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Standards Actions

Howard Gugel, Vice President of Engineering and Standards
Board of Trustees Meeting
November 16, 2022

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Project 2020-03 Supply Chain Low Impact Revisions

- Background
  - The purpose of Project 2020-03 was to address the risk of low impact Bulk Electric System (BES) Cyber Systems with remote electronic access connectivity identified in the Supply Chain Risk Assessment Report
  - Additionally, the team was asked to address the NERC Board resolution to:
    - detect known or suspected malicious communications for both inbound and outbound communications;
    - determine when active vendor remote access sessions are initiated; and
    - disable active vendor remote access when necessary.
- Reliability Benefits
- Action
  - Adopt
    - Reliability Standard - CIP-003-9 – Cyber Security – Security Management Controls

Project 2020-03 Supply Chain Low Impact Revisions

- Reliability Benefits
  - Address risk of low impact BES Cyber Systems with remote electronic access connectivity
    - Added R1.2.6 for "vendor electronic remote access security controls" to be included in cyber security policies
    - Added Section 6 in Attachment 1 for required sections of Cyber Security Plan(s) to include vendor electronic remote access security controls that include:
      - *One or more method(s) for determining vendor electronic remote access;*
      - *One or more method(s) for disabling vendor electronic remote access; and*
      - *One or more method(s) for detecting known or suspected inbound and outbound malicious communications.*
- Action
  - Adopt
    - Reliability Standard - CIP-003-9 – Cyber Security – Security Management Controls

2023-2025 Reliability Standards Development Plan

- Status
  - Posted for industry comment from July 26 - August 24, 2022
  - Endorsed by Standards Committee on September 21, 2022
- Action
  - Approve the 2023-2025 Reliability Standards Development Plan

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Low Impact Criteria Review Team Whitepaper

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Overview

- Whitepaper posted for comment through September 12
- Identification of risks and management strategies
- Team is considering comments and finalizing whitepaper
- Present to NERC Board in November

Recommendations

- CIP Standard revisions
  - Authenticate remote users for lows with external routable connectivity
  - Protect user authentication information for lows with external routable connectivity
  - Detect malicious communications to/between lows with external routable connectivity
- Security Guidelines
  - Protection of communications to and between lows across publicly accessible networks
  - Procurement risk evaluation for lows
  - Voluntarily submit E-ISAC report for unauthorized physical access attempts
- Risk Monitoring
  - Continuous monitoring of E-ISAC physical access attempt reports to see if risk increases

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Standards Process Improvement Opportunities

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Overview

- Stakeholder group met to consider NERC staff recommendations
- Post recommendations as modified for policy input
- Recommendations in three areas
  - Rules of Procedure
  - Standard Processes Manual
  - Standing Committees
  - Registered Ballot Body
- Policy input discussed at MRC

Questions and Answers

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2023 Work Plan Priorities

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Areas of Focus

1. **Energy:** Tackle the challenge of grid transformation; climate change-driven, extreme weather; and inverter performance issues

2. **Security:** Move the needle by focusing on supply chain, Information Technology (IT) and Operational Technology (OT) system monitoring, cyber-informed grid planning and design, and evolution of the Critical Infrastructure Protection (CIP) standards

3. **Agility:** Tool the company to be more nimble in key areas, particularly standards development, internal operational processes, technical deliverables, revisit the FERC settlement restrictions, and explore alternate funding mechanisms

4. **Sustainability:** Invest in ERO systematic controls, eliminate single points of failure, strengthen succession planning, and ensure robust cyber security protections for all systems

5. **And … everything else we need to do**

2023 Work Plan Priorities

Reliability Assessments	➢ Reliability assessments incorporate consistent and documented methods to identify and evaluate extreme condition scenarios and energy availability ➢ Perform a special assessment of the potential impacts on the adequacy and operating reliability of the bulk power system (BPS) from new and evolving electricity market practices and state authority resource adequacy assurance/availability mechanisms ➢ Conduct extensive outreach to raise awareness and prompt action to assure reliability for the 2023 summer and 2022/2023 winter seasons
Reliability Standards	➢ Board adopts or endorses, as applicable: ▪ 2023 enhancements to Reliability Standards identified by Cold Weather Inquiry ▪ ERATF Energy Assessment Reliability Standards in operations planning timeframe ▪ Inverter base resource Reliability Standards (performance, modeling, studies, validation) ▪ CIP Reliability Standard modifications to accommodate virtualization ▪ Changes needed based on evaluation of the CIP bright-line risk criteria ➢ Standards Committee accepts Standard Authorize Requests focused on transmission planning energy scenarios* ▪ Normal and extreme events ▪ Gas-Electric interdependencies ▪ Distributed energy resource (DER) events

*Includes extreme events creating common conditions that impact the energy resilience of the BPS, such as extreme long-term, widespread cold and hot temperatures, widespread droughts conditions, solar, wind, and fires

2023 Work Plan Priorities (cont.)

Registration	➢ Review, and update if needed, registration criteria for generation to include Bulk Electric System (BES)-connected Variable Energy Resources (VERs) and DERs
Event Analysis	➢ Include loss of significant amounts of energy-constrained resources and energy deficiencies ➢ BPS awareness daily reports to include new system conditions and expand depth and breadth
Engineering	➢ Develop cyber-informed planning approaches documented in technical reports or other guidance material to study, identify, and reduce the number of critical facilities and attack exposure/impact
E-ISAC	➢ Increase the analysis of IT/OT environments and extract key, actionable insights ➢ Support DOE/CESER's Energy Threat Analysis Center (ETAC) and DHS/CISA's Joint Cyber Defense Collaborative (JCDC) ➢ Strategically expand CRISP participation, including natural gas pipeline companies ➢ Provide support to the natural gas sector for OT analytics and access to E-ISAC Portal ➢ Formally integrate the natural gas sector into GridEx VII planning
BPS Risk Mitigation	➢ Implement a revised and more agile Reliability Standards development process ➢ Establish Level 3 Alert process ➢ Strengthen reliability guidelines (essential actions, measures of effectiveness) ➢ Leverage CMEP tools for early visibility of BPS risk

2023 Work Plan Priorities (cont.)

Corporate Risk Reduction	➢ Provide additional data management, classification, and protection tools and processes ➢ Implement audit management software solution to automate Internal Audit processes
Talent Management	➢ Successfully onboard 14 new employees ➢ Maintain regrettable turnover at <10% and sustain employee engagement score
State/Provincial Outreach	➢ Expand outreach to national associations, including NARUC and CAMPUT, to further educate state and provincial regulators and policymakers on NERC assessments ➢ Build bench strength in NERC's External Affairs team with a focus on state outreach and stakeholder engagement
Process Improvement & Efficiency	➢ Decide on future direction of Finance & Accounting/HR systems and begin execution ➢ Complete Atlanta facility workplace assessment, survey market conditions, and conduct site tours of alternate options

Questions and Answers

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Section 1600 Data Request

For GADS Conventional, GADS Wind, and GADS Solar

John Moura, Donna Pratt
Board of Trustees Meeting
November 15 - 16, 2022

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Action Requested

- Approve the GADS Section 1600 Data Request to become effective January 1, 2024

GADS Section 1600 Data Request

- NERC is requesting an update to the GADS Section 1600 data to include:
  - Solar (new):
    - Inventory/configuration, event reporting, and performance data
    - Inventory/configuration of connected energy storage and performance data
  - GADS Wind extensions:
    - Event reporting and connected energy storage
    - Changes to configuration data to support event reporting
  - Conventional GADS extensions:
    - Unit design data that is comparable to the types of information being collected for wind and solar
    - Enhanced event reporting (Contributing Operating Condition)

Process

- NERC began development of this proposed Section 1600 data request with industry in 2018
- FERC staff review and public comment periods were provided in 2021 and 2022
  - After reviewing the feedback from the 2021 public comment period, substantial changes and clarifications were provided
    - Revisions focused on information essential to evaluating performance and impact to the BPS
  - In 2022, the second public comment period provided an opportunity for additional feedback
  - Final materials are available for review at: https://www.nerc.com/pa/RAPA/PA/Pages/Section1600DataRequests.aspx
- The Reliability and Security Technical Committee endorsed the GADS Section 1600 Data Request via electronic vote on October 6, 2022

Proposed Effective Dates for Reporting

Who	Reporting Schedule*
Photovoltaic Reporting	• Late 2023: Voluntary reporting* • 2024: Mandatory reporting for photovoltaic facilities with a total installed capacity of 100 MW or greater • 2025: Mandatory reporting for photovoltaic facilities with a total installed capacity of 20 MW or greater
Incremental Wind Event Reporting	Effective beginning January 1, 2024
Incremental Design Data and Event Contributing Operating Condition Field	Effective beginning January 1, 2024

**Estimated dates, subject to organization project priorities*
**Mid-year implementations may not begin until new calendar year*

Summary

- Collecting this data will improve NERC's ability to track the changing resource mix and evaluate the performance of the generating fleet

Discussion

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2022 Long-Term Reliability Assessment

John Moura, Director, Reliability Assessments and Performance Analysis

Board of Trustees Meeting

November 16, 2022

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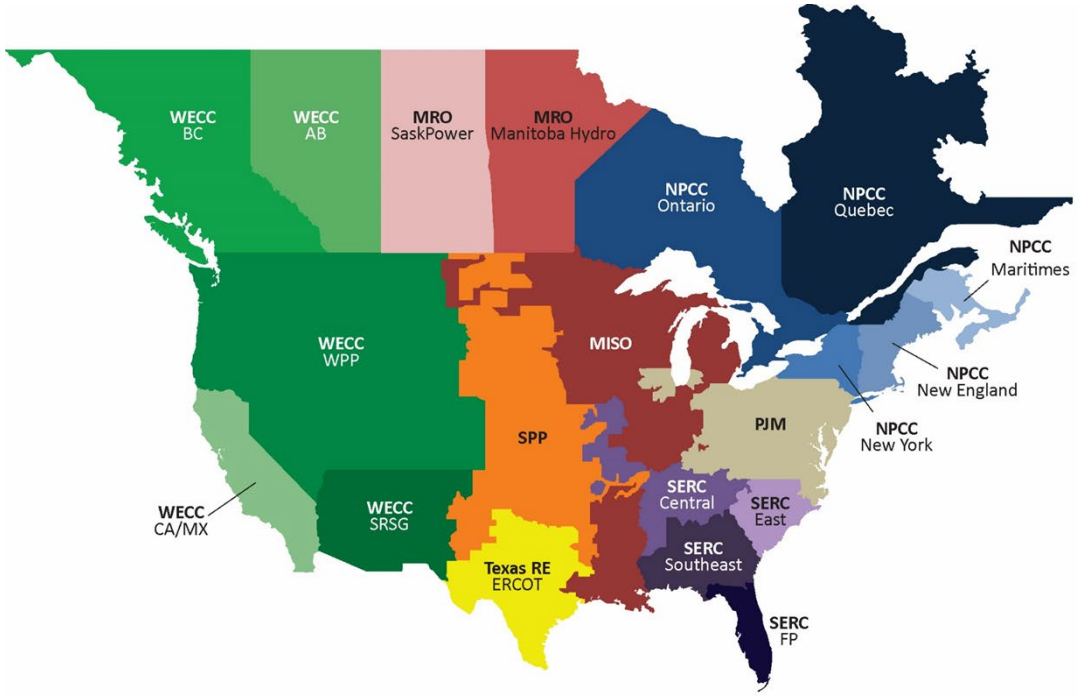
Long-Term Reliability Assessment

- Assessment of resource capacity and energy risks
- Demand, generation, and transmission projections
- Demand-side resources
- Emerging Issues
- Coordination and Review with Regional Entities and Stakeholder Groups



MISO *(Midcontinent Independent System Operator)*
PJM

MRO – Midwest Reliability Organization
- MRO-Manitoba Hydro
- MRO-SaskPower
- SPP

NPCC – Northeast Power Coordinating Council
- NPCC-Maritimes
- NPCC-New England
- NPCC-New York
- NPCC-Ontario
- NPCC-Québec

SERC – SERC Reliability Corporation
- SERC-East
- SERC-Central
- SERC-Southeast
- SERC-Florida Peninsula

Texas RE – Texas Reliability Entity
- Texas RE-ERCOT *(Electric Reliability Council of Texas)*

WECC
- WECC-CA/MX *(California/Mexico)*
- WECC AB *(Alberta)*
- WECC BC *(British Colombia)*
- WECC WPP *(Western Power Pool)*
- WECC-SRSG *(Southwest Reserve Sharing Group)*

Resource Adequacy Finding - Summary

- Parts of North America are at risk of electricity supply shortfall during forecasted or extreme conditions over the next five years
- Contributing factors in affected areas
  - Declining capacity from recent and projected generator fleet retirements without capacity replacement
  - Energy limitations in the resource mix
  - Generator and fuel supply vulnerability to extreme weather

LTRA Risk Assessment Approach

On-Peak Reserve Margins

- **Compares margin between resources and peak demand to a reference margin level (RML)**
- Variable energy resources are rated at expected output
- Demand Response resources are included as reduced peak demand
- RML is set by regulators, ISO/RTO, or other authorities to achieve an accepted level of risk

Probabilistic Assessment

- **Compares calculated load loss and unserved energy metrics from probabilistic study to criteria**
- Demand and resources modeled probabilistically at all hours
- Generator availability, demand variation and resource output can be modeled probabilistically
- Various load loss and energy metrics can be calculated

LTRA Risk Assessment Criteria

Resource capacity and energy risks are assessed for Years 1 – 5* in all assessment areas using the following criteria:

High Risk

- Supply shortfall can occur in **forecast conditions**
  - Historical peak demand and resource performance
- Indicators
  - Reserve margins fall below RML
  - Loss of Load Hours (LOLH) exceed 1-day-in-10 years
- Extreme conditions are also likely to result in shortfall

Elevated Risk

- Supply shortfalls are likely in **extreme conditions** only
  - Extreme high demand or abnormal low resource output
- Indicators
  - LOLH expected but less than 1-day-in-10 years
  - Unserved energy expected
  - Supply risks found in studies of extreme conditions

*Resource adequacy trends are reported for years 6 - 10

Preliminary

Capacity and Energy Risk Assessment

Ontario

- Reserve Margins below RML in 2025
- Planned retirements and nuclear work

MISO

- Reserve Margins below RML in 2023
- 5,700 MW of thermal generation retirements since 2022

California-Mexico

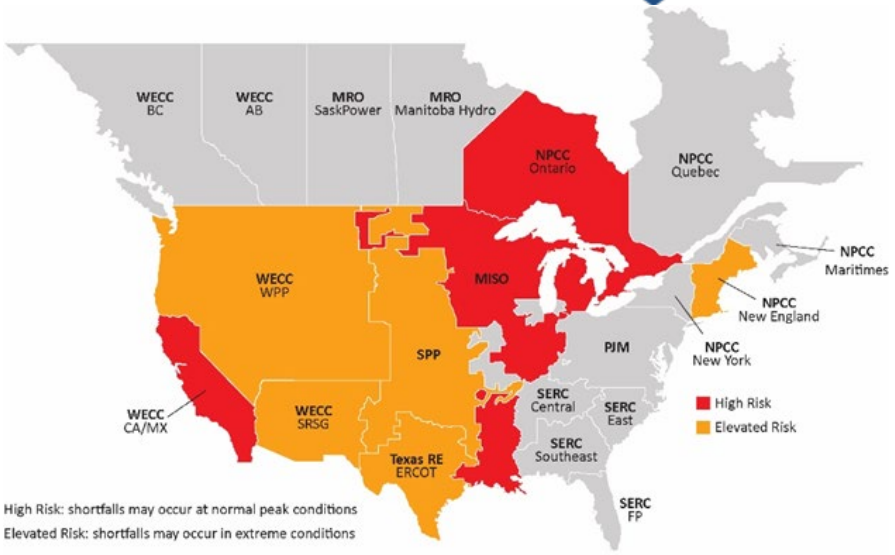
- Load loss hours anticipated due to variable resource mix and demand
- Improving trend in metrics with recent capacity additions

U.S. West

- Unserved energy is increasing in summer months as variability grows

New England

- Fuel risk in extended cold weather



Texas

- Energy risk shifts to winter due to potential impacts of extreme weather

SPP

- Energy shortfalls likely during low-wind and high demand periods

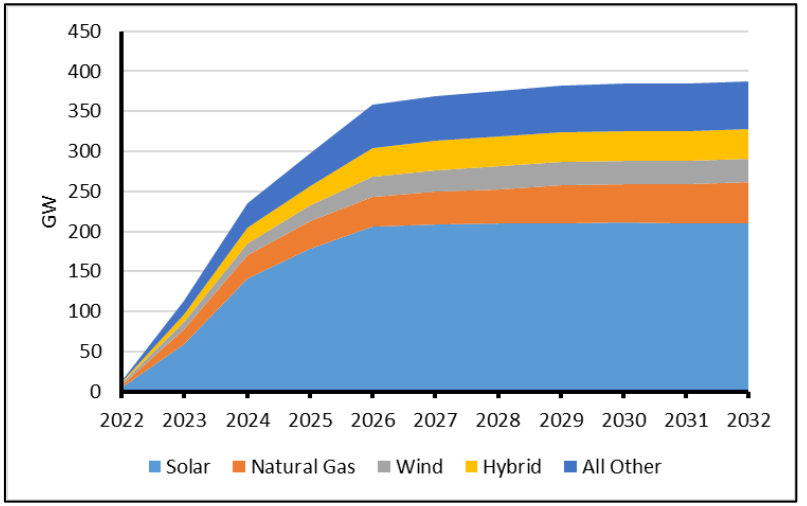
Changing Resource Mix

- Wind, solar, and hybrid generation in interconnection processes enable continued transition as older thermal resources retire
- Implications:
  - Increasing hourly and weather dependent variability
  - New resource characteristics and performance issues
  - Less fuel diversity in dispatchable fleet

Table 1: 2022 Capacity at Peak Demand

Type	Capacity (GW)	Change since 2021 (GW)
Natural Gas	435	**-31.9**
Coal	198	**-22.1**
Nuclear	102	**-5.1**
Solar and Wind	71	**+10.4**
All others	188	**-1.5**

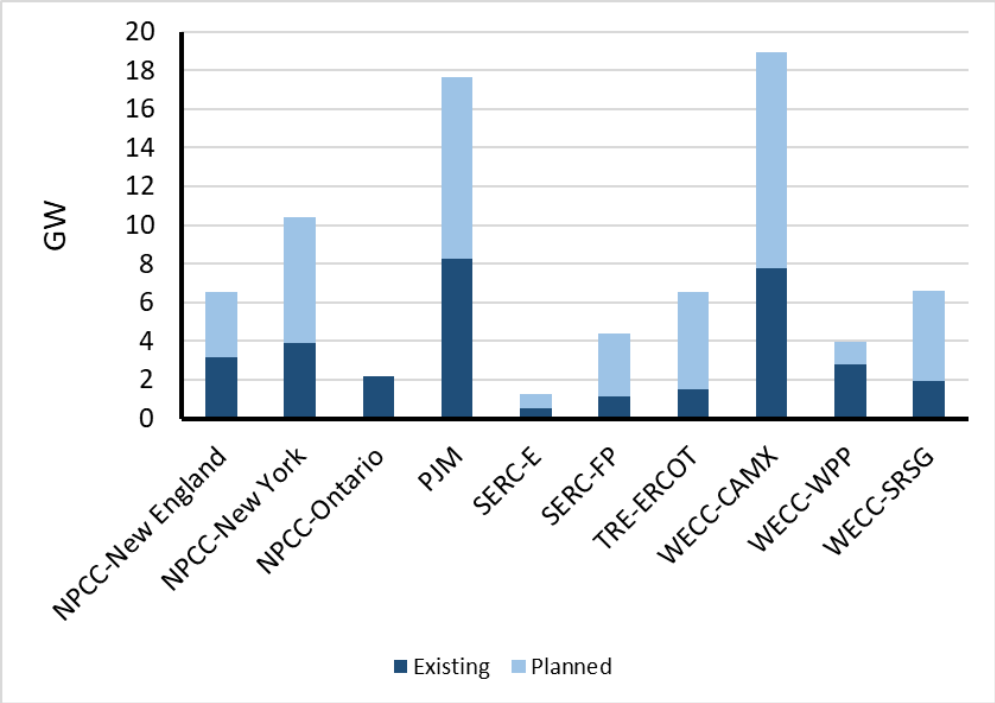
Contributions at hour of peak demand. Variable energy resource (solar, wind, and some hydro) typically count less than installed nameplate capacity.



Resource Capacity in Development (Tier 1 and 2)

Changing Resource Mix - DER

- Cumulative solar PV DER expected to reach over 80,000 MW by the end of the 10-year assessment period (up 25% since 2021)
  - 12 of the 20 assessment areas expect to double their total solar DER footprint by 2032



Solar DER by Assessment Area by 2032 – Select Areas

Generator Retirements

- Retirements factor into risk assessment and resource mix trends
- Generators that are *Confirmed* for retirement by ISO/RTO and Planners are not counted as capacity in the LTRA
- LTRA will evaluate generators that have announced retirements but have not met ISO/RTO or Planner approval (*Unconfirmed*) for impacts on resource adequacy and resource mix

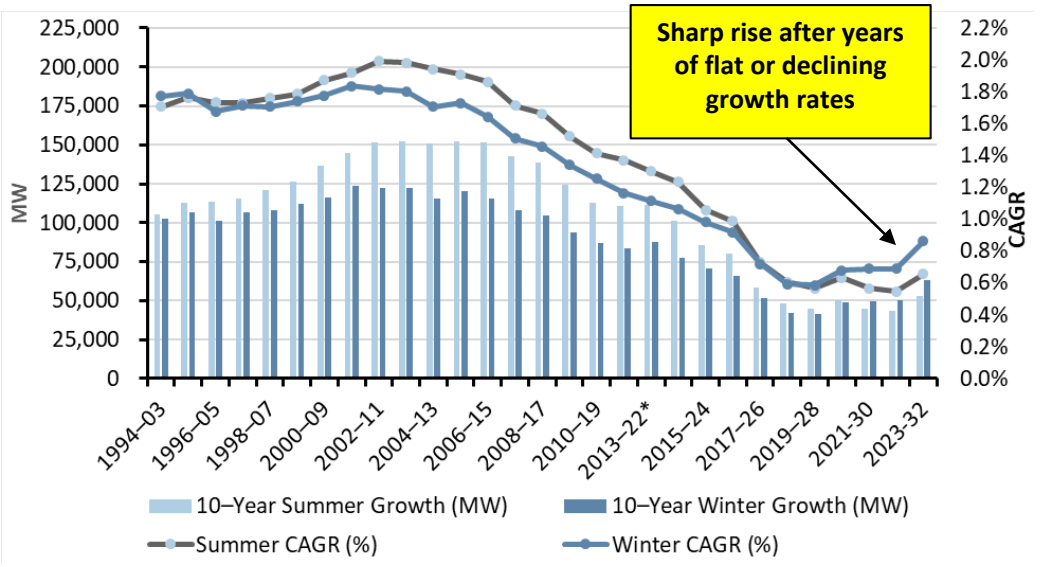
Table 2: Generation Retirement Projections through 2032

Type	Confirmed (MW)	Baseline Case (MW)[1]	High-Retire Scenario (MW)[2]
Natural Gas and Oil	29,639	38,602	41,603
Coal	52,931	89,539	97,439
Nuclear	6,163	15,194	18,594

[1] The baseline case is obtained by combining EIA 2022 Annual Energy Outlook reference case retirement projections for the U.S. with confirmed retirements in Canada.
[2] The high-retirements scenario is obtained by combining EIA 2022 Annual Energy Outlook low-renewable-cost case retirement projections for the U.S. with confirmed retirements in Canada.

Peak Demand: Growth across the BPS

- 10-year Peak Demand growth showing largest increases in recent years
- Electric vehicle growth influences projections
- Demand Response offsets Peak Demand
- Dual-peaking or changing from summer to winter peaking anticipated in some parts of the U.S. Southeast and Northeast



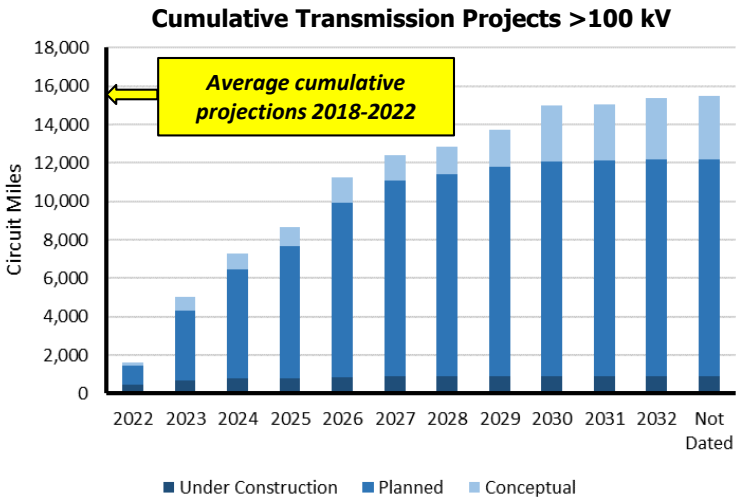
10-year Summer and Winter Peak Demand Growth

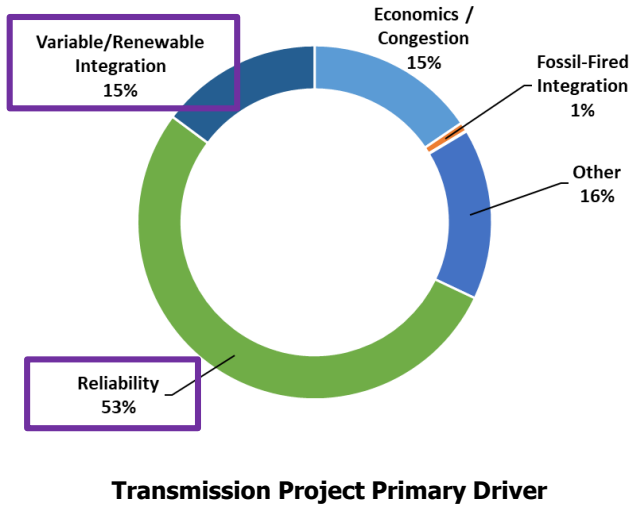
Largest 10-year Winter Peak Demand Growth	
Assessment Area	**Demand Change**
NPCC-New York	2.36%
WECC-SRSG	2.06%
NPCC-New England	1.95%
NPCC-Ontario	1.32%
Texas RE-ERCOT	1.30%

Largest 10-year Summer Peak Demand Growth	
Assessment Area	**Demand Change**
WECC-SRSG	1.69%
NPCC-Ontario	1.27%
WECC-CAMX	1.19%
MRO-SaskPower	1.05%
NPCC-Maritimes	1.03%

Trend in Transmission Projects: Steady

- Little change in transmission miles projections in past five years
- Most projects are initiated to support grid reliability
- Miles of transmission being planned or constructed for renewable integration increased from 1,589 mi to 2,376 mi since 2021 LTRA





Transmission Miles in Planning or Construction through 2032			
Area	**Miles**	**Area**	**Miles**
WECC WPP	3,439	SERC SE	629
NPCC New York	1,635	WECC SRSG	581
PJM	983	NPCC Ontario	570
WECC CAMX	902	NPCC New England	506
WECC BC	775	All other areas	<500 mi each

2022 LTRA Status

- The LTRA report was reviewed by the NERC Reliability and Security Technical Committee (RSTC) in October
- NERC Staff is preparing the report and recommendations for Board acceptance on December 14

Questions and Answers

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2022-2023 Winter Reliability Assessment

Mark Olson, Manager, Reliability Assessments
Board of Trustees Meeting
November 16, 2022

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About the Report

- 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

Energy Risk Assessment Summary

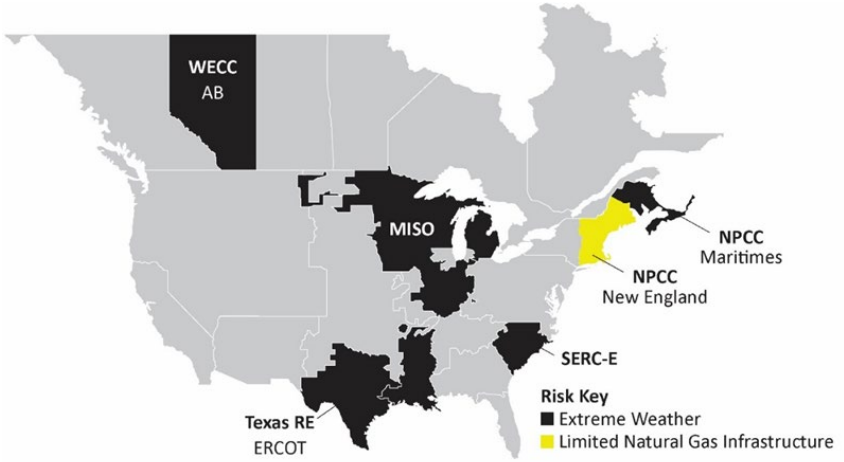
- A large portion of the North American BPS is at risk of insufficient electricity supplies during peak winter conditions
- Factors contributing to reliability risks in affected areas include:
  - Higher peak-demand projections
  - Generator retirements
  - Generator vulnerability to extreme weather
  - 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

Risk Assessment Considerations

- 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 be less than nameplate and determined by historical information
  - Solar resource output at winter peak hour is typically zero

Winter Energy and Capacity Risk Summary

- Texas
  - High generator outages, fuel disruption and volatile demand in extreme cold
- MISO
  - Over 7,800 MW of 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

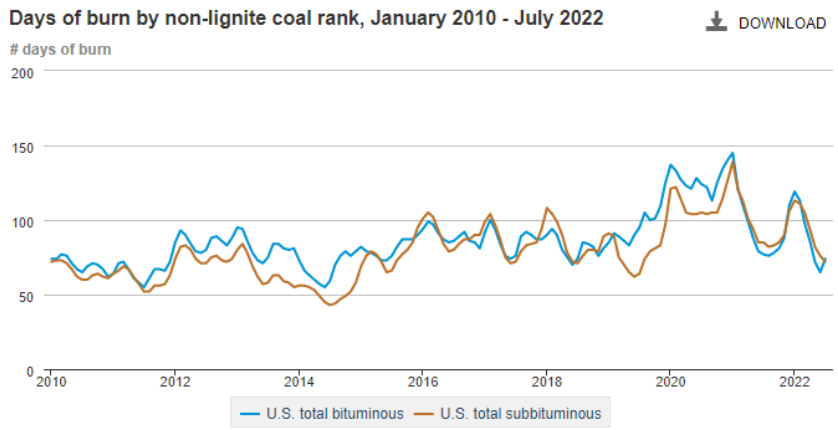


Winter Reliability Risk Map

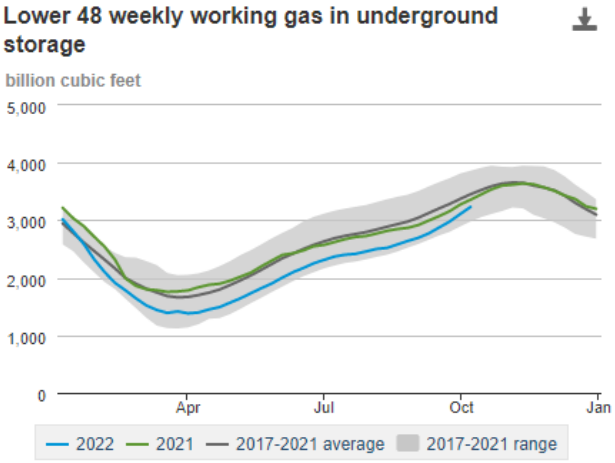
- New England
  - Natural gas supply infrastructure limitations

Fuel Monitoring

- **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



Other Findings

- 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

Key Actions

- **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.

Questions and Answers

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Credential Maintenance Research Project Update

Personnel Certification Governance Committee

Cory Danson, Chair, WAPA

NERC Board of Trustees Meeting

November 16, 2022 | New Orleans, LA

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Problem Statement

- The industry and its regulatory authority are questioning the validity of credential maintenance Continuing Education Hours (CEHs) requirements for recertification NERC Certified System Operators (NCSO)

Project Purposes

Primary Purpose

- Examine credential maintenance practices against literature and other credentialing bodies/ institutions
- Determine what evidence-based changes and/or enhancements should be made to existing NCSO credential maintenance CEH requirements

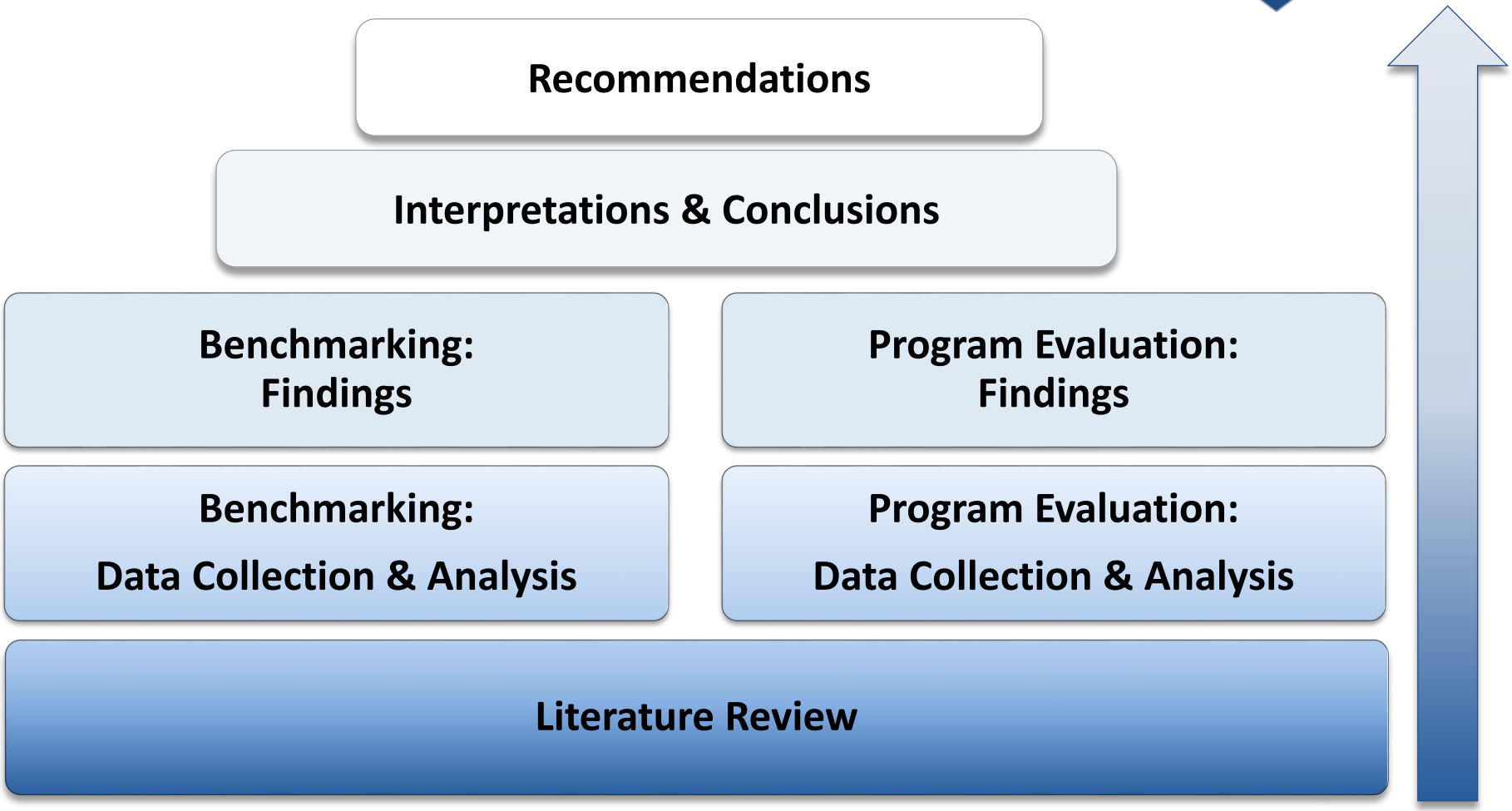
Secondary Purpose

- Determine if there is sufficient evidence to warrant consolidating the existing four NCSO credentials into one credential
- If so, determine the appropriate maintenance requirements for the one credential based on evidence.

Project Approach

- Team Effort
  - EPRI-led project leveraging subject matter experts and contractor strengths
  - NERC Staff
  - Personnel Certification Governance Committee (PCGC) and Credential Maintenance Working Group (CMWG) Task Force
- Fact-Based Approach
  - Literature review, benchmarking, data analysis, surveys, and interviews, etc.

Project Structure



Key Project Phases

Literature Review

- Assess the current state of the research

Data Collection & Analysis

- Historical Analysis
- Benchmarking Study
- Program Evaluation

Reporting of Findings

- Present detailed data resulting from the three analyses

Conclusions

- Compile the findings by evaluation question
- Draw conclusions
- Consider implications

Recommen-dations

- Make specific suggestions for program enhancements

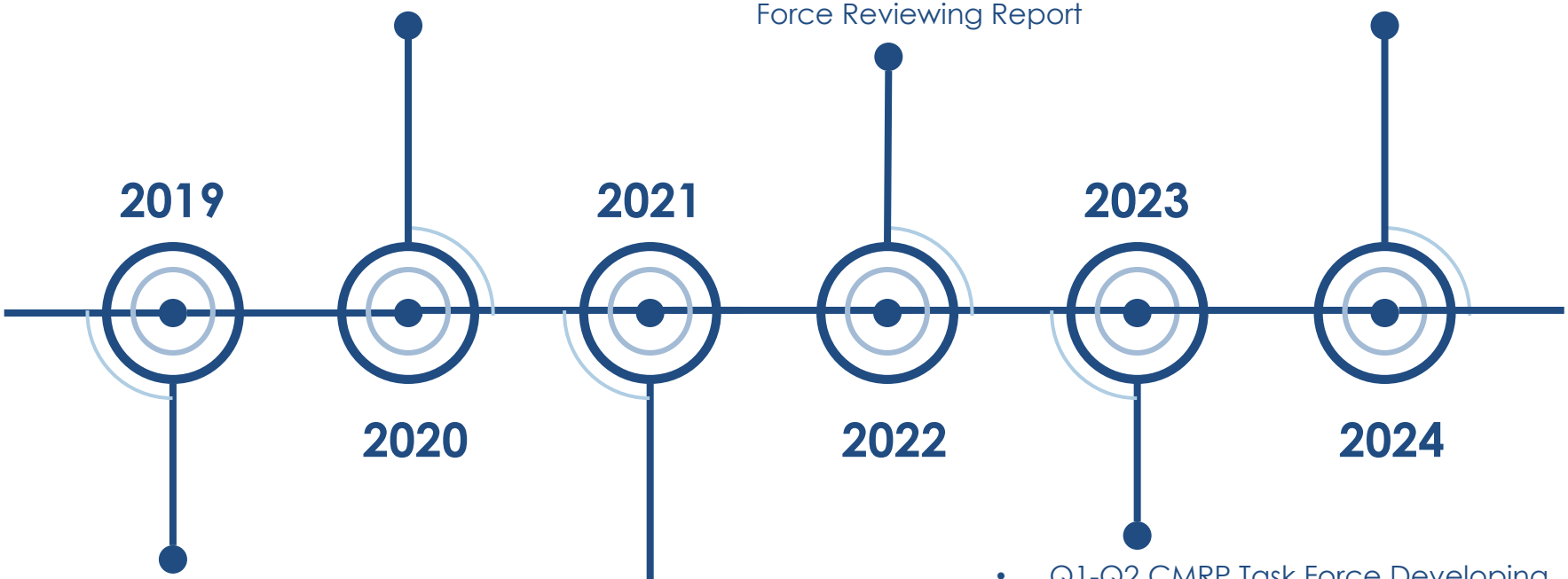
Evaluation Questions

1	• How should the credential maintenance program align with both the certification exam and with knowledge and skills required on the job?
2	• What is the optimum type and number of credentials NERC should offer?
3	• For each credential, what number, unit, and distribution of hours are required to meet the stated program purpose (per Q1)?
4	• For each credential, what categories and levels of subject matter must operators complete in order to meet the stated program purpose (per Q1)?

Major Themes for the Findings

- Facts and data support several possible program improvement ideas
- 19 recommendations developed, which may bring:
  - Higher quality and more effective training
  - Increased focus on operator skills, situational awareness, industry changes

Timeline



- Q1 Posted Credential Whitepaper: Move from Four to One Credential and change CEHs to 140 for One Credential

- Q1 NERC, PCGC, & FERC Discussed Justification to Change CEHs

- Q3 Selected EPRI

- Q1-Q3 EPRI Research, Weekly Meetings with NERC & CMRP Task Force
- Q3 CMRP Final Report, Task Force Reviewing Report

- Q1-Q2 CMRP Task Force Developing Recommendation from Final Report
- Q2 PCGC/CMWG Task Force Recommendation
- Q3-Q4 Outreach with FERC, MRC, and Industry

- Q1-Q2 Develop Implementation Plan and Industry Outreach

Moving Forward

- PCGC and CMWG Task Force
  - Evaluate recommendations
  - Update PCGC and CMWG at November meeting
  - Final recommendation Q2 2023
- NERC and PCGC
  - Evaluate Task Force recommendation
  - Discuss changes with NERC leadership, MRC, and FERC
  - Propose changes and gather industry feedback
  - Begin implementation planning

Questions and Answers

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2022 First Quarter Reliability Indicators

Soo Jin Kim, Director of PRISM
Board of Trustees
November __, 2022

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Indicator 1: Fewer, Less Severe Events

- **Why is it important?**
  - Provides a quantitative measure and trend of actual impacts on the BPS
- **How is it measured?**
  - Count: Number of Category 3 or above events
  - Trend: Statistical test is performed on the five-year cumulative daily event Severity Risk Index (eSRI) for (Category 1–3) events

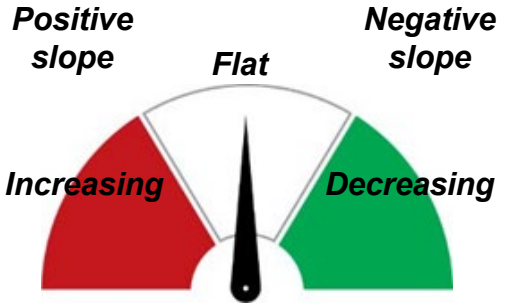
Data (Annual Measurement)

- Threshold: No Category 3 or above events: *Zero is green, else is red*
  - *One Category 3 event in 2022 YTD*

2022 Status

Data (Compared to a 5-year rolling average)

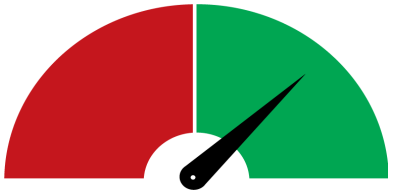
- Slope of eSRI line is flat to decreasing and does not show an increase above zero that is statistically significant (95% Confidence Interval).
- "2022 Status" relates to the slope of the 5 year rolling average (Positive, Flat, or Negative), not just the 2022 performance.



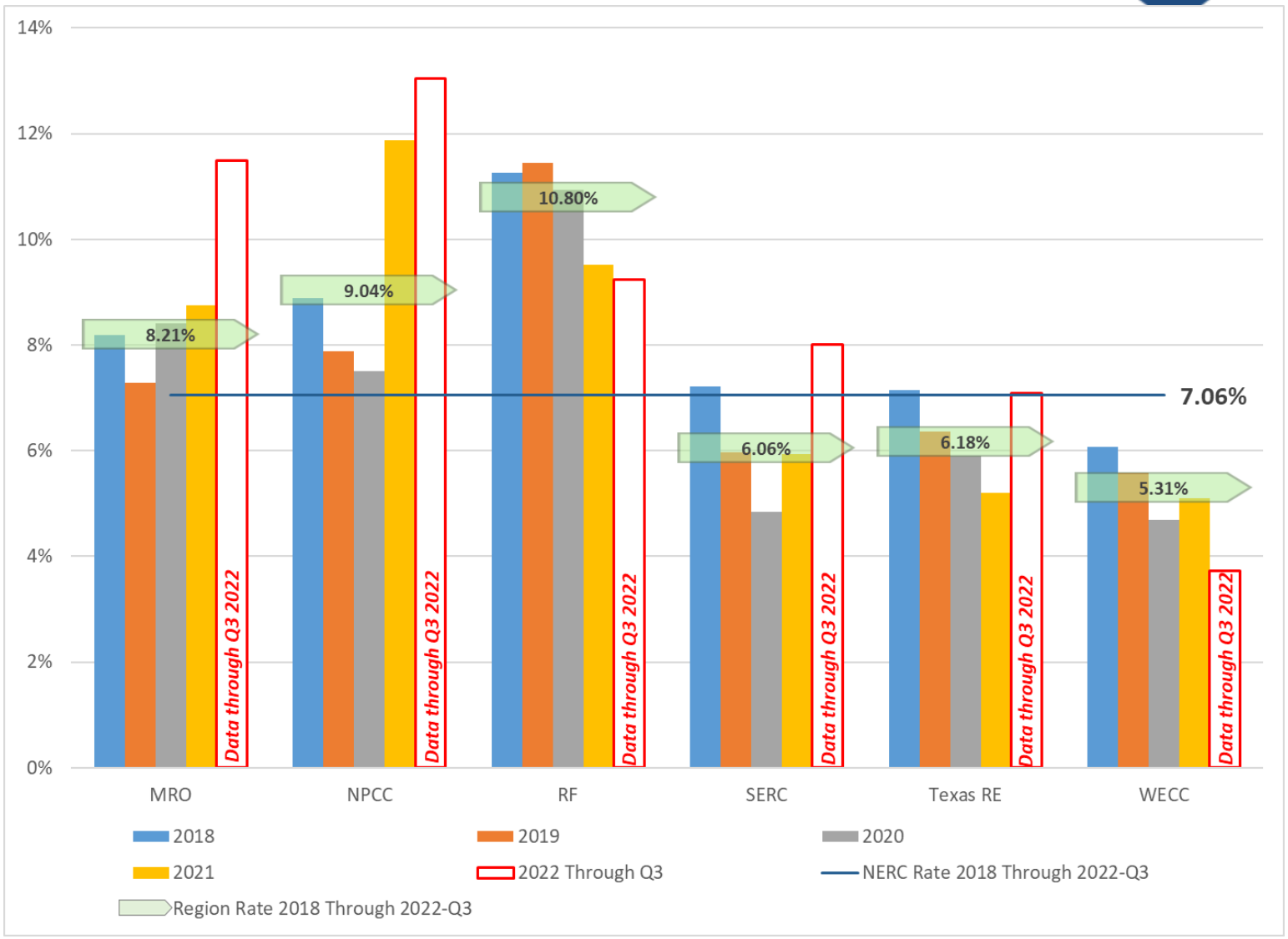
Indicator 2: Compliance Violations

- **Why is it important?**
  - Reduce risk to BPS reliability from Standard violations by registered entities
- **How is it measured?**
  - Moderate and serious risk noncompliance with a relevant history of similar past conduct: 3% of moderate and serious risk violations filed in Q1-Q3 2022 had relevant past conduct.
  - The number of violations discovered through self-reports: 92% of noncompliance submitted in Q1-Q3 2022 were self-reported.
  - Risk to the BPS based on the severity of Standard violations: 9% of the violations filed in Q1-Q3 2022 were assessed as serious risk.
    - *3% of past 5-year filings are assessed as serious risk.*

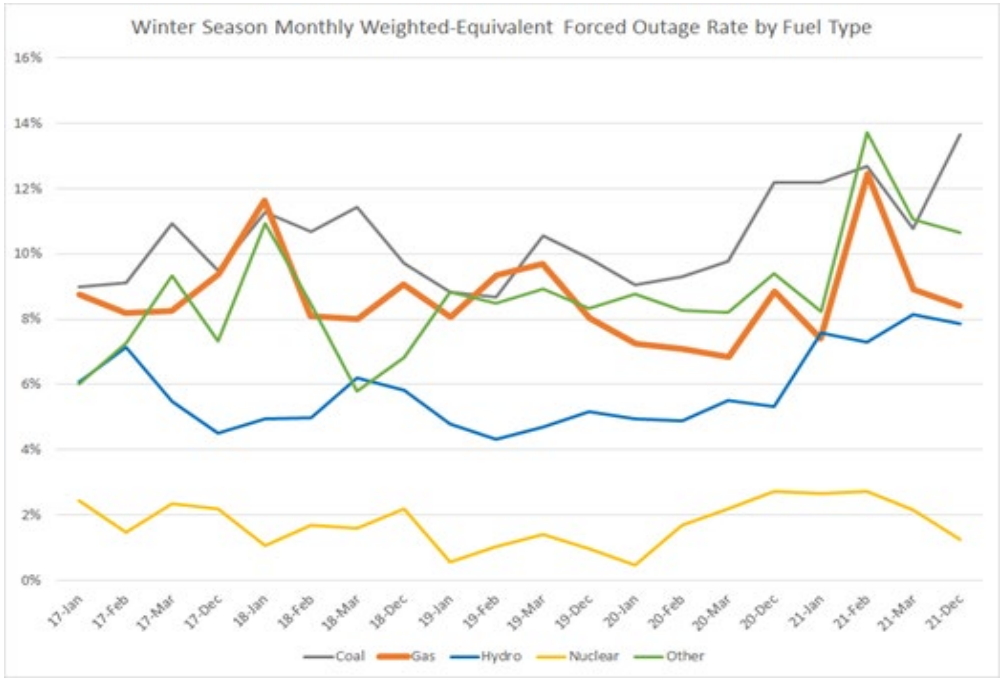
** For additional detail please refer to Q3 2022 CMEP report.*



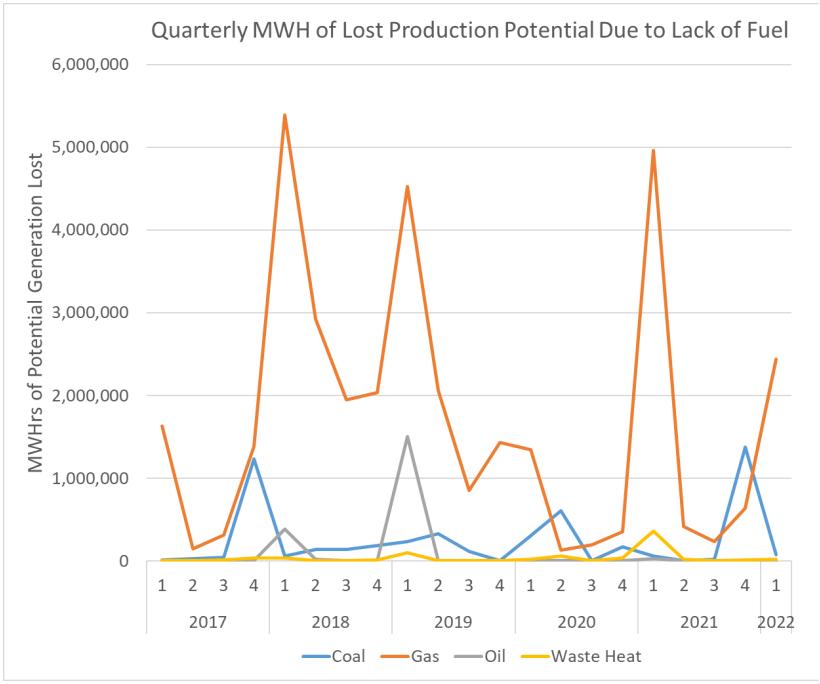
Indicator 3: Protection System Misoperations Rate



Indicator 4: Forced Outage Rate During Cold Weather Months and Potential Production MWH Loss Due to Lack of Fuel

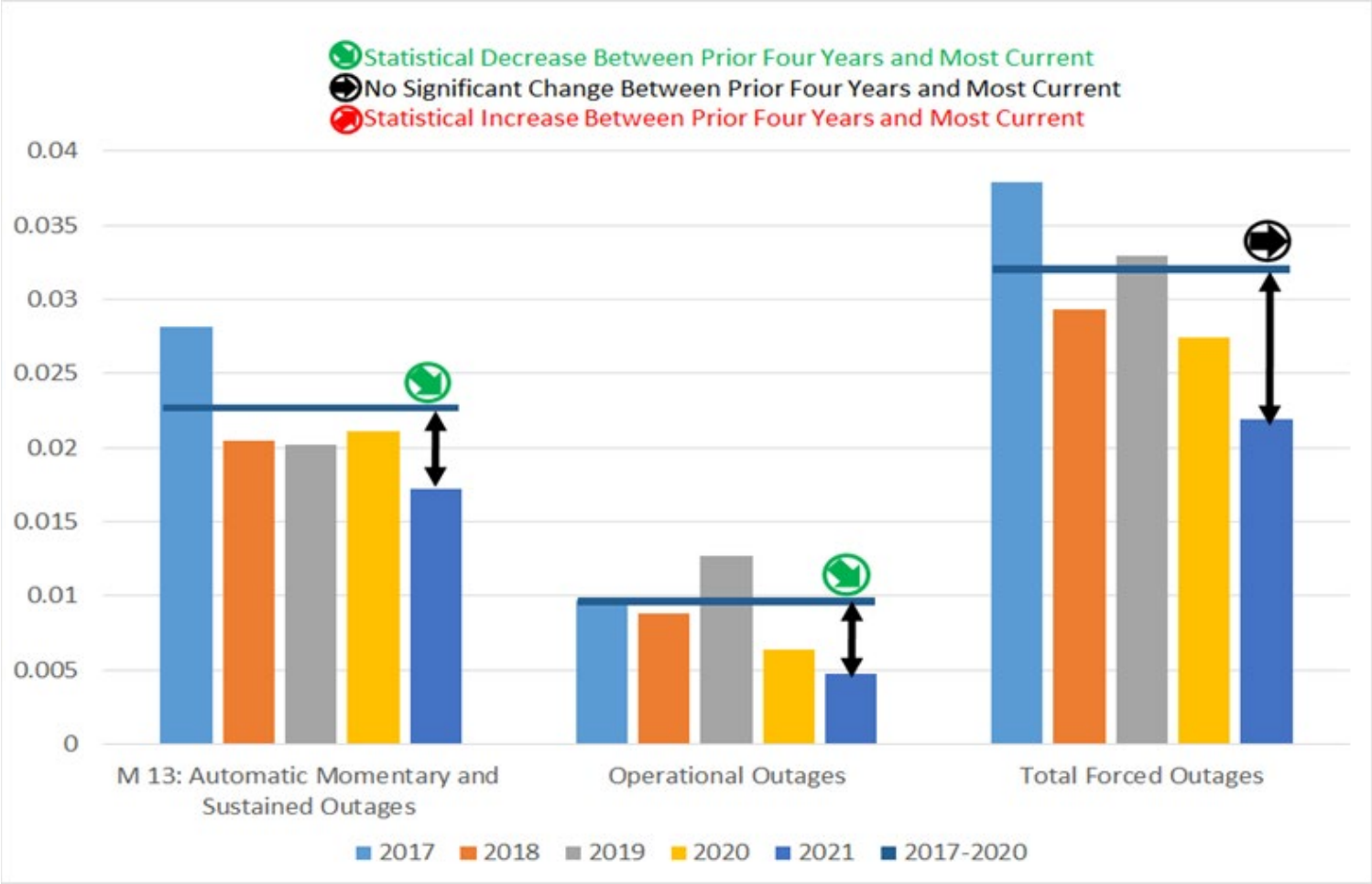


Winter Season Monthly Weighted EFOR by Fuel Type



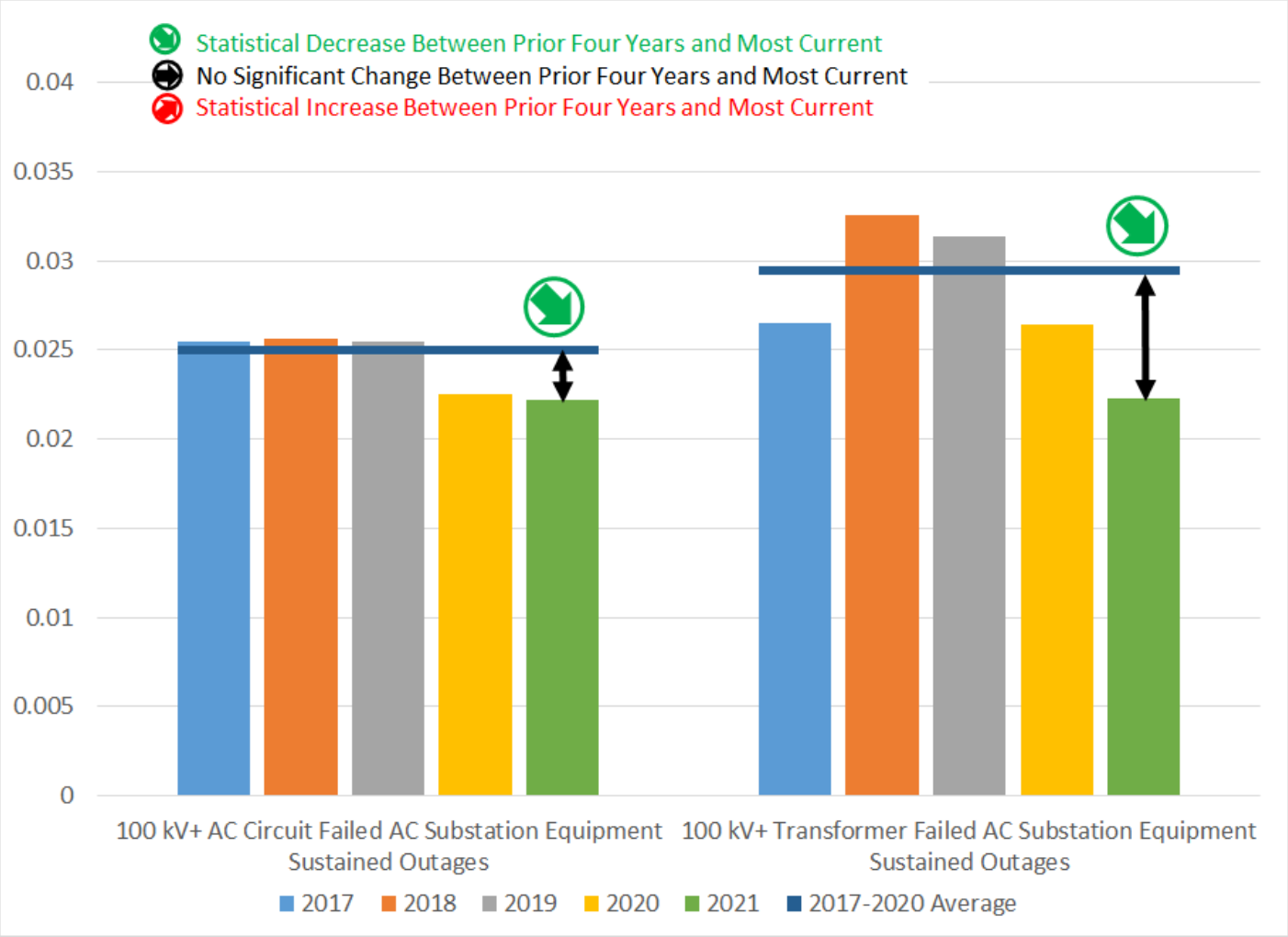
Percent of Potential Production Lost Due to Lack of Fuel

Indicator 5a: Operator or Other Human Performance Issues



Outages Caused by Human Error
AC Circuits

Indicator 5b: Substation Equipment Failures or Failed Circuit Equipment



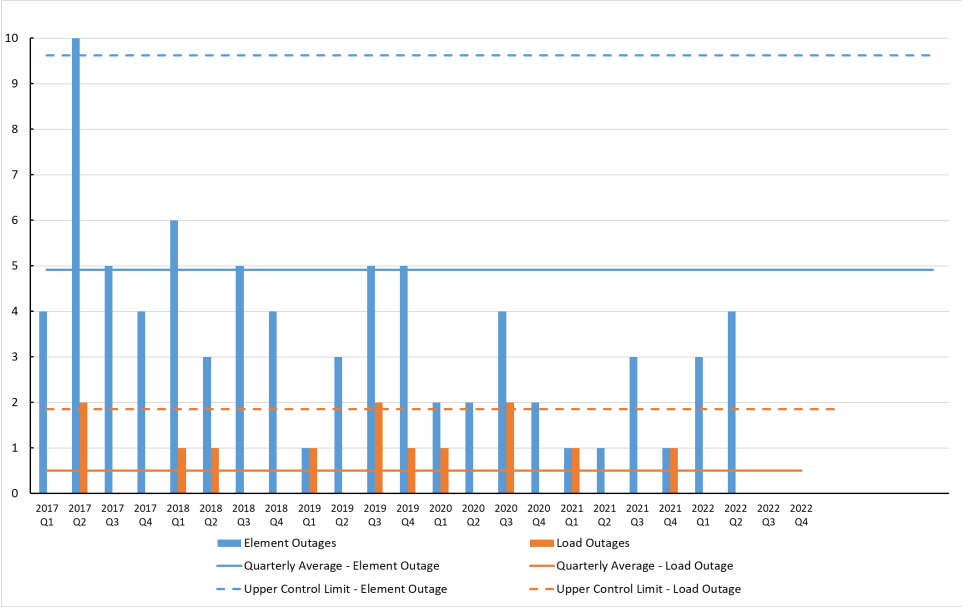
Failed AC Substation Equipment

Indicator 5c: Vegetation Encroachment

- **How is it measured?**
  - Number of vegetation encroachments: No Vegetation encroachment from inside of the right-of-way was reported to NERC during Q1-Q3 2022.

Security Indicator 6 : Impactful Cyber and Physical Security Incidents

- **How is it measured?**
  - Number of applicable DOE OE-417 Electric Emergency Incident and Disturbance Reports and NERC EOP-004 Event Reports



Data (Compared to 2016-2018 Quarterly Baseline)

- No disruption* of BES operations due to cyber security incidents
  Zero disruptions of BES operations due to cyber attacks in 2022 Q3
- Number of disruptions* of BES operations due to physical security incidents: *Below baseline Upper Control Limit is green, else is red*
  Zero disruptions of BES operations (Zero with load loss) due to physical attacks in 2022 Q3

*A disruption means that a BES element was removed from service as a result of the cyber or physical incident

2022 Status

Cyber Security

Physical Security

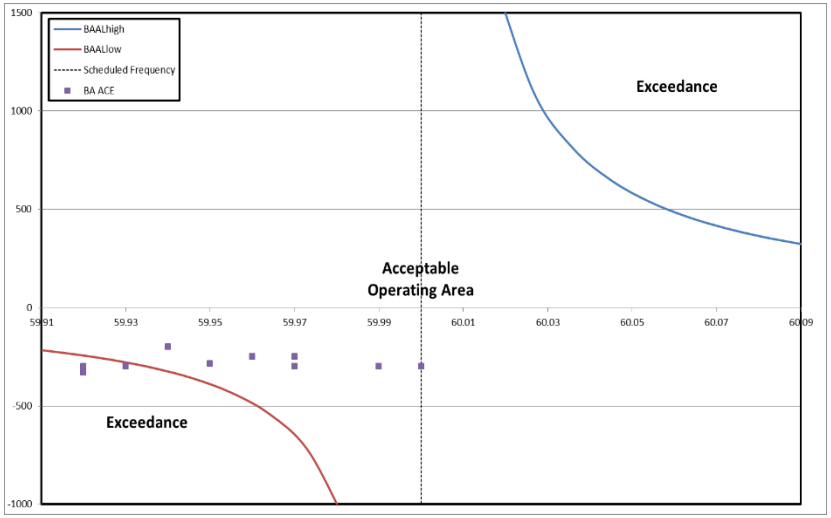
Indicator 7: Real Power Balancing Control Performance (BAAL)

Why is it important?

Each Balancing Authority (BA) is required to operate such that its clock-minute average of reporting area control error (ACE) does not exceed its clock-minute BA ACE limit (BAAL) for more than 30 consecutive clock-minutes. The purpose of this metric is to measure risk to the BPS by monitoring the trend in the number of clock minutes in which BAs return their ACE to within their BAAL after an exceedance has occurred.

How is it measured?

Success (green) is achieved when the linear regression line of the most recent four years of quarterly BAAL exceedances greater than or equal to 15 clock minutes has a statistically significant negative slope or when the slope of the time trend is statistically neither increasing nor decreasing. This equates to either improvement or no decline in performance. Failure (red) occurs if slope of the time trend is increasing with statistical significance.



Indicator 8: Interconnection Frequency Response

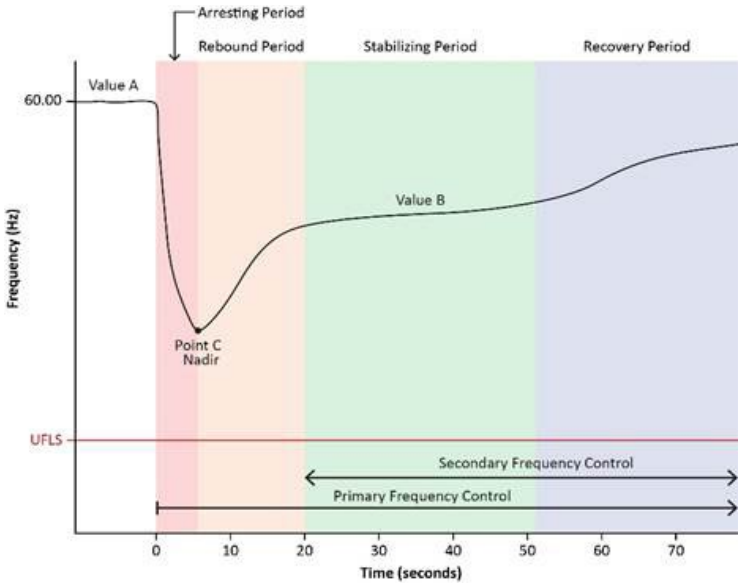
Why is it important?

Measures risk and impact to the BPS by evaluating the trend in the magnitude of the decline in Interconnection frequency experienced in each Interconnection during low frequency events selected for BAL-003-2 compliance. The Indicator will evaluate whether the risk of activating under frequency load shed devices is increasing or decreasing.

How is it measured?

EI, WI, QI, TI

Success (green) is achieved when the linear regression line of the most recent four years of quarterly mean values of Frequency A minus Frequency C has a statistically significant negative slope or when the slope of the time trend is statistically neither increasing nor decreasing. This equates to either improvement or no decline in performance where Interconnection risk has not changed or declined. Failure (red) occurs if the slope of the time trend is increasing with statistical significance or if under frequency load shedding is activated for any single BAL-003 frequency event in any Interconnection.



Indicator 8: Interconnection Frequency Response

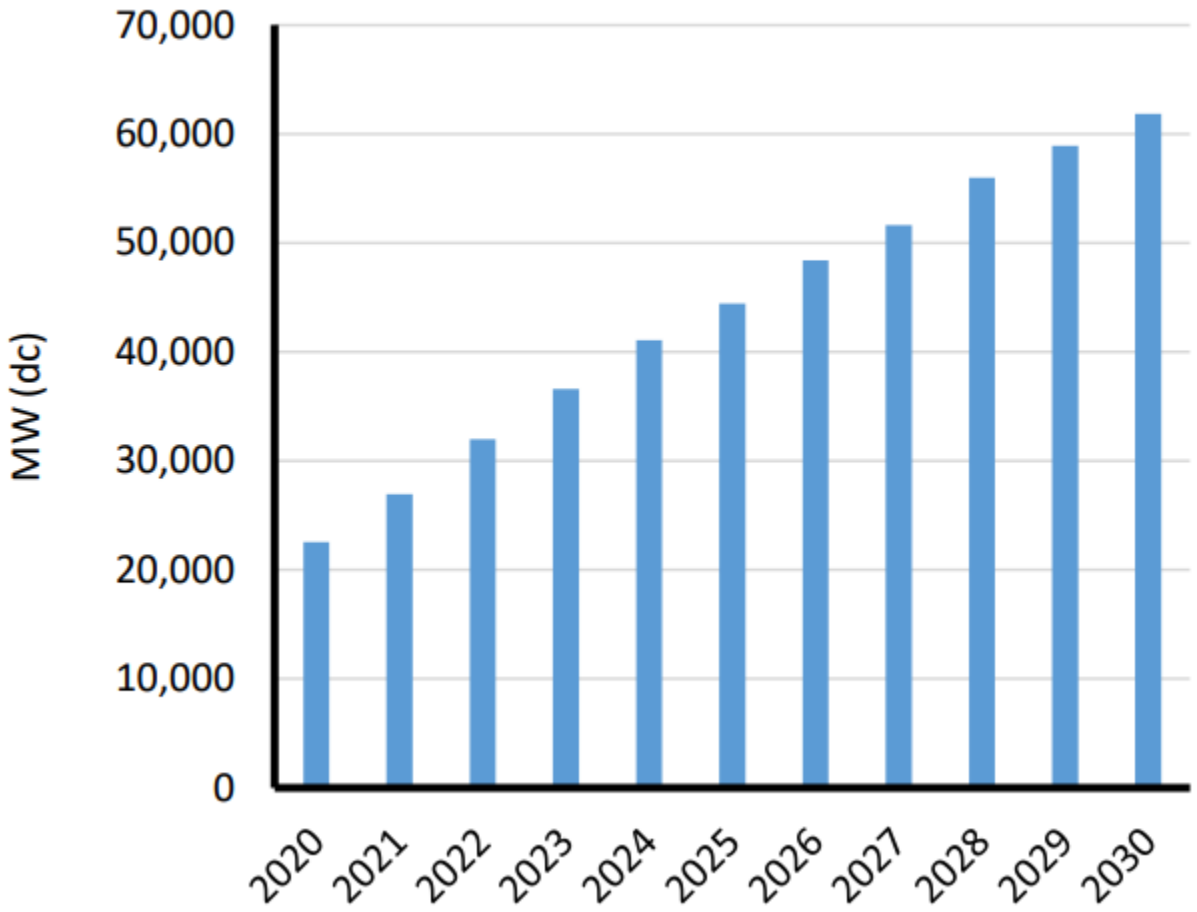
- **Why is it important?**
  - Measures risk and impact to the BPS by measuring the interconnection frequency response performance measure (IFRM) for each BAL-003-2 event as compared to the Interconnection Frequency Response Obligation (IFRO)
- **How is it measured?**
  - IFROs are calculated and recommended in the Frequency Response Annual Analysis Report for Reliability Standard BAL-003-2.1 implementation
  - IFRM performance is measured for each event by comparing the resource (or load) MW loss to the frequency deviation
  - Due to the timing in selection of events the metric is updated one quarter in arrears.

Data (Quarterly & Annual Measurement), NEW

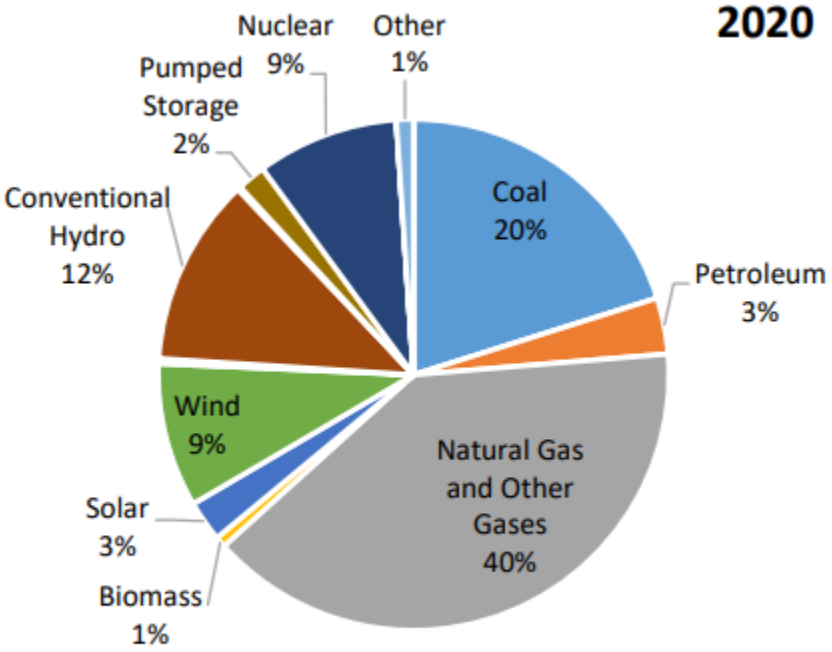
- IFRM for each BAL-003-2 event is compared to the IFRO for each quarter of the 2021 operating year
- Success is no Interconnection experiencing a BAL-003-2 frequency event where IFRM performance is below their respective IFRO: *Zero is green, else is red*
- **Metric Results through 1Q22:** No Interconnection experienced a BAL-003-2 event where their IFRM was below their IFRO

2022 Status

Indicator 9: DER Penetration



Indicator 10: Measure of the Changing Resource Mix



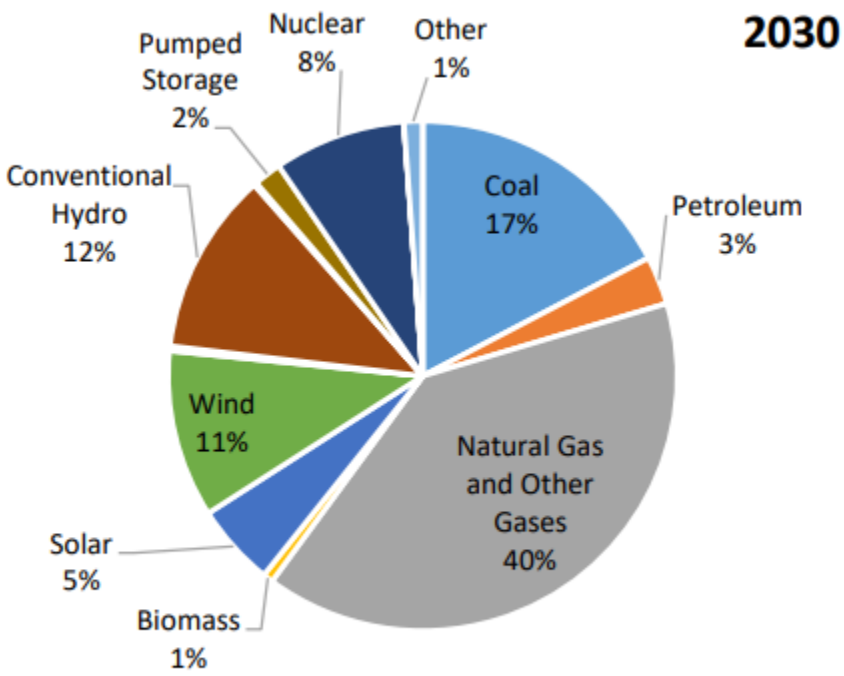


Figure 33: Installed Nameplate Capacity by Fuel Mix Trend (Includes Future Tier 1 Resources)

Indicator 10: Measure of the Changing Resource Mix

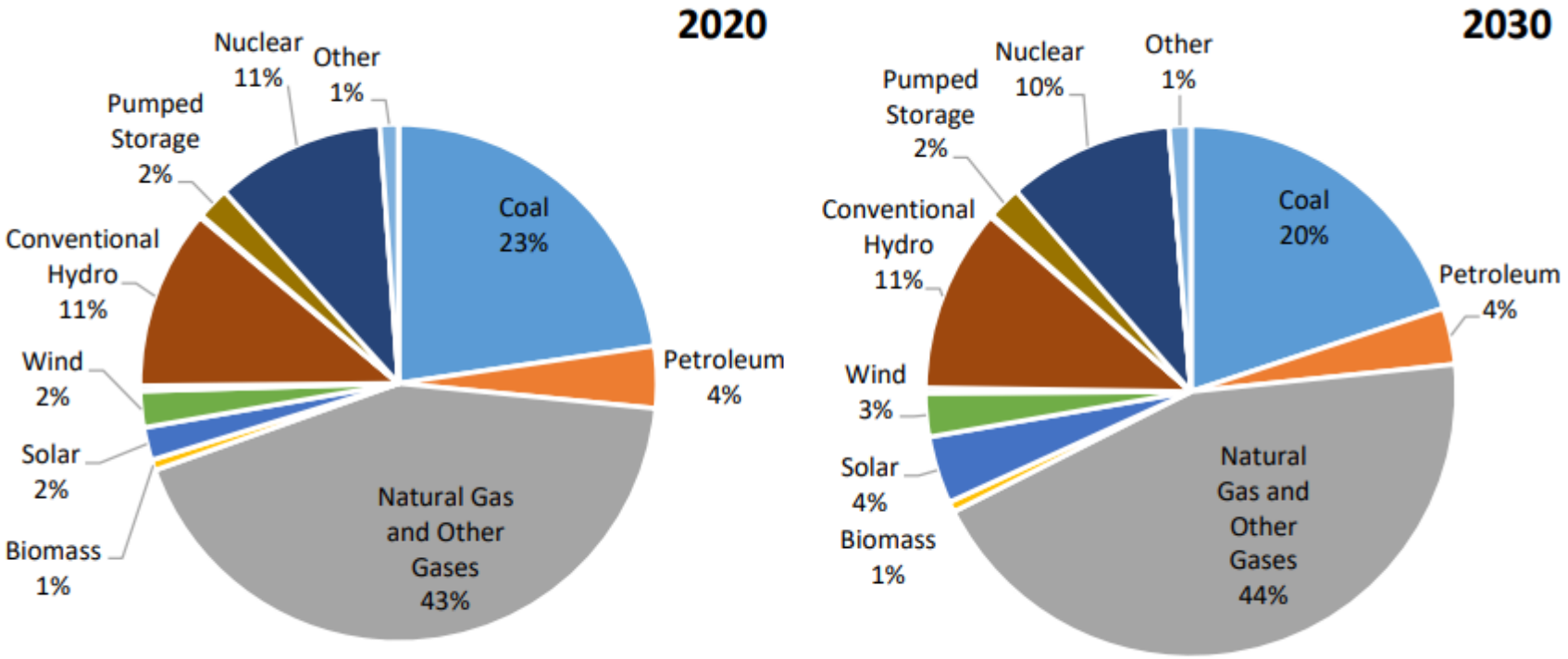


Figure 34: Installed On-Peak Anticipated Capacity Trend by Fuel Mix

Questions and Answers