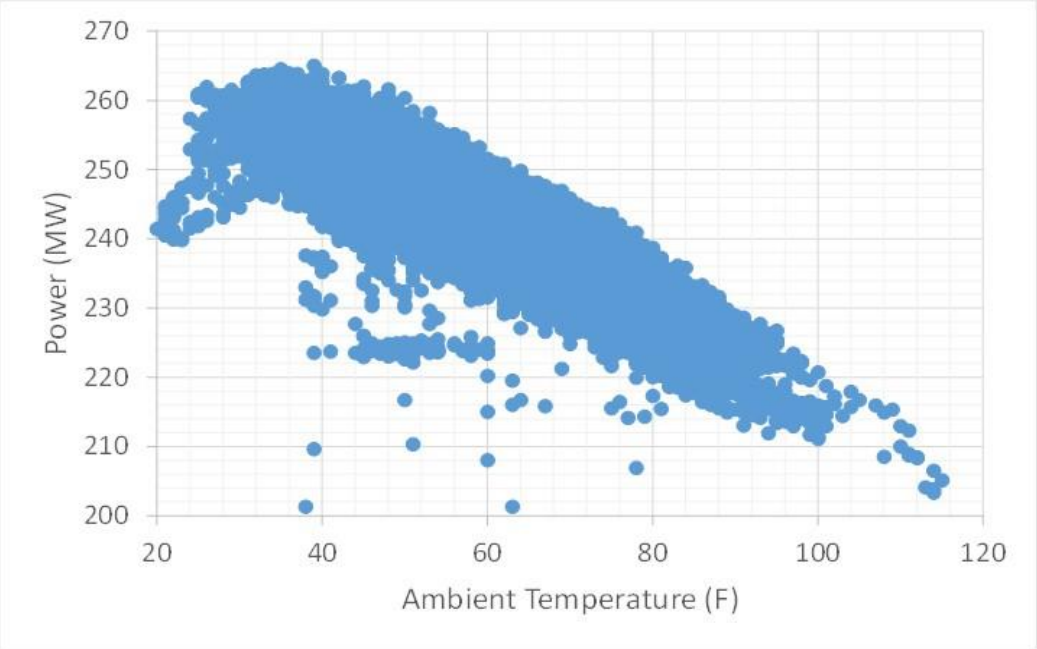
Event	Region	Voltage	Unavailable Generation	MW of Load Lost	Reference
September 9-11, 2013	Midwest, mid-Atlantic	500 kV (forced outage)		None reported	
August 14-19, 2020	California, Desert Southwest	500kV, +/- 500kV HVDC line (fire threats), previous 500kV line forced outage	475 MW trip	1,000 MW (1.5 hours)	http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf
June 26-30, 2021	Pacific Northwest	No reported transmission outage	250 MW trip	None reported	https://www.oregonencyclopedia.org/articles/heat-dome-2021/

- Selecting extreme heat and extreme cold benchmark events
- Developing **initial benchmark powerflow case, benchmark planning cases** and sensitivity cases
- NERC will provide a library of extreme cold and extreme heat wide-area events that meet the specified target criterion
  - The criteria for developing extreme heat and extreme cold benchmark events will be provided, e.g. 3-day heatwaves, that exceed the 95th percentile of climate normal temperature during daytime hours
- PC or a group of PCs, in conjunction with the corresponding TPs, will select one extreme heat and one extreme cold benchmark events from the ERO-maintained library.





- **Benchmark planning cases** will include the following:
  - Seasonal and temperature dependent adjustments to load, generation, transmission and transfers.
  - The above adjustments will be applied to the wide-area of study as defined by the impacted PCs and TPs.
- **Sensitivity cases** will include the following changes to one of the following conditions:
  - Generation
  - Real and reactive forecasted Load
  - Transfers



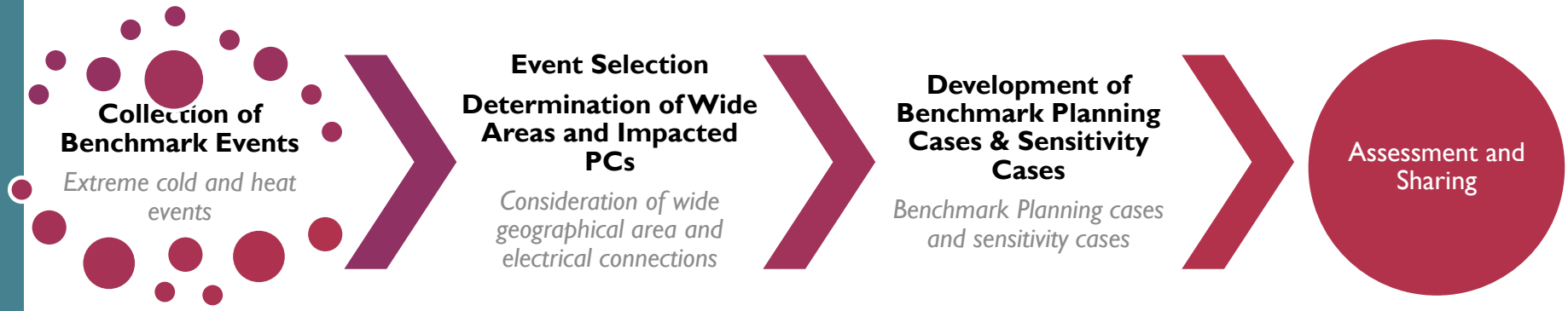
Example: power output of a 250-MW gas-powered combined cycle plant as a function of ambient temperature

- 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

Extreme Temperature Assessments, Contingencies, CAPs, and Standard Drafting Team Next Steps

David Le, California ISO
February 2024

High Level Process Flow



ERO-Maintained Library

Responsible PC(s) and TP(s)

Responsible PCs and TPs

Benchmark Planning Cases
- *MOD-032-2*
- *Seasonal and temperature dependent adjustments for load, generation, transmission and transfers.*

Sensitivity Cases
Changes to one of the following:
- *Generation*
- *Real and reactive forecasted Load*
- *Transfers*

PCs and TPs

- *Steady-state analysis*
- *Transient stability analysis*
- *Corrective Action Plans (P0, P1)*
- *Possible actions (P2, P4, P5, P7)*
- *Documented study results, CAPs and possible actions*
- *Sharing Extreme Temperature Assessment results upon request by other functional entity that has reliability related need*

Process Cycle: Once Every 5 Years

Modified from Sun-Wook Kang's Flow Chart, ERCOT

Contingencies & Performance Criteria

Table 1: Contingencies and Performance Criteria						
Event **See Table 1 of the mandatory and enforceable TPL-001 standard**	P0	P1	P2	P4	P5	P7
Voltage Level	200 kV and above Any common structure that includes a Facility 200kV and above For non-generator step up transformer outage events, the reference voltage applies to the low-side winding. For generator and Generator Step Up transformer outage events, the reference voltage applies to the BES connected voltage (high-side of the Generator Step Up transformer).					
Steady State Performance Criteria	• Applicable Facility Ratings shall not be exceeded. • System steady state voltages shall be within acceptable limits as defined in Requirement R5.	• Applicable Facility ratings shall not be exceeded • System steady state voltages shall be within acceptable limits as defined in Requirement R5.	• Evaluation for uncontrolled separation or Cascading, as defined in Requirement R6.			
Stability Performance Criteria	• Initialization without oscillation	• Instability, uncontrolled separation, or Cascading, as defined in Requirement R6, shall not occur.	• Evaluation for instability, uncontrolled separation, or Cascading, as defined in Requirement R6.			
CAP Required	Yes (See Requirement R9)	Yes (See Requirement R9)	No (See Requirement R10)			
Non-Consequential Load Loss Allowed	No (See Requirement R9)	Yes (See Requirement R9)	Yes			

Current Tentative Schedule

- Initial Posting:
  - March 20 – April 29, 2024 (45-day comment and ballot period)
- Additional Postings:
  - July 9 – August 6, 2024 (35-day comment and ballot period)
  - September 17 – October 15, 2024 (35-day comment and ballot period, if needed)
- Final Ballot period:
  - November 5 – 15, 2024
- NERC Board Adoption:
  - December 13, 2024
- File with Regulatory Authorities:
  - December 2024 (Regulatory Deadline – FERC Order 896)

Questions

- Questions throughout the standards development process or want to have a call with some drafting team members to discuss the standard.

Contact:

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