

NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

Cold Weather Preparedness and Energy Assurance

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2022 OMS/MGA Transmission Summit
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To ensure the reliability and security of the North American Bulk Power System (BPS)

- Develop and enforce reliability standards
- Assess current and future reliability issues
- Analyze system events and recommend improved practices
- Critical Infrastructure Protection
- Education, training and awareness
- Accountable as Electric Reliability Organization (ERO) to regulatory bodies in the United States (FERC) and Canada (Canada Energy Regulator and provincial governments)



- Interconnected grid with Canada and Mexico; each country with authority within their own jurisdiction
- Roughly 1500 owners, operators, and users of the BPS
 - Focus on reliable operation of the BPS
- Standards cannot require construction of new transmission or generation capacity
- Independent Board of Trustees
- All entities with a material interest in the reliability of the BPS can be NERC members
 - Member Representative Committee reports to the Board
- Six Regional Entities at the front line, performing delegated functions

2022 ERO Enterprise Compliance Monitoring and Enforcement Program Implementation Plan

Version 1.0
October 2021

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Products and Services

- Secure portal supporting collaboration in a virtual team environment
- Data analytics and analysis
- Reports focused at different levels from analysts to executives
- Cyber and physical bulletins
- Malware drop box
- Industry Engagement Program (IEP)
- Cross-sector shares
- Vulnerability reports
- Monthly webinars
- Critical Broadcast Program
- Unclassified threat workshop
- Biennial grid security exercise (GridEx)
- Annual grid security conference (GridSecCon)
- Cybersecurity Risk Information Sharing Program (CRISP)
- Cyber Automated Information Sharing System (CAISS)

The E-ISAC's Vision
To be a world-class, trusted source of quality analysis and rapid sharing of security information for the electric industry.



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Portal: www.eisac.com

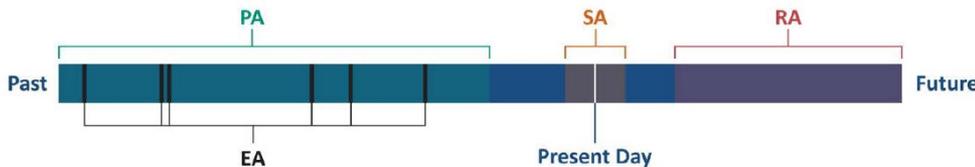
E-ISAC
ELECTRICITY
INFORMATION SHARING AND ANALYSIS CENTER

Products and Services

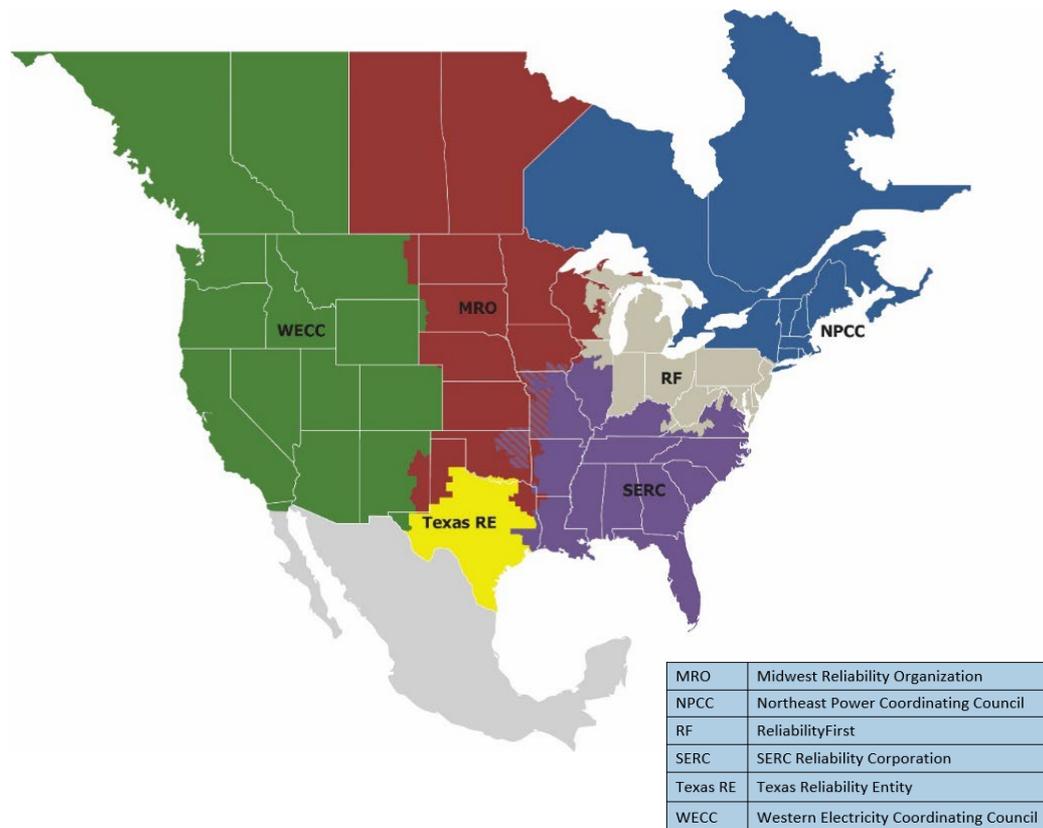


- Standards
- Compliance & Enforcement
- Reliability Risk Management
- Reliability Assessment and System Analysis
- System Operator Certification and Continuing Education
- Electricity Information Sharing and Analysis Center (E-ISAC)

Performance Analysis	Event Analysis	Situational Awareness	Reliability Assessments
			
Focus: past	Focus: specific events	Focus: current events	Focus: future



- NERC provides delegated authority to Regional Entities
- Delegated functions:
 - Compliance Monitoring and Enforcement
 - Reliability Standards Development
 - Organization Registration
 - Reliability Assessments and Performance Analysis
 - Training and Education
 - Situation Awareness
 - Infrastructure Security
- Regional consistency is key for transparency and predictability





Reliability Guideline

Suggested approaches or behavior in a given technical area for the purpose of improving reliability. Guidelines are not enforceable, but may be adopted by a responsible entity in accordance with its own polices, practices, and conditions.



NERC Alert: Level 2-3

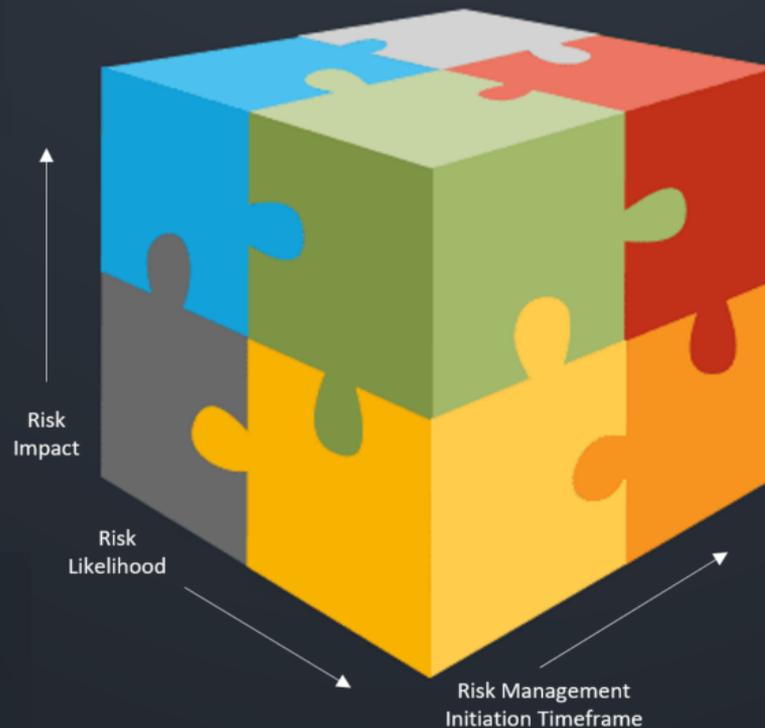
NERC alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.



Technical Engagement

Technical Engagement is a catch-all for a variety of technical activity that is conducted between the ERO and entities. This includes, technical committee activities, technical reference documents, workshops and conferences, assist visits, joint and special studies, etc.

Electric Reliability Organization: Reliability Risk Mitigation Toolkit



Reliability Standards



NERC Reliability Standards define the mandatory reliability requirements for planning and operating the North American BPS and are developed using a results-based approach focusing on performance, risk management, and entity capabilities.

Reliability Assessment



NERC independently assesses and reports on the overall reliability, adequacy, and associated risks that could impact BPS reliability. Long-term assessments identify emerging reliability issues that support public policy input, improved planning and operations, and general public awareness.

NERC Alert: Level 1



NERC Alerts are divided into three distinct levels, 1) Industry Advisory, 2) Recommendation to Industry, and 3) Essential Action, which identifies actions to be taken and require the industry to respond to the ERO.

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Cold Weather Preparedness

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Updated: 11/22/2021

NERC Information Resources on Cold Weather Preparation and BPS Impacts

NERC has collected and shared information on cold weather preparation and BPS impacts for years via Webinars, Special Reports, Lessons Learned, Failure Modes & Mechanisms, and other resources.

Here are links to some cold weather resources:



Reports on major BPS-impacting Cold Weather events

- [Outages and Curtailments during the Southwest Cold Weather Event of February 1-5, 2011](#)
- [Winter Weather Readiness for Texas Generators, \(2011\)](#)
- [January 2014 Polar Vortex Review](#)
- [The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018](#) (There are a number of "sound practices" from the industry, starting on page 100.)
- The [Generating Unit Winter Weather Readiness Reliability Guideline](#) Version 3 (Dec 2020) is a resource for helping develop generator cold weather preparation plans.
- [FERC - NERC - Regional Entity Staff Report: The February 2021 Cold Weather Outages in Texas and the South Central United States](#)

Other Cold Weather Reports and Training Materials can be found [on this site](#).

Cold weather related Lessons Learned:

- [LL20110902 Adequate Maintenance and Inspection of Generator Freeze Protection](#)
- [LL20110903 Generating Unit Temperature Design Parameters and Extreme Winter Conditions](#)
- [LL20111001 Plant Instrument & Sensing Equipment Freezing Due to Heat Trace & Insulation Failures](#)
- [LL20120101 Plant Onsite Material and Personnel Needed for a Winter Weather Event](#)
- [LL20120102 Plant Operator Training to Prepare for a Winter Weather Event](#)
- [LL20120103 Transmission Facilities and Winter Weather Operations](#)
- [LL20120901 Wind Farm Winter Storm Issues](#)
- [LL20120902 Transformer Oil Level Issues During Cold Weather](#)
- [LL20120903 Winter Storm Inlet Air Duct Icing](#)
- [LL20120904 Capacity Awareness During an Energy Emergency Event](#)
- [LL20120905 Gas and Electricity Interdependency](#)
- [LL20180702 Preparing Circuit Breakers for Operation in Cold Weather \(also 2018 Webinar w/FMM\)](#)
- [LL20200601 Unanticipated Wind Generation Cutoffs during a Cold Weather Event](#)
- [LL20201101 Cold Weather Operation of SF6 Circuit Breakers](#)

Winter Weather Webinars from 2012 – 2021 can be found [on this site](#).

Annual Winter Reliability Assessments 2003/2004 thru 2021/2022 can be found [on this site](#).

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Reliability Guideline

Generating Unit
Current Industry

Preamble:
The objective of the Guideline is to provide critical information to promote an industry-wide effort to monitor and enforce the Guideline, or to revise, update, or develop the Guideline.

Purpose:
This reliability guideline is intended to be strictly voluntary, and its implementation is left to the discretion of individual entities. The Guideline is a collection of best practices that, when implemented, will help to ensure that local conditions do not impact weather events.

Assumptions:

1. Each BPS Generator is required to maintain its own procedures to ensure that it is able to dispatch to meet the needs of the system.
2. Balancing Authorities are responsible for ensuring that the system is able to meet the needs of the system.
3. What constitutes a "cold weather event" is left to the discretion of the local entity.

Guideline Details:
An effective winter weather preparation plan should generally address:



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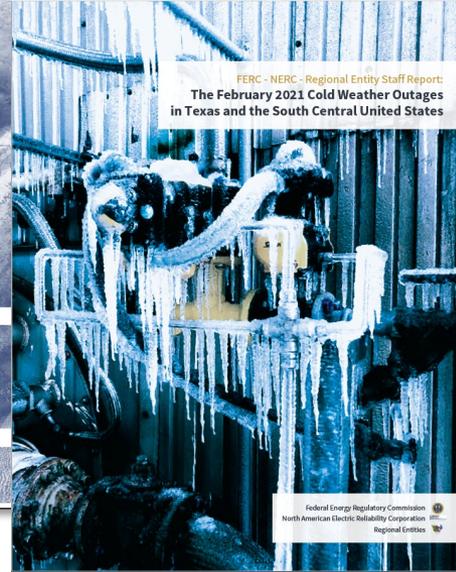


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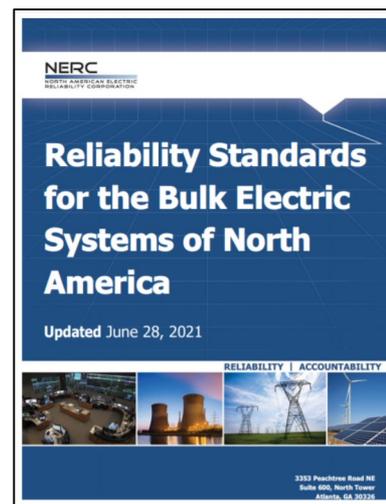
**FERC - NERC - Regional Entity Staff Report:
The February 2021 Cold Weather Outages
in Texas and the South Central United States**



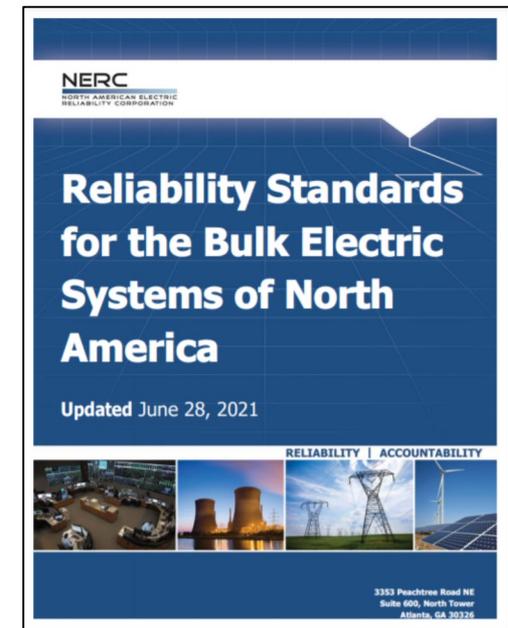
Federal Energy Regulatory Commission
North American Electric Reliability Corporation
Regional Entities

FERC-approved – Future Effective Dates

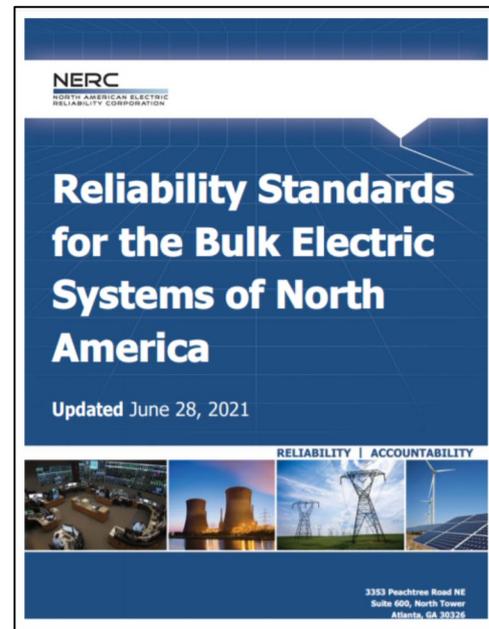
- EOP-011-2
 - TOP and BA emergency plans include cold weather impacts
 - GO have cold weather preparation plans
 - Appropriate freeze protection measures (self determined)
 - Annual inspection
 - Know operating limits
 - Awareness training on plans
- IRO-010-4 and TOP-003-5
 - RC and TOP data specifications to include requesting operating limits



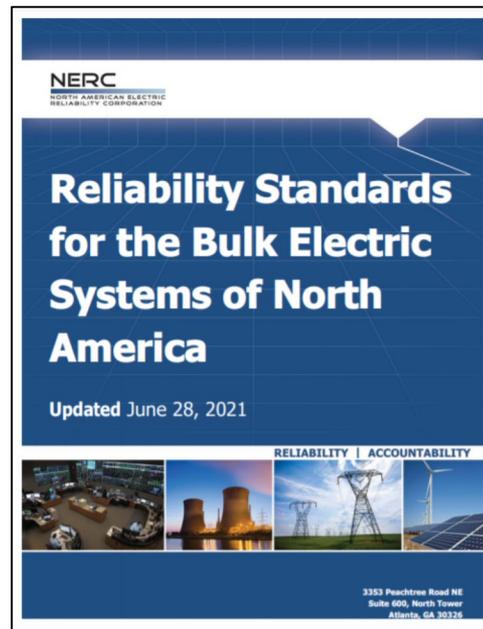
- Requirement R1 (TOP) and Requirement R2 (BA)
 - Not a new requirement
 - Partial new subpart 1.2.6 and 2.2.9
- New provision to determine reliability impacts of cold weather conditions as part of its Operating Plans



- Requirement R7 GOP
 - New requirement
 - Cold weather preparedness plan
 - Generating unit(s) freeze protection measure based on geographical location and plan configuration
 - Annual inspection and maintenance of generating unit(s) freeze protection measures
 - Generating unit(s) cold weather data, to include:
 - Capability and availability
 - Fuel supply and inventory concerns
 - Fuel Switching capabilities
 - Environmental constraints
 - Generating unit(s) minimum
 - Design temperature, historical operating temperature, or current cold weather performance temperature determined by an engineering analysis.



- Requirement R8 GOP
 - New requirement
 - Training
- Train GOP personnel on the GO cold weather preparedness plan(s).



Phase 1

- EOP-012-1 (new)
 - Incorporates all GO cold weather preparation requirements from EOP-011-2
 - Design any new generation and update, as necessary, capability of existing generation to operate to a specified ambient temperature
 - Development of Corrective Action Plan(s)
 - Conduct annual preparedness training
- EOP-011-3 (revised)
 - Minimize overlap of manual and automatic load shed

Phase 2 (specific Standards TBD)

- Identify and protect cold-weather critical components
- Account for effects of precipitation and the accelerated cooling effect of wind when providing generation temperature data
- Improve provision and use of data related to percentage of generating unit capacity that can be relied upon during local forecasted cold weather
- Address use of critical natural gas loads in demand response programs
- Protect critical natural gas loads from manual and automatic load shedding

Rec #2: Funding for Generator Winterization (Winter '22/23)

- GOs should have the opportunity to be compensated for the costs of retrofitting their units to operate to a specified ambient temperature and weather conditions through markets or through cost recovery approved by state public utility commissions to be included in end users' service rates.

Rec #8: Fuel Supply & Inventory Concerns (Winter '21/22)

- GOs/GOPs should identify the full reliability risks related to the contracts and other arrangements they have made to obtain natural gas commodity and pipeline transportation for generating units

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2022-2023 Winter Reliability Assessment

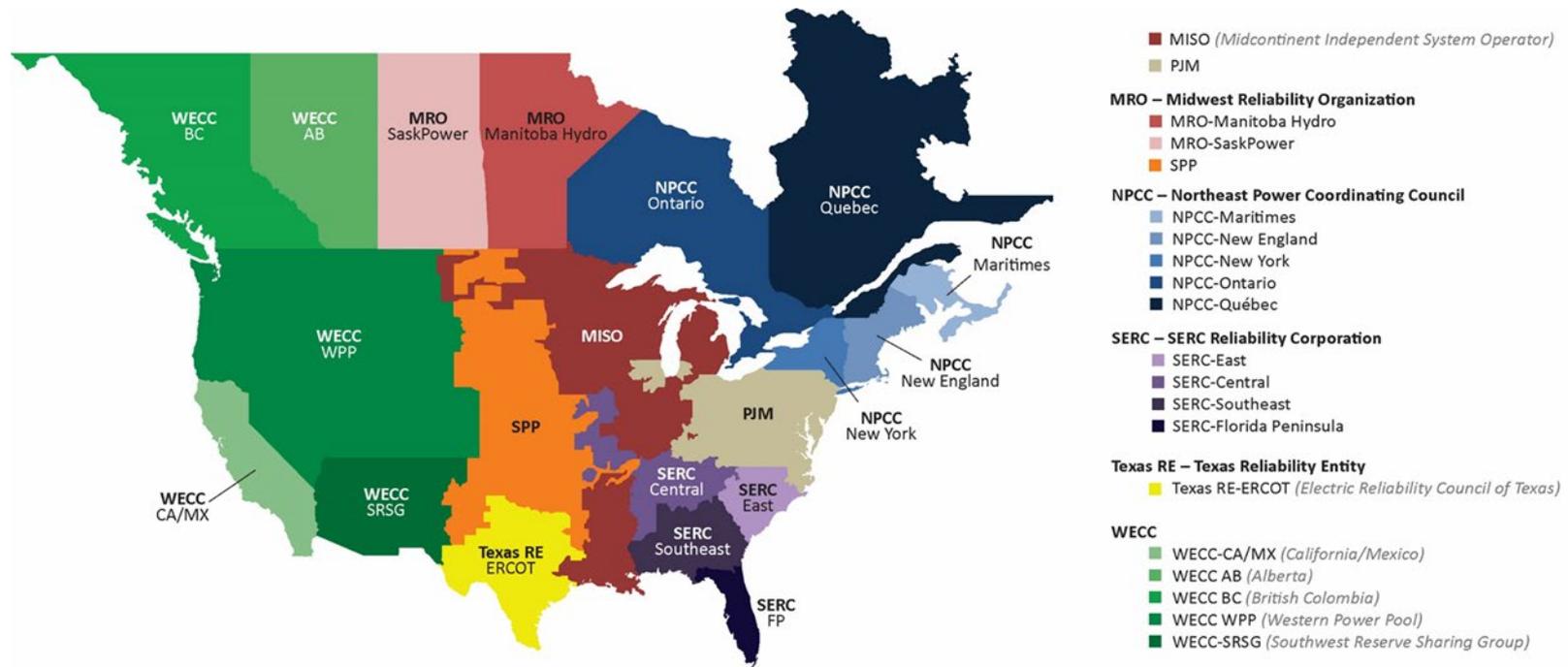
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- NERC's Winter Reliability Assessment (WRA) examines potential regional resource deficiencies and operating reliability concerns
 - Describes industry preparations to manage seasonal risks
- Developed with the Reliability Assessment Subcommittee (RAS) and reviewed by the Reliability & Security Technical Committee



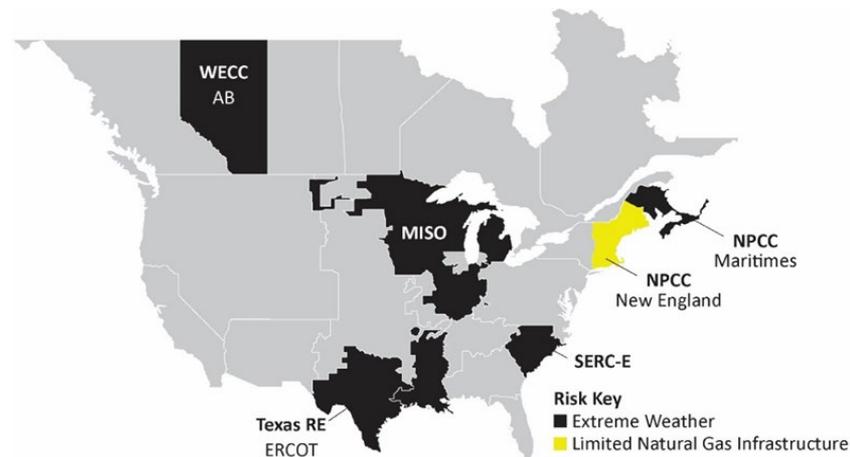
- Examines potential regional resource shortfalls and operating reliability concerns
- Describes industry preparations to manage risks
- Coordination and Review
 - 20 Assessment Areas
 - Regional Entities and Region stakeholder groups



- A large portion of the North American BPS is at risk of insufficient electricity supplies during peak winter conditions
- Factors contributing to reliability risks in affected areas include:
 - Higher peak-demand projections
 - Generator retirements
 - Generator vulnerability to extreme weather
 - Fuel supply and natural gas infrastructure limitations
- Special attention on generator fuel supplies is warranted by current domestic and global energy markets and supply chains

- Capacity and Energy Risk Assessment based on:
 - On-peak reserve margins compared to Reference Margin Level
 - Operational risk analysis of risk periods (waterfall chart)
 - Probabilistic energy metrics (Calculated loss-of-load hours, unserved energy)
- Generator availability assessed for extreme winter scenarios
- Variable energy resource contribution is rated at expected output
 - Wind resource output is less than nameplate and determined by historical information
 - Solar resource output at winter peak hour is typically zero

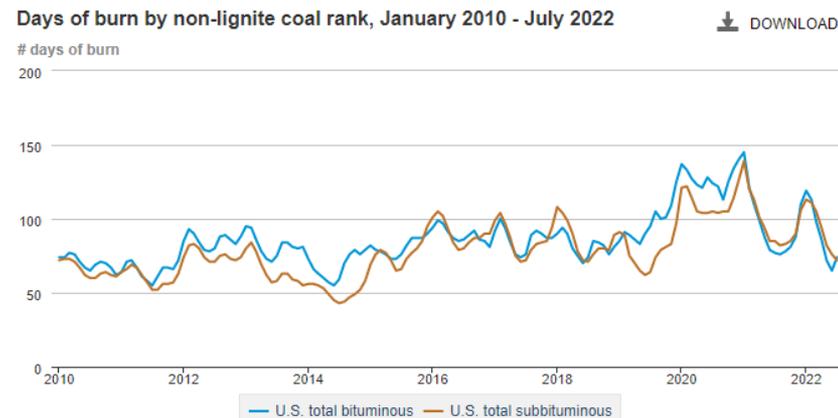
- Texas
 - High generator outages, fuel disruption and volatile demand in extreme cold
- MISO
 - 4.2 GW of nuclear and coal plant retirements since last winter
 - Extreme cold impact to generation and fuel
- Alberta and Maritimes Provinces
 - Peak electricity demand growth strains tight winter reserve margins
- SERC East
 - Shrinking capacity and demand growth cause risk of shortfall in extreme cold



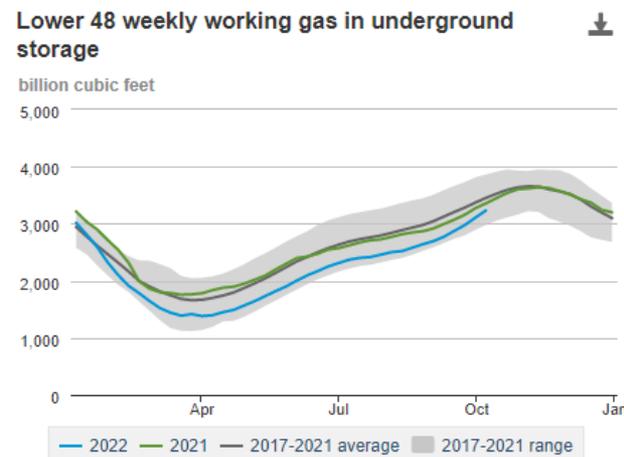
Winter Reliability Risk Map

- New England
 - Natural gas supply infrastructure limitations

- **Coal** fleet inventories down to 74 days of bituminous supply on average in EIA reporting
 - Reliability Coordinators are monitoring coal and consumable inventories
- **Natural Gas** storage inventory rebounding from summer
 - Cold weather production and delivery are ongoing area concerns
- Specific fuel risks in New England
 - Generator on-site stored **liquid fuels** at 37% capacity (October)
 - Record high global demand for **LNG** increases fuel availability risk



As of October



- Inadequate supply of distribution transformers could slow restoration efforts following winter storms
- Steps taken in areas affected by the February 2021 Winter Storm are expected to reduce the likelihood and lessen the severity of similar events
- Responses to Level 2 Alert *Cold Weather Preparations for Extreme Weather Events* show progress in winter readiness

- **Cold Weather Preparations** – Generators should prepare for winter conditions and communicate with grid operators to reduce the risk of supply shortfalls
 - Guidance in NERC’s Level 2 Alert - Cold Weather Preparations (Sept 2022)
- **Fuel** – Generators should take early action on assuring fuel and availability. Reliability Coordinators and Balancing Authorities should monitor fuel supply adequacy.
- **State regulators and policy makers** – Preserve critical generation resources at risk of retirement prior to the winter season. Support requests for environmental and transportation waivers when needed for reliability.

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Energy Assurance

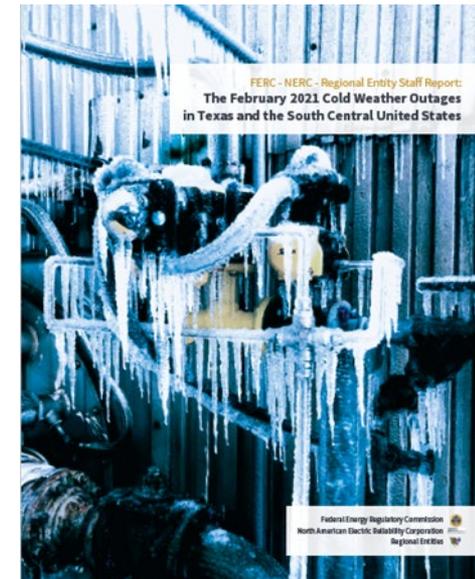
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- The following drivers have led to rapid changes in energy resources:
 - Governmental policies
 - Changes in resource economics
 - Consumer demand for clean energy
- In addition to the shift in resources, an increase in extreme weather presents new challenges
 - Fuel sources are inherently less secure



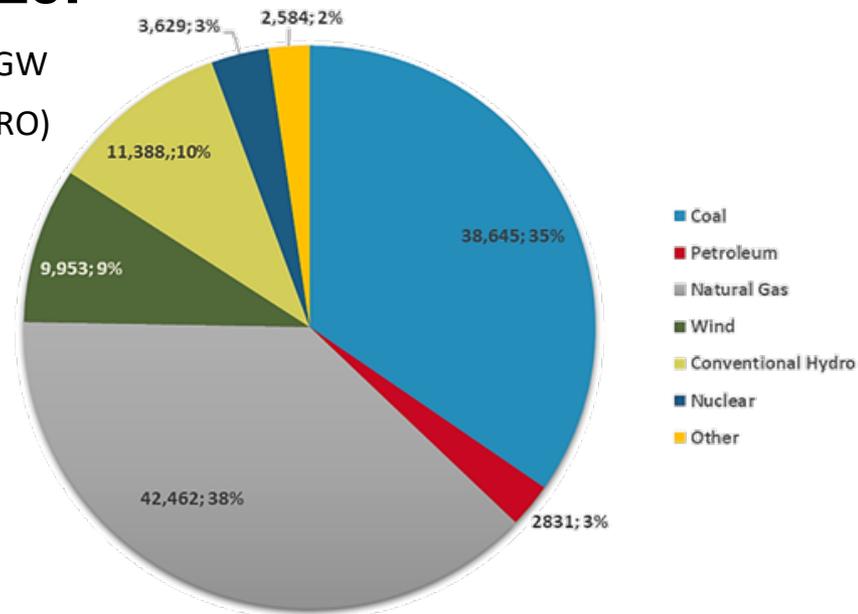
- Rapidly changing generation fleet
- Increasing electrification
- Widespread, long-duration, extreme weather events
- Historically, industry ensured energy through capacity and reserve margins with assurance of fuel



Across North America, from 2010-2020:

- Load has grown 85 GW while CAPACITY has dropped by 23 GW
- 2020 Wind Capacity was 2.4% of total (9% in wind-heavy MRO)

Area	2020-21 Winter Nameplate (MW)	2021-22 Winter Nameplate (MW)	2021-22 Winter Peak Capacity (MW)
MH	259	259	52
MISO (MRO)	26,064	28,447	4,561
SPC	241	627	85
SPP	23,546	27,535	6,334





Mid-to-Long Term (1-5 years)

- Ensure that resources are planned that can provide options to obtain sufficient and flexible energy resources
- Review tools, rules-of-thumb and processes to support the need for these energy resources



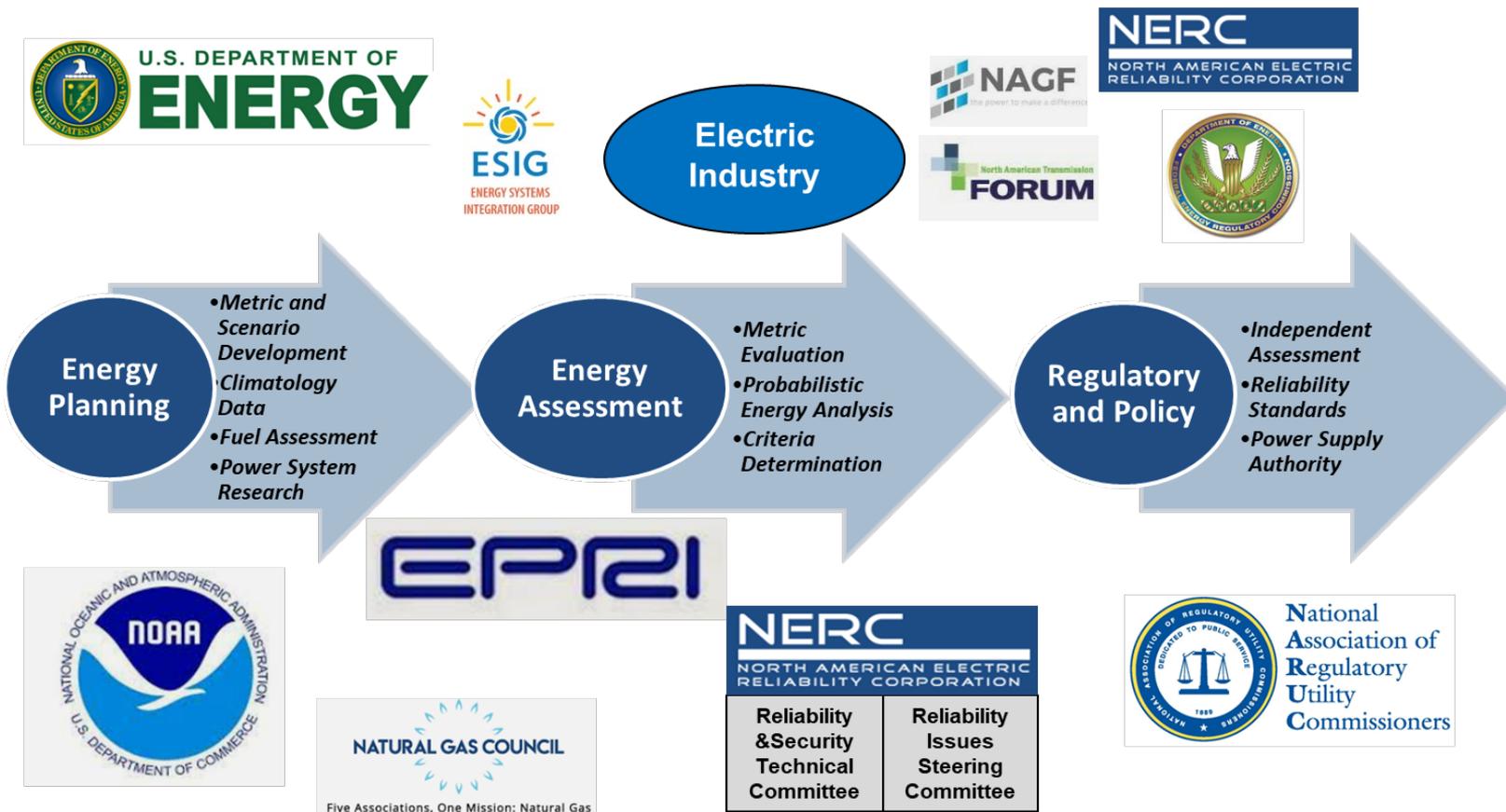
Operational Planning (1 day – 1 year)

- Ensure sufficient resources are available and able to provide energy to meet demand and off-set ramping requirements
- Electrical energy production needs to reflect status of energy availability given the uncertainties



Real-Time (0-1 day)

- Ensure sufficient amounts of capacity, energy, and ramp flexibility are available from available resources



Energy Reliability Assessments Task Force (ERATF)

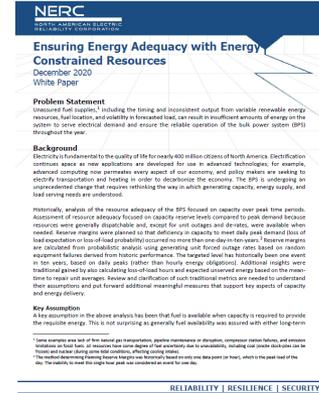
Utilities

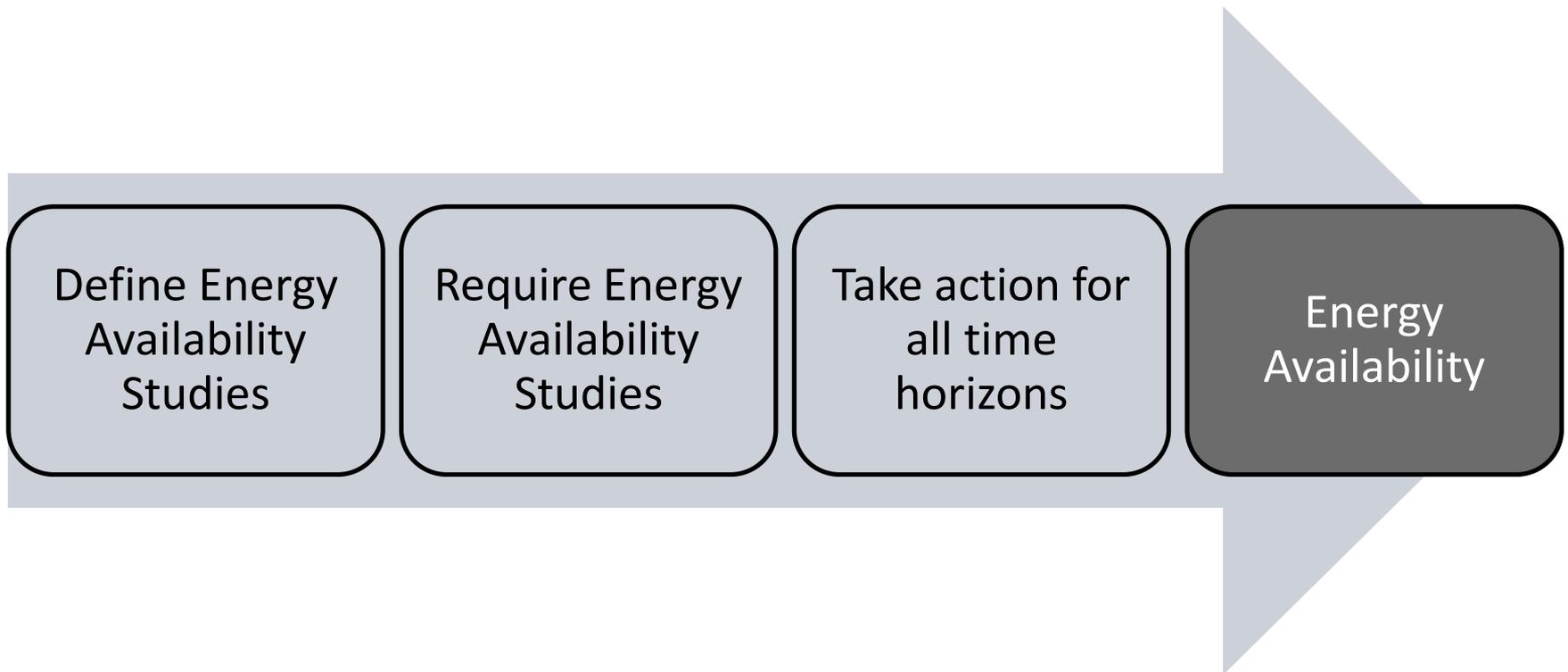
ISOs/RTOs

EPRI

Manufacturers

ERO







Questions and Answers