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NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Standards Actions

Howard Gugel, Vice President of Engineering and Standards
Board of Trustees Meeting
February 4, 2021

RELIABILITY | RESILIENCE | SECURITY




FAC-008-5

- Project 2018-03 Standards Efficiency Review Retirements
  - FAC-008-4 – Facility Ratings
    - Adopted by BOT on May 9, 2019
    - Filed with FERC on June 7, 2019
  - FERC Issued Order No. 873 on September 17, 2020
  - SER SDT developed FAC-008-5
    - FAC-008-5 retires Requirement R7 of FAC-008-3; and
    - FAC-008-5 retains Requirement R8 of FAC-008-3
- Action
  - Adopt FAC-008-5 – Facility Ratings

CIP-002-6

- Proposed Reliability Standard CIP-002-6
  - Proposes revisions to criterion designating BES Cyber Systems at certain Control Centers as medium impact
  - Adopted by BOT on May 14, 2020
  - Filed with FERC on June 12, 2020
  - Recent cybersecurity events prompt NERC Staff to gather more data prior to permitting more BES Cyber Systems to become low impact
- Action
  - Withdraw CIP-002-6 – Cyber Security – BES Cyber System Categorization

SERC Regional Reliability Standard Development Procedure

- Background
  - Updated references to the Executive Committee(s)
  - Updated references to the SERC Board of Directors
  - Added abbreviations to maintain consistency
- Action
  - Approve SERC Regional Reliability Standard Development Procedure

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Supply Chain Update

RELIABILITY | RESILIENCE | SECURITY




Current Activity

- Standard development
  - Electronic Access Control and Monitoring System and Physical Access Control System (complete in 2020)
  - Low impact BES Cyber Assets
- NERC Alerts
  - 2020 – Generation and transmission assets (Level 2)
  - 2020 - Advanced APT Supply Chain Threats (Level 2)
  - 2021 - Prohibition Order Securing Critical Defense Facilities (Level 1)
- Industry partnerships
  - NATF work on certifications
  - Vendor work with DoE

Supply Chain Outreach

- NERC CA Continues to assist Regional Entity Support/Outreach
  - SERC Spring Workshop (March 2020)
  - Supply Chain Working Group Guidelines – webinars (March - May 2020)
  - RF Fall Workshop (August 2020)
  - ERO Enterprise Internal Call on Audit Approaches
- Compliance and Certification Committee
  - Supply Chain Task Force
    - *"..will execute the CCC role to address potential concerns with industry readiness for the upcoming enforcement of the Supply Chain Risk Management."*

Low Impact Study

- FERC Directive - *".. direct NERC to conduct a study to assess the implementation of Reliability Standard CIP-003-7."*
  - Determine whether the electronic access controls provide adequate security
  - Due 18 months after CIP-003-7 effective date (July 2021)
- Regional Entities collecting data throughout 2020
  - COVID-19 Impact
  - Already started receiving data
  - Engagements throughout 2020 and 1Q 2021
- All data collected by end of Q1 2021
- Draft report ~June 2021

Supply Chain Pilot Project

- Coordinator: BPS Security and Grid Transformation
  - Independent of and unrelated to CIP compliance activities
- Understand pervasiveness of equipment manufactured by Chinese telecommunication companies
  - Questionnaire based on FERC-NERC joint staff white paper
  - Provide better understanding of the potential risks to security and reliability of the BPS.
- Representative cross section of industry

Supply Chain Working Group

- Webinars on Security Guidelines
  - Risk Considerations for Open Source Software
  - Cyber Security Risk Management Lifecycle
  - Vendor Identified Incident Response Measures
  - Secure Equipment Delivery
  - Vendor Risk Management Lifecycle
  - Procurement Language
  - Provenance
  - Risks Related to Cloud Service Providers

Recent events

- ERO staff evaluating standards for effectiveness and gaps
- CIP drafting team addressing virtualization
  - Zero-trust model
  - Addresses system-to-system communication
  - Also evaluating standards for gaps
- ERO staff evaluating events

Questions and Answers

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Framework to Address Known and Emerging Reliability and Security Risks

Mark Lauby, Senior Vice President & Chief Engineer

Board of Trustees Meeting

February 4, 2021

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Declaration & Problem

- *Declaration:*

  The Electric Reliability Organization (ERO) Enterprise requires a consistent framework to address and prioritize known and emerging reliability risks

- *Problem Statement:*
  - ERO Enterprise has continued to lead industry in reliability and security initiatives to identify known and emerging risks, and their mitigation
  - The reliability toolkit for risk mitigation the ERO currently deploys includes, for example: webinars and conferences, lessons learned, Alerts, Guidelines, and standard development
  - A framework is needed that provides a transparent process using industry and ERO Enterprise experts
  - Framework must include: risk identification, deployment of mitigation strategies, to monitoring the success of these mitigations

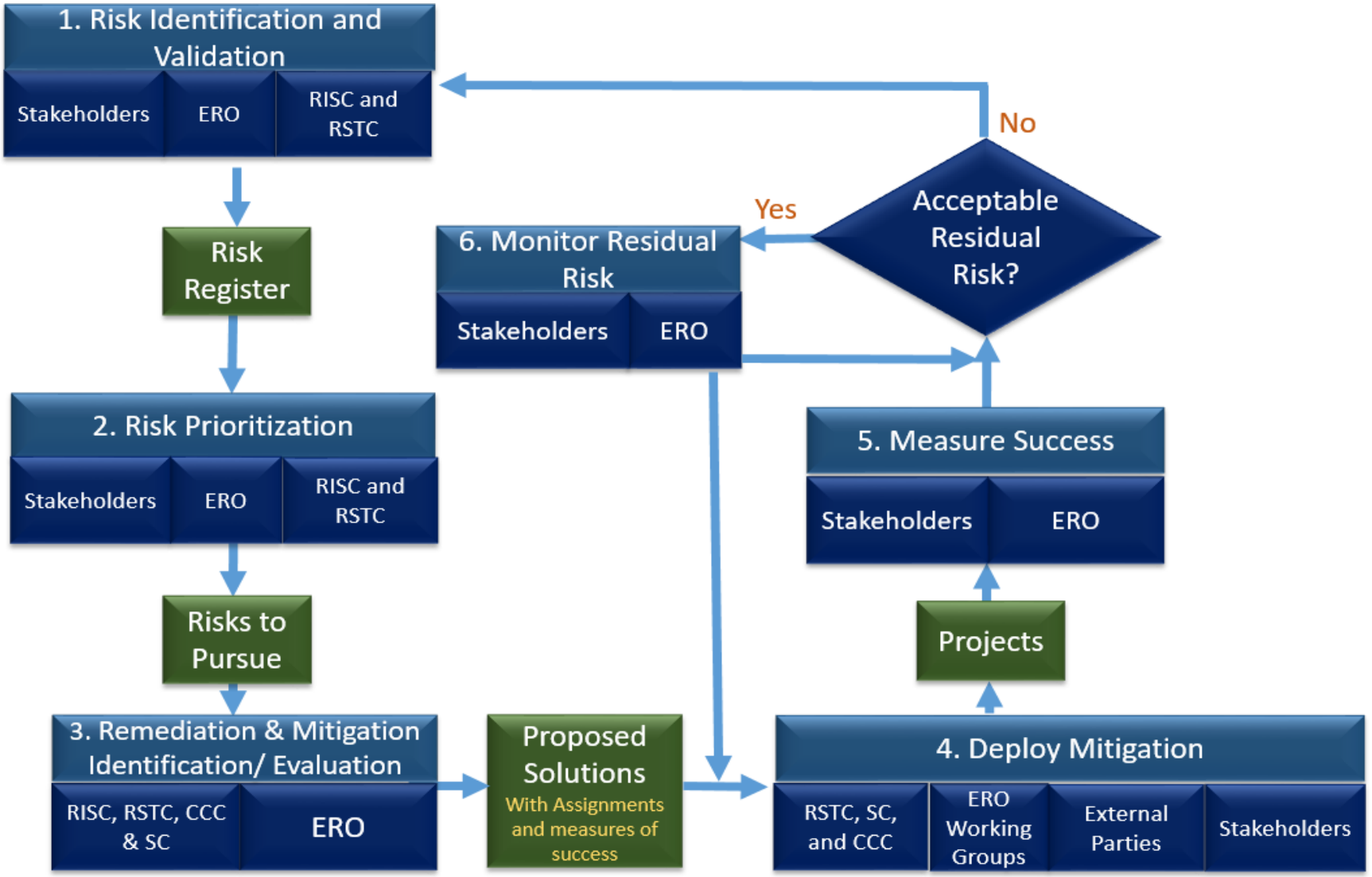
Iterative Six-Step Framework

1. Risk Identification
2. Risk Prioritization
3. Mitigation Identification and Evaluation
4. Mitigation Deployment
5. Measurement of Success
6. Monitor Residual Risk

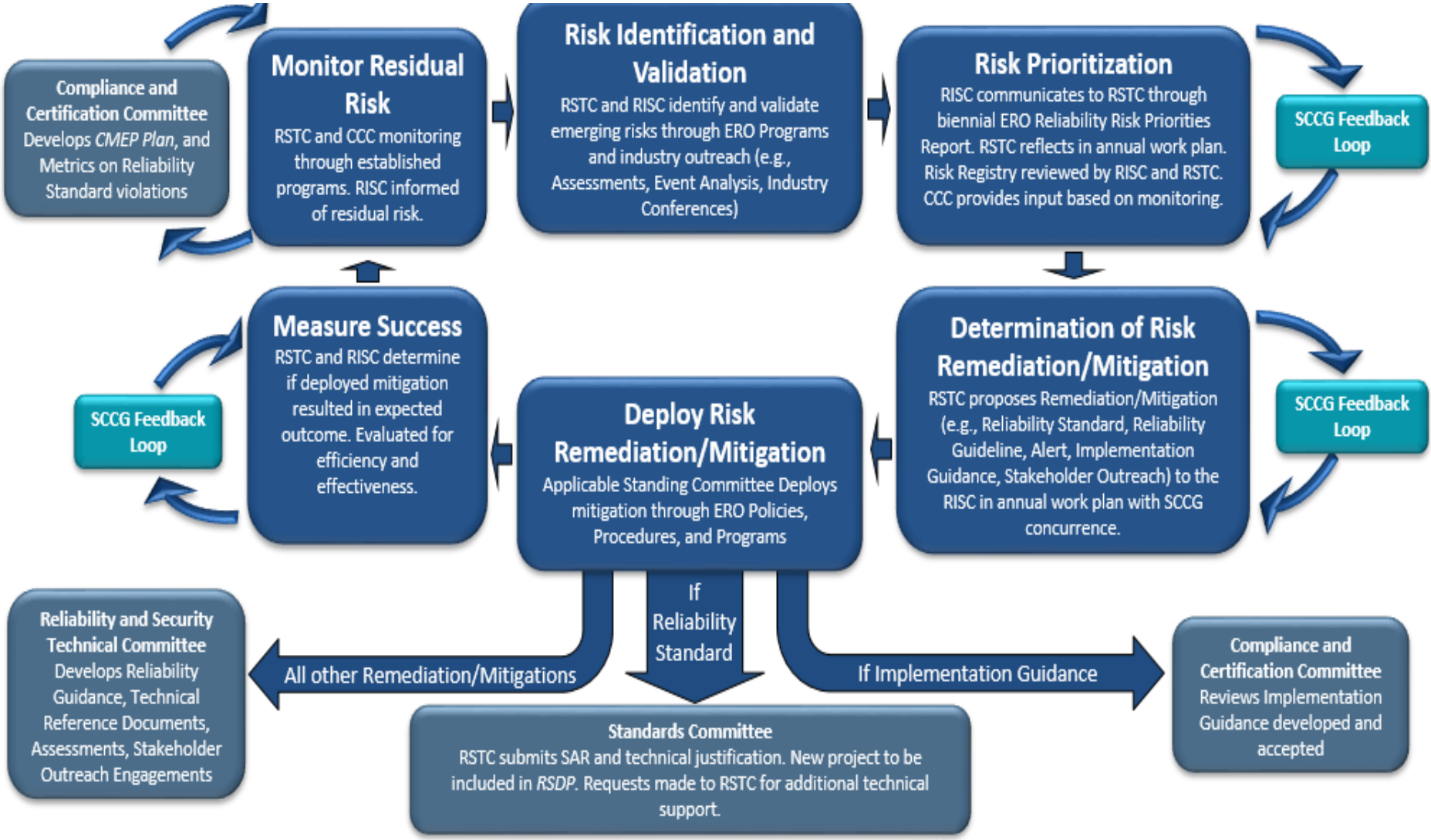
ERO Policies, Procedures, and Programs

1. **Reliability Standards, Assurance, and Enforcement:** sustained risks with moderate impacts that are likely, and high impacts, whether likely or unlikely
2. **Reliability Guidelines:** moderate impact sustained risks that are unlikely, and low impact sustained risks that are unlikely or likely
3. **Technical Engagement:** risks or one-and-done activities with low impacts, whether likely or unlikely
4. **Reliability Assessments:** longer or short-term risks, whether likely or unlikely
5. **Alerts:** sharing information, especially time-sensitive information, to request action or direct action

Monitor Residual Risk



Standing and Administrative Committee Coordination



Reliability Tools: Risk Likelihood and Impact

Electric Reliability Organization: Reliability Risk Mitigation Toolkit

Identifying Solutions to Emerging Reliability Issues

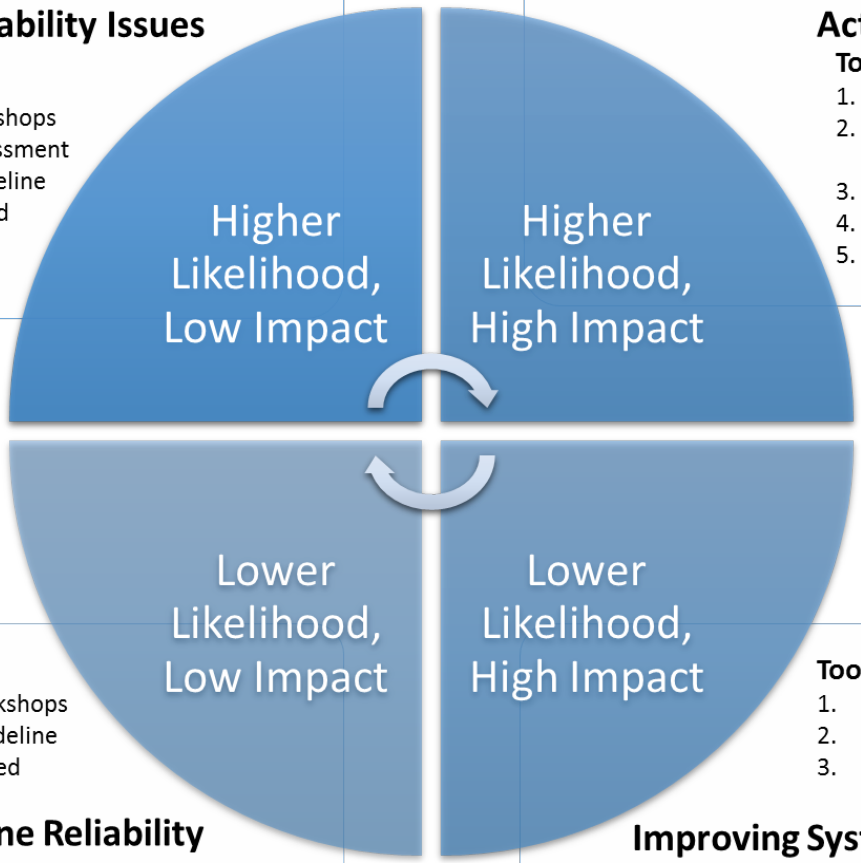
Tools:

1. Technical Workshops
2. Reliability Assessment
3. Reliability Guideline
4. Lessons Learned
5. Assist Visits
6. Advisories

Targeted Awareness and/or Action Campaign

Tools:

1. SA/RC Hotline
2. E-ISAC Critical Broadcast System
3. NERC Alerts
4. Reliability Standard
5. Assist Visits



Tools:

1. Technical Workshops
2. Reliability Guideline
3. Lessons Learned

Robust Baseline Reliability Requirements

Tools:

1. Reliability Guideline
2. Reliability Standard
3. Analysis of Major Events

Improving System Resilience to Extreme Events

*Likelihood is Likelihood of an "Adverse Reliability Impact"

Risk Management Timeframe

Electric Reliability Organization: Reliability Risk Mitigation Toolkit

Reliability Guideline

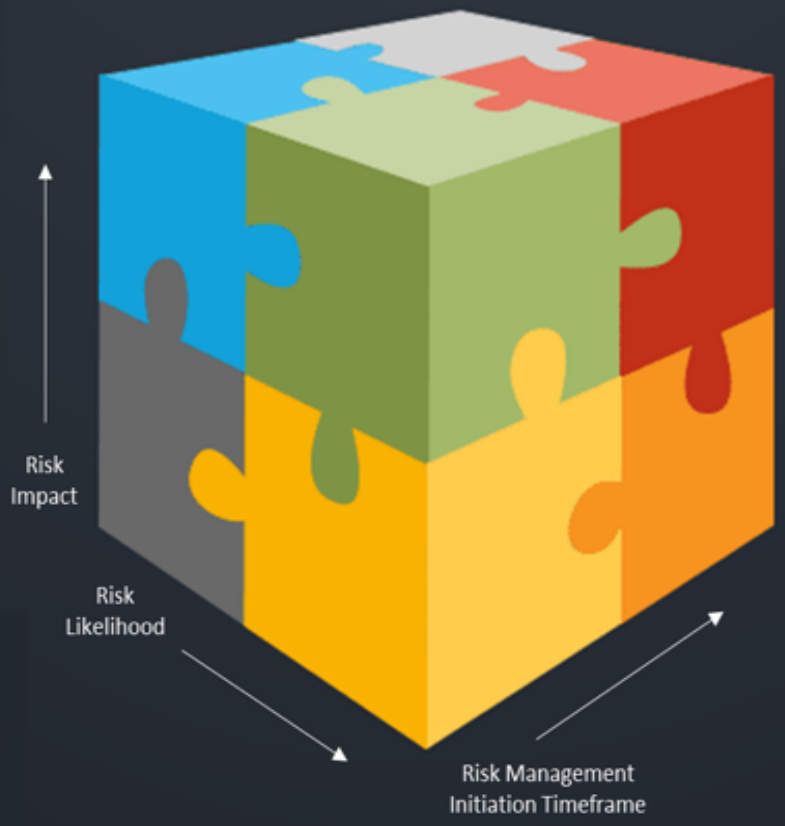
Suggested approaches or behavior in a given technical area for the purpose of improving reliability. Guidelines are not enforceable, but may be adopted by a responsible entity in accordance with its own policies, practices, and conditions.

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.



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.

Questions and Answers

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2020 ERO Enterprise Reliability Indicators

Year End Status

Howard Gugel, Vice President of Engineering and Standards
Board of Trustees Meeting
February 4, 2021

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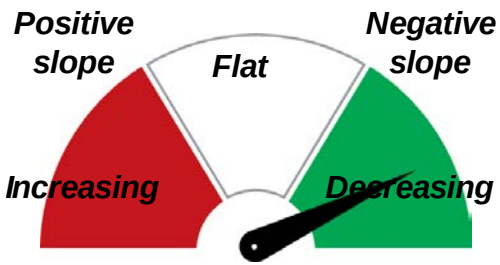
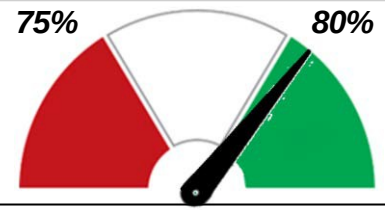
Reliability Indicator 1: Fewer, Less Severe Events

- **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*	**2020 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). ▪ "2020 Status" relates to the slope of the 5-year rolling average (Positive, Flat, or Negative), not just the 2020 performance.	

Reliability Indicator 2: Compliance Violations

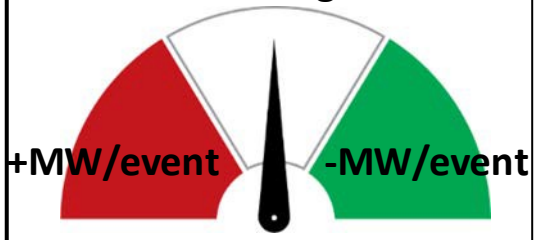
- **Why is it important?**
  - Reduce risk to BPS reliability from Standard violations by registered entities
- **How is it measured?**
  - Moderate and serious risk noncompliance with a relevant history of similar past conduct*
  - The number of violations discovered through self-reports, audits, etc.
  - Risk to the BPS based on the severity of Standard violations

Data (Annual Measurement) ▪ Percent moderate and serious risk violations with relevant compliance history of similar past conduct compared with total noncompliance filed with FERC--- 1%	**2020 Status** 
Data (Annual Measurement) ▪ Percent of noncompliance self-reported (Self-certified noncompliance is not included) ----Current number is 82%	
Data (Compared to a 3-year rolling average) ▪ The number of serious risk violations resolved compared to the total noncompliance resolved --- Current number is 1.4%	

* To measure the effectiveness of the risk-based CMEP in reducing noncompliance, NERC reviews moderate and serious risk violations and includes them in one of three categories: 1) noncompliance with no prior compliance history; 2) noncompliance with prior compliance history that does not involve similar conduct; and 3) noncompliance with compliance history that includes similar conduct.

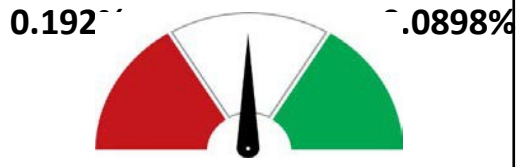
Reliability Indicator 3: Protection System Misoperations Rate

- **Why is it important?**
  - Protection system misoperations exacerbate the impacts
- **How is it measured?**
  - Annual Misoperations rate and the annual loss of load for events with misoperations

Data (Year-Over-Year Comparison) ▪ Q3-Q2 comparison misoperations rate based on collection interval (95% Confidence Interval) (Based on 2018 Metric) ▪ *Includes five years: Q3 2015 through Q2 2020*. Five-year average: 7.87%* ** Data for Q4 2020 not available until Q1 2021. Includes reports through Q3 2020.*	**2020 Status** 
Data (Year-Over-Year Comparison) ▪ Q3-Q2 comparison for qualified events with misoperations and loss of load (load loss/number of events) during the collection interval (95% Confidence Interval)	**No Change** 

RI 4: Events Caused by Gas-Fired Unit Forced Outages Due to Cold Weather or Gas Unavailability

- **Why is it important?**
  - Reduce risk to BPS reliability due to gas-fired unit outages during cold weather or gas unavailability
- **How is it measured?**
  - Firm load loss due to cold weather or gas unavailability
  - MWh of potential production lost initiated by cold weather and gas unavailability

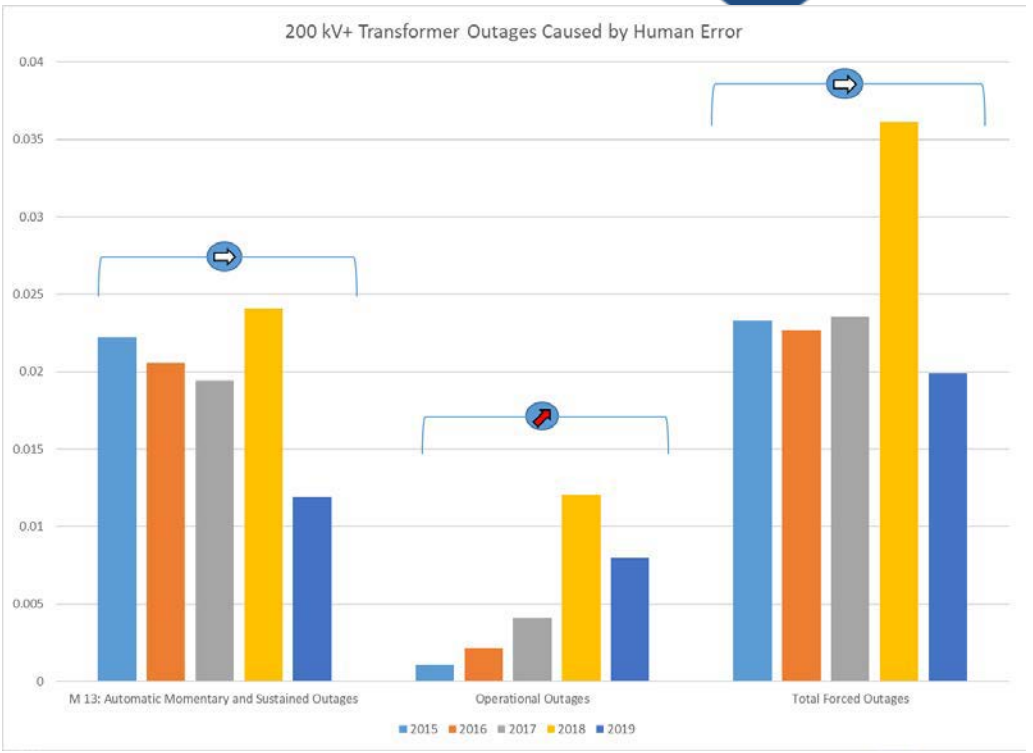
Data (Annual Measurement) ▪ No firm load loss due to gas-fired unit outages during cold weather: *Zero is green, else is red* (Cold weather months: January – March and December of the same calendar year) *As of 12/31/2020, Metric status is Green.*	**2020 Status** 
Data (Annual Measurement) (Match with 4.4, year defined as Q3-Q2) ▪ No firm load loss due to gas unavailability: *Zero is green, else is red* *As of 12/31/2020, Metric status is Green.*	
Data (Compared to a 5-year rolling average) ▪ Percentage of winter period net MWh of potential production lost due to gas-fired unit outages during cold weather (Cold weather months: January – March and December of the same calendar year) *Five-year average: 0.0058%*	
Data (Compared to a 5-year rolling average) ▪ Percentage of annual net MWh of potential production lost due gas unavailability compared to a 5-year rolling average (Due to data availability, year defined as Q3-Q2) *Five-year average: 0.1513%*	

Reliability Indicator 5: Reduce AC Transmission Line Forced Outages

- **Why is it important?**
  - Measures risks to BPS reliability from three priority causes:
    1. Operator or other human performance issues
    2. Substation equipment failures or failed circuit equipment
    3. Vegetation encroachment

Reliability Indicator 5a: Operator or Other Human Performance Issues

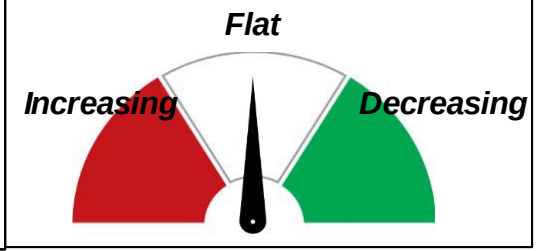
- **How is it measured?**
  - Number of transmission line outages caused by Human Error divided by the total inventory of circuits



Data (Compared to a 5-year rolling average)

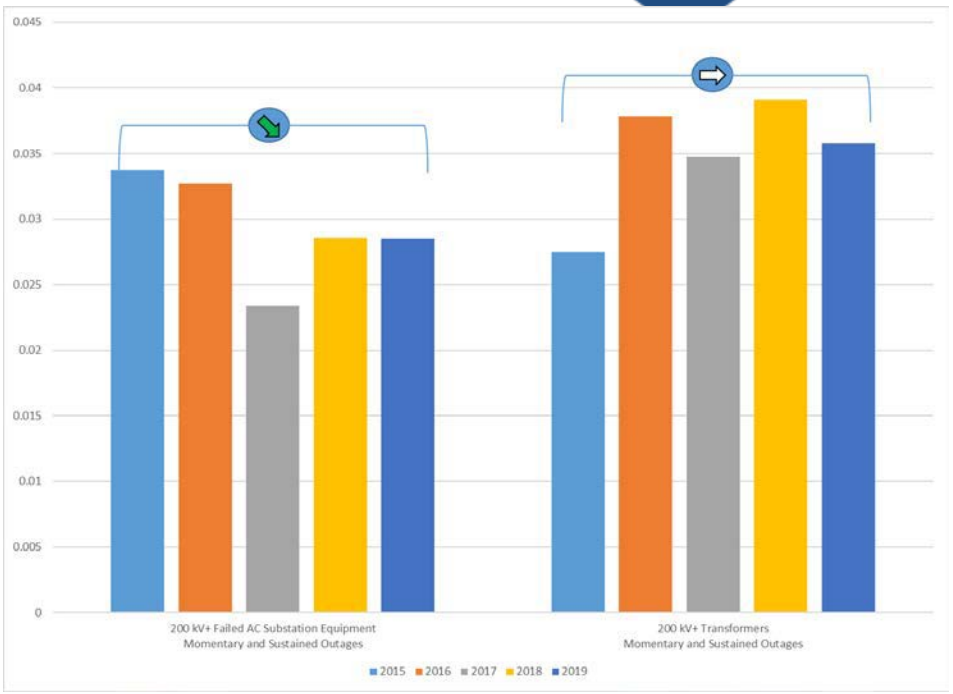
- Annual outage rate flat compared to a 5-year rolling average (95% Confidence Interval)

2019 Status



Reliability Indicator 5b: Substation Equipment Failures or Failed Circuit Equipment

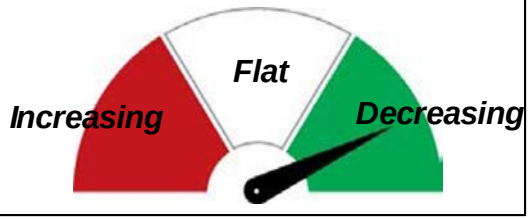
- **How is it measured?**
  - Number of transmission line outages caused by AC substation equipment outage failures and failed AC circuit equipment (such as transformers), divided by the total inventory of circuits



Data (Compared to a 5-year rolling average)

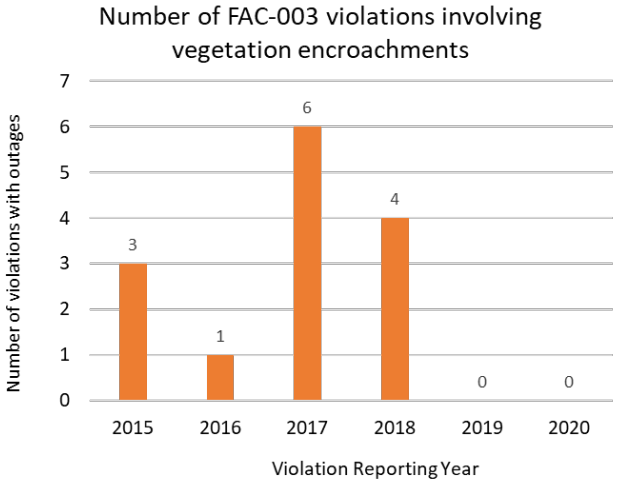
- Annual outage rate decreasing compared to a 5-year rolling average (95% Confidence Interval)

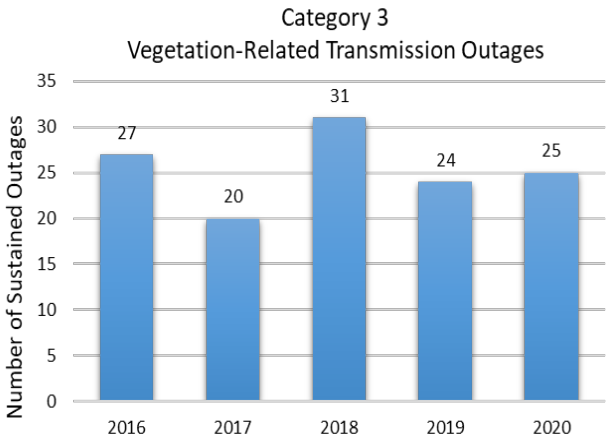
2019 Status



Reliability Indicator 5c: Vegetation Encroachment

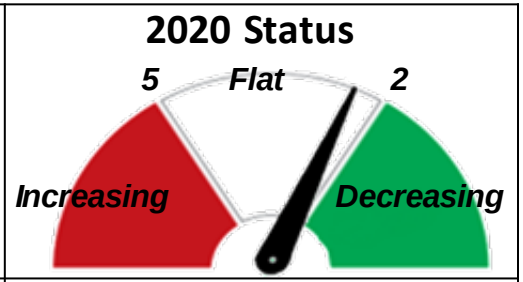
- **How is it measured?**
  - Number of vegetation encroachments and Sustained Outages





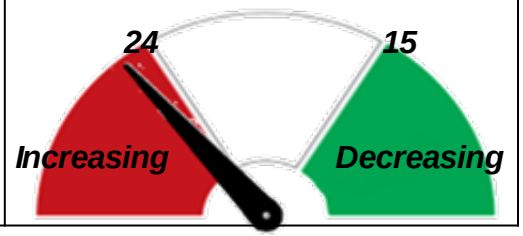
Data (Compared to a 5-year rolling average)

- Number of vegetation encroachments, excluding fall-ins, decreasing (within one standard deviation, based on small sample size) (Based on 2018 metric) -- 5-year average is 2.2



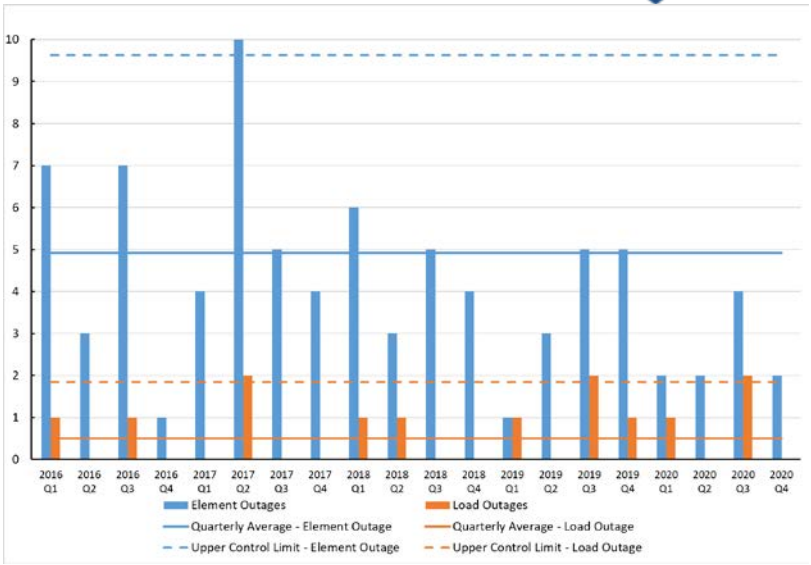
Data (Compared to a 5-year rolling average)

- Fall-ins: Number of vegetation encroachments decreasing (within one standard deviation, based on 6-year sample) -- 5-year average is 25.4



Reliability 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 2020 Q4
- Number of disruptions* of BES operations due to physical security incidents: *Below baseline Upper Control Limit is green, else is red*
  Two disruptions of BES operations (no load loss) due to physical attacks in 2020 Q4

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

2020 Status

Cyber Security

Physical Security

RI 7: Disturbance control events greater than the most severe single contingency

- **Why is it important?**
  - Measures risk to the BPS by monitoring the number of Disturbance Control Standard (DCS) events that are greater than the Most Severe Single Contingency (MSSC)
- **How is it measured?**
  - Information received by NERC based on the BAL-002 Reliability Standard
  - Due to the timing in Balancing Authority data submittals the metric is updated one quarter in arrears
  - Measures a rolling 7 year quarterly time trend testing for statistical significance

Data (Quarterly Measurement), New

- **Green**: a time trend line of the most recent 7 years of quarterly DCS events > MSSC has a statistically significant negative slope
- **Middle**: no statistically significant trend for the slope
- **Red**: a time trend line of the most recent 7 years of quarterly DCS events > MSSC has a statistically significant positive slope
- **Metric Results through 3Q20: White** - DCS data for the most recent 28 quarters shows a statistically insignificant trend

3Q2020 Status

Reliability 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-003-1 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-003-1.1 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-003-1 event is compared to the IFRO for each quarter of the 2019 operating year*
- *Success is no Interconnection experiencing a BAL-003-1 frequency event where IFRM performance is below their respective IFRO: Zero is green, else is red*
- ***Metric Results through 4Q20:*** *No Interconnection experienced a BAL-003-1 event where their IFRM was below their IFRO*

2020 Status

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Questions and Answers

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2021 Proposed Reliability Indicators

RELIABILITY | RESILIENCE | SECURITY




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

*No Change in this indicator from previous year

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
  - The number of violations discovered through self-reports, audits, etc.
  - Risk to the BPS based on the severity of Standard violations

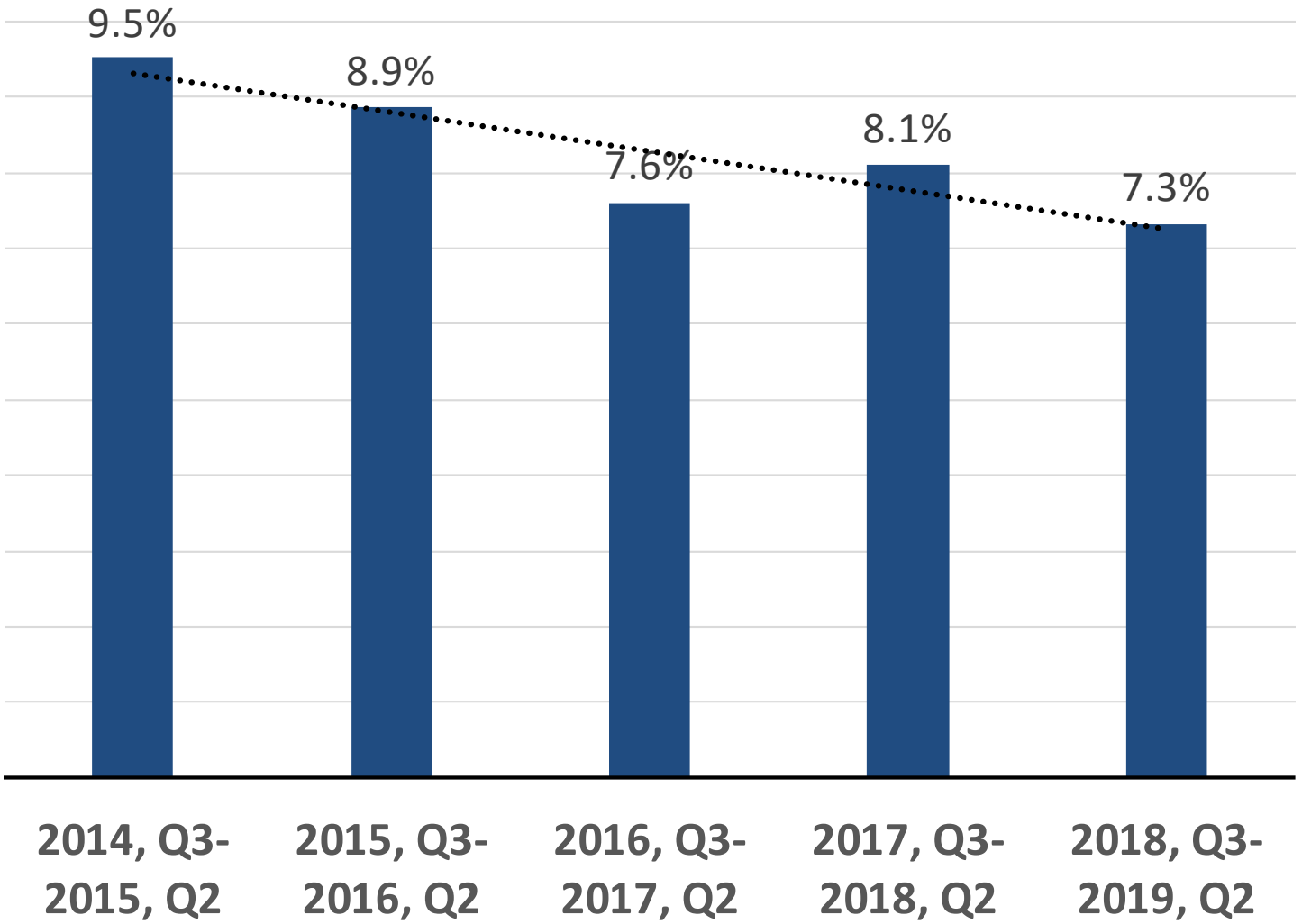
* No Change in this indicator from previous year

Indicator 3: Protection System Misoperations Rate

- **Why is it important?**
  - Protection system misoperations exacerbate event impacts for the BPS, thereby increasing their severity.
- **How is it determined?**
  - By calculating an annual misoperations rate
  - By comparing annual misoperations rates

* The graphic has been changed for this indicator and no longer included loss of load/event

Indicator 3: Protection System Misoperations Rate

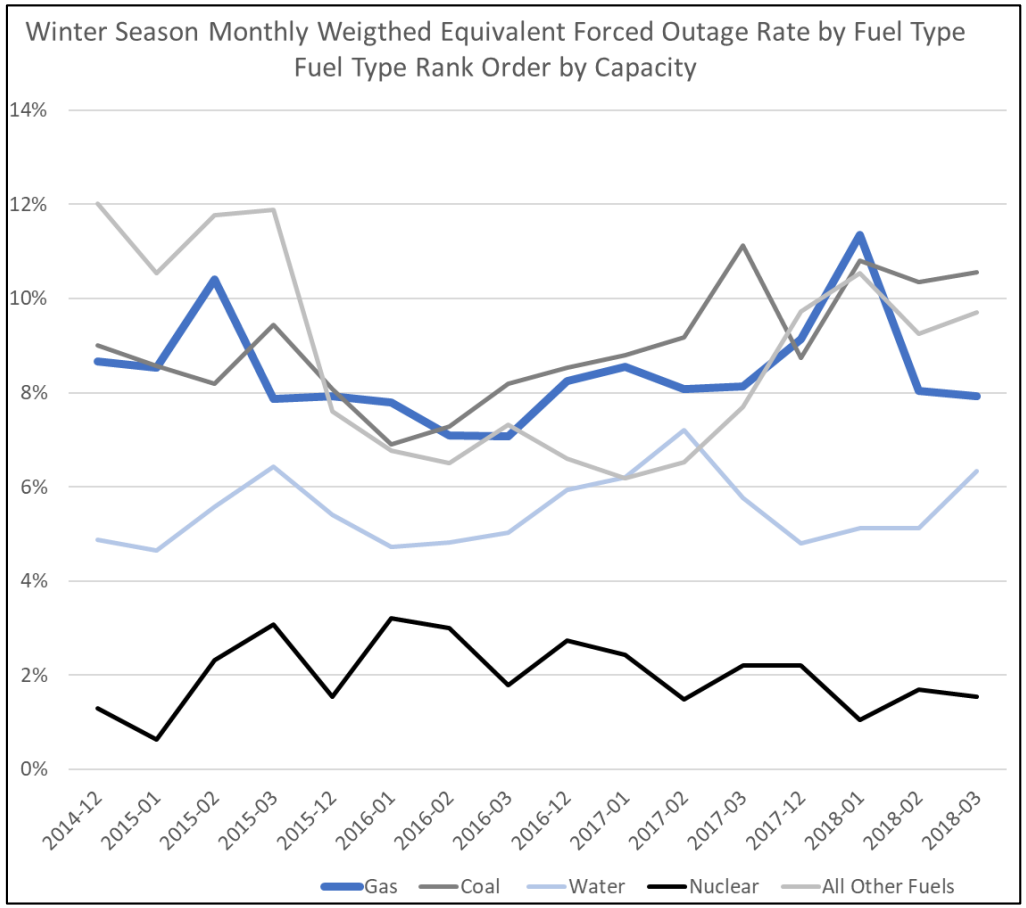


Indicator 4: Forced Outage Rate During Cold Weather Months and Potential Production MWH Loss Due to Lack of Fuel

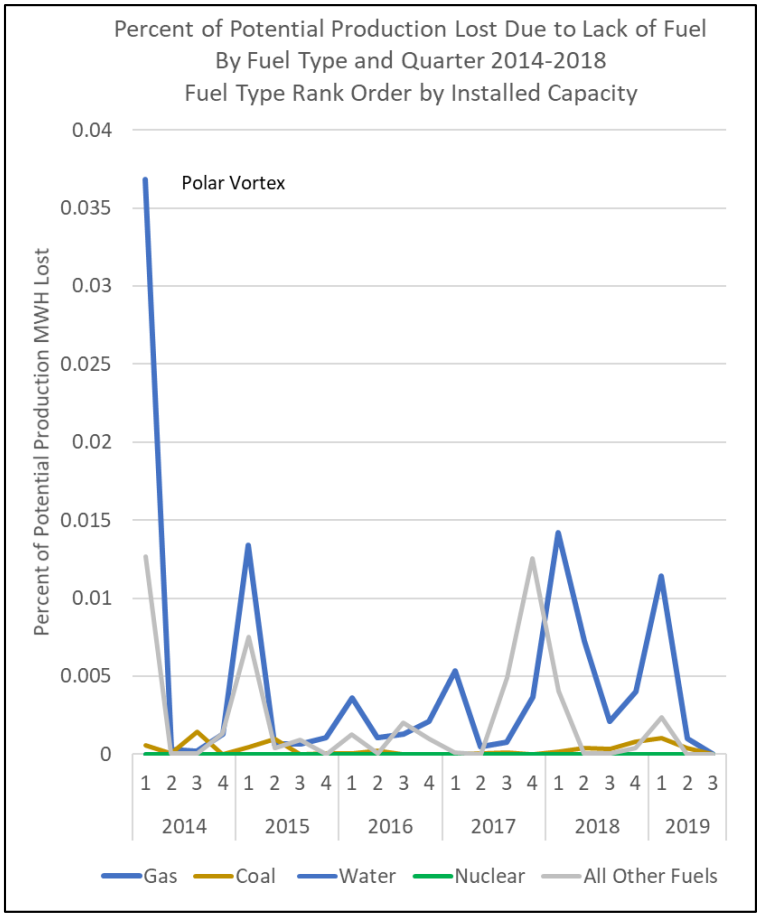
- **Why is it important?**
  - Reduce risk to BPS reliability due to unit outages during cold weather or gas unavailability
- **How is it measured?**
  - Weighted Equivalent Forced Outage Rate (WEFOR) by fuel type during cold weather season (Dec. – March)
  - Quarterly potential production MWH lost by fuel type due to lack of fuel

* This indicators is being expanded to reflect outages during cold weather of all types reported in NERC GADS

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 5: Reduce AC Transmission Line Forced Outages

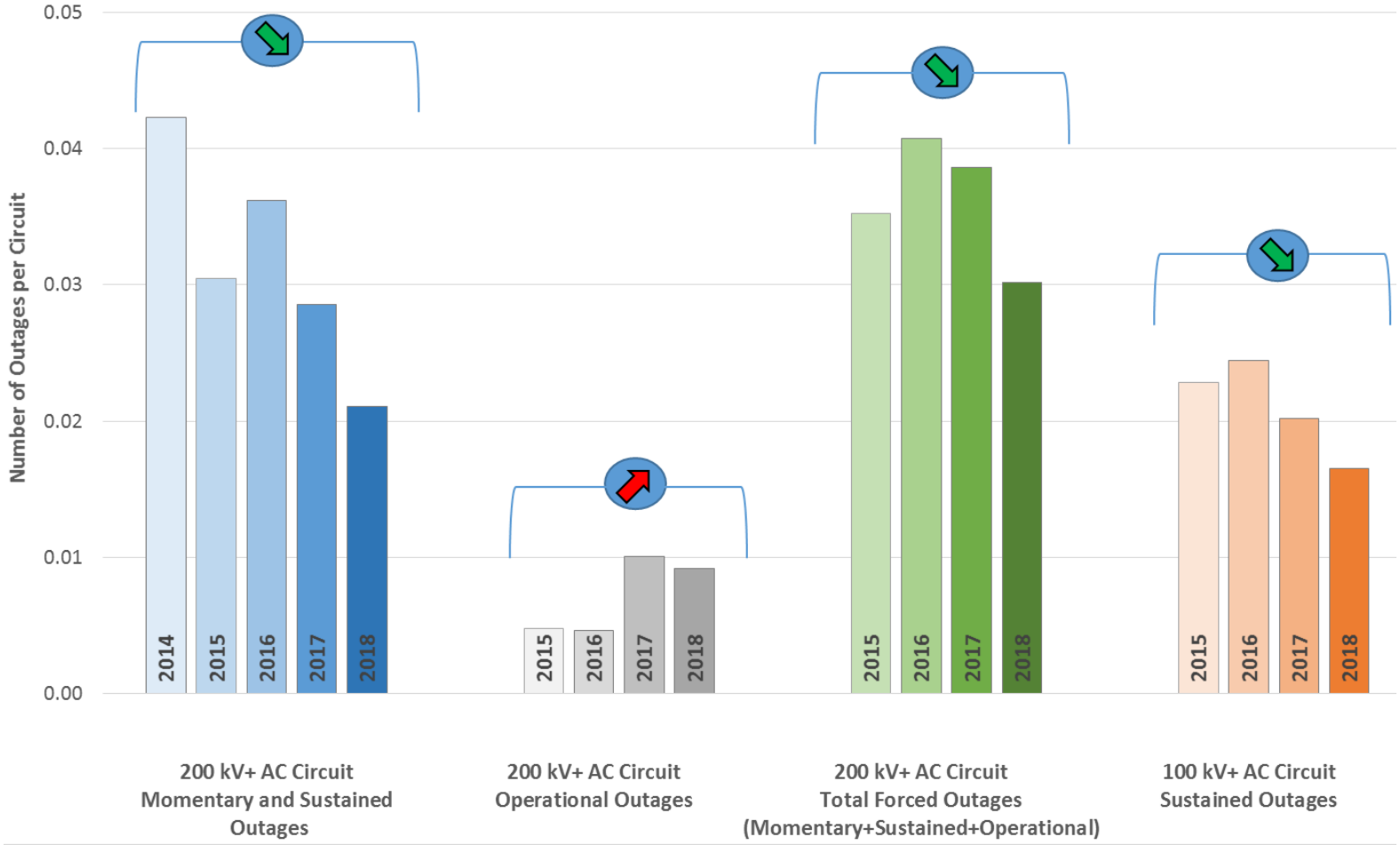
- **Why is it important?**
  - Measures risks to BPS reliability from three priority causes:
    1. Operator or other human performance issues
    2. Substation equipment failures or failed circuit equipment
    3. Vegetation encroachment

Indicator 5a: Operator or Other Human Performance Issues

- **How is it measured?**
  - Number of transmission line outages caused by Human Error divided by the total inventory of circuits

* Depiction of this indicator has been modified from previous year

Indicator 5a: Operator or Other Human Performance Issues



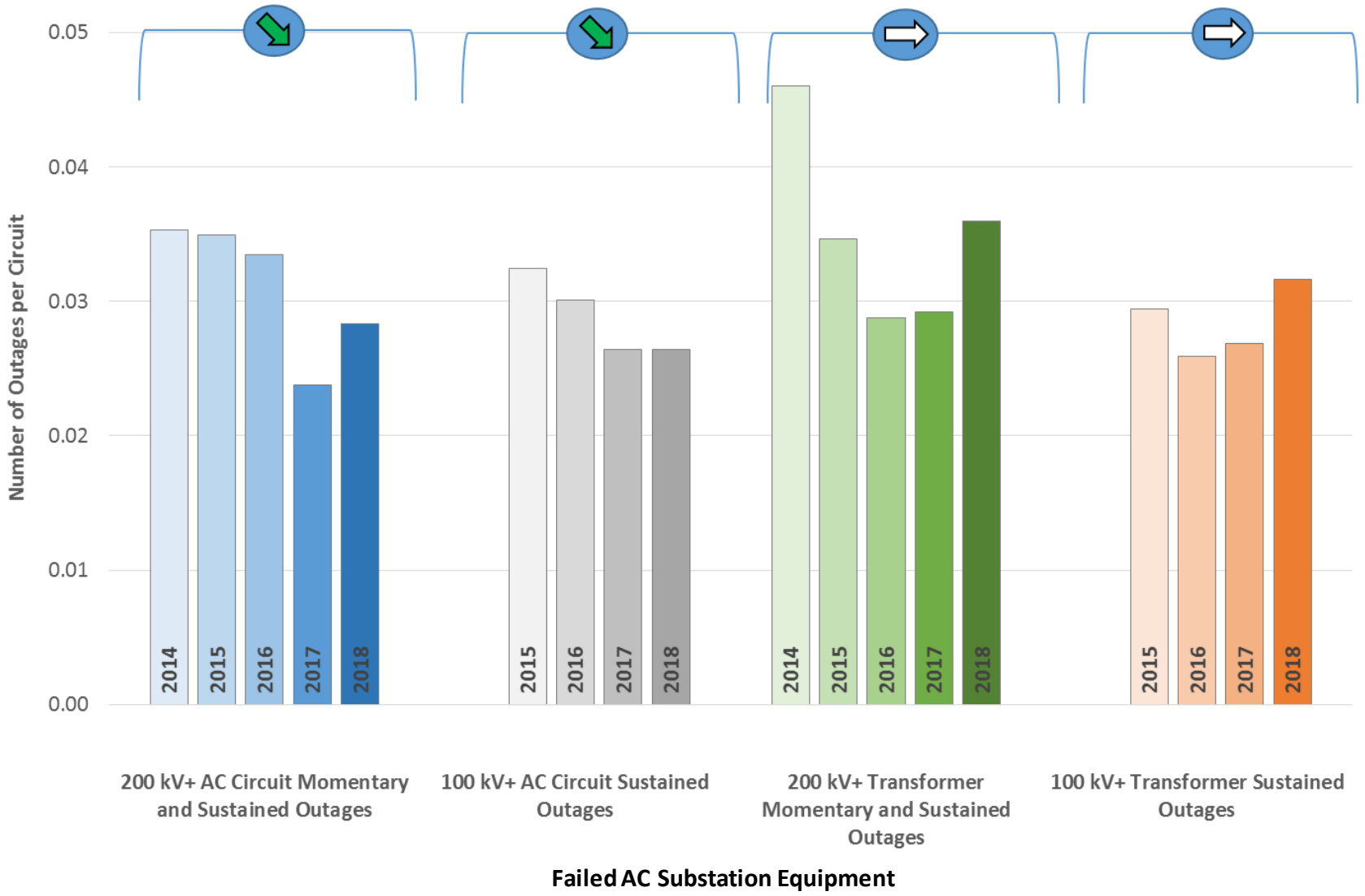
Outages Caused by Human Error
AC Circuits

Indicator 5b: Substation Equipment Failures or Failed Circuit Equipment

- **How is it measured?**
  - Number of transmission line outages caused by AC substation equipment outage failures and failed AC circuit equipment (such as transformers), divided by the total inventory of circuits

* Depiction of this indicator has been modified from previous year

Indicator 5b: Substation Equipment Failures or Failed Circuit Equipment

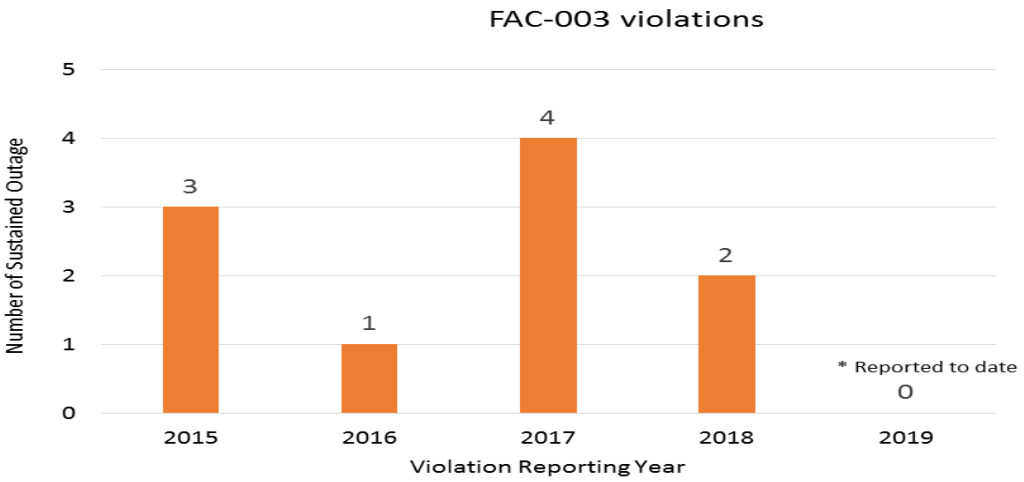


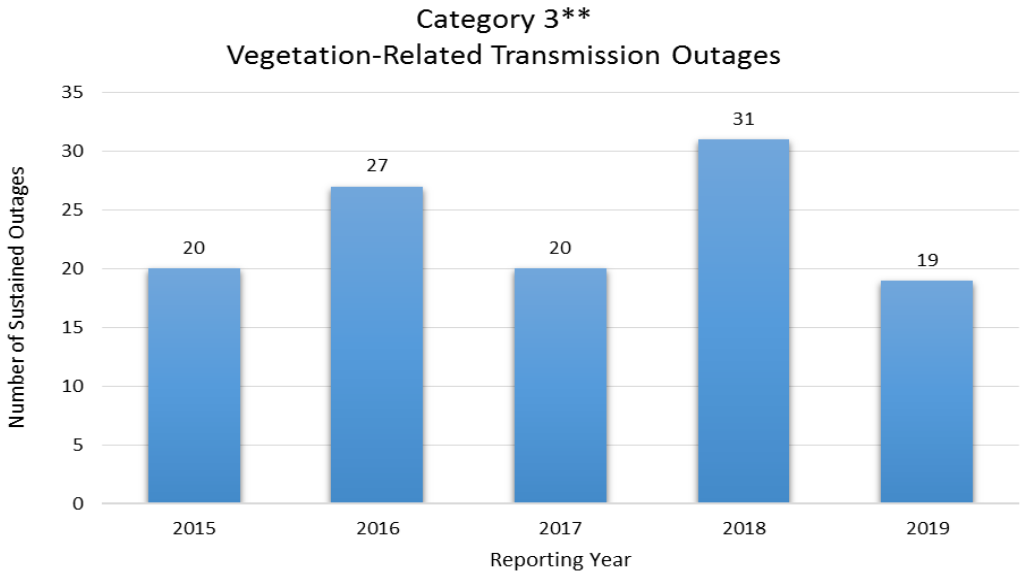
Indicator 5c: Vegetation Encroachment

- **How is it measured?**
  - Number of vegetation encroachments and Sustained Outages

* No change to this indicator from previous year

Indicator 5c: Vegetation Encroachment





Indicator 6: Disruptions Due to Physical or Cyber Security Incidents

- **Why is it important?**
  - Measures impact to the BPS from cyber or physical security attacks
- **How is it measured?**
  - Based on industry-submitted OE-417 and/or EOP-004 Electric Emergency Incident and Disturbance Reports

* Indicator changed to reflect actual disruptions

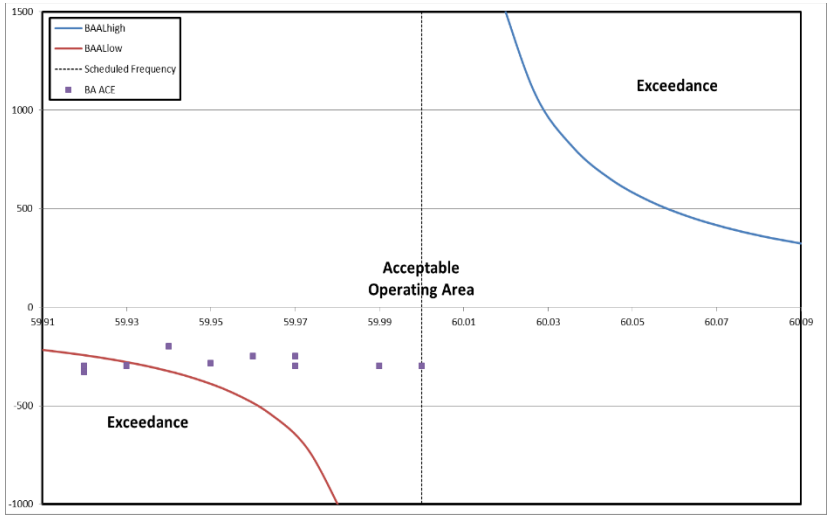
Indicator 7: Real Power Balancing Control Performance (BAAL)

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.



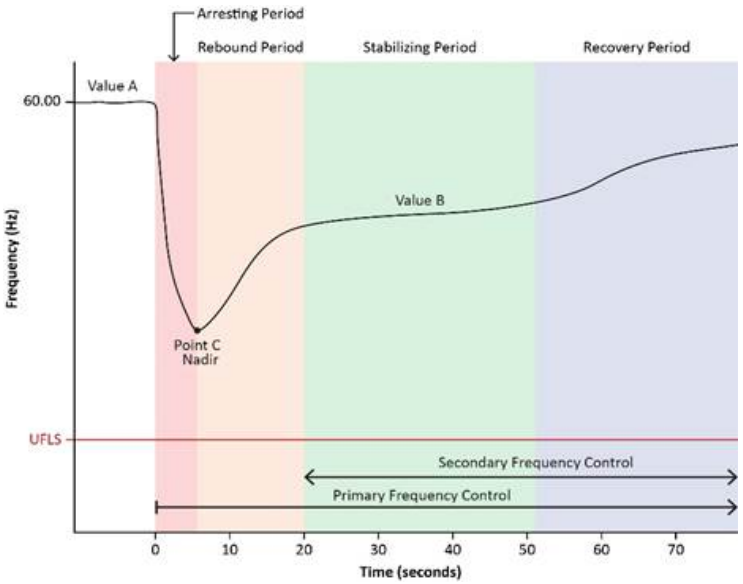
Indicator 8: Interconnection Frequency Response

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-003-1 compliance. The Indicator will evaluate whether the risk of activating under frequency load shed devices is increasing or decreasing.

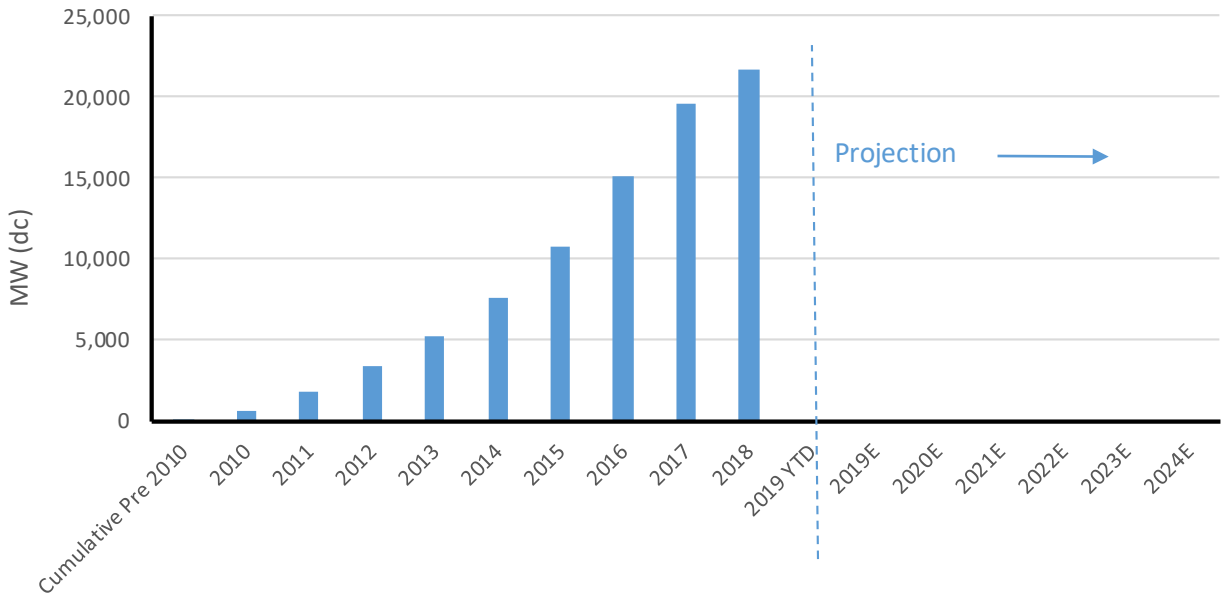
How is it measured?

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 9: DER Penetration

- The objective of this Indicator is to provide forward looking grid attributes affected by increases in DER which may demonstrate areas for further analysis and monitoring by the ERO and industry. This is a new indicator for 2021.

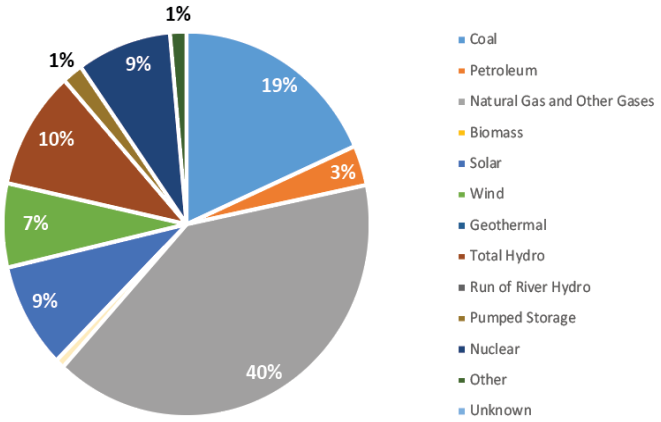


Indicator 10: Measure of the Changing Resource Mix

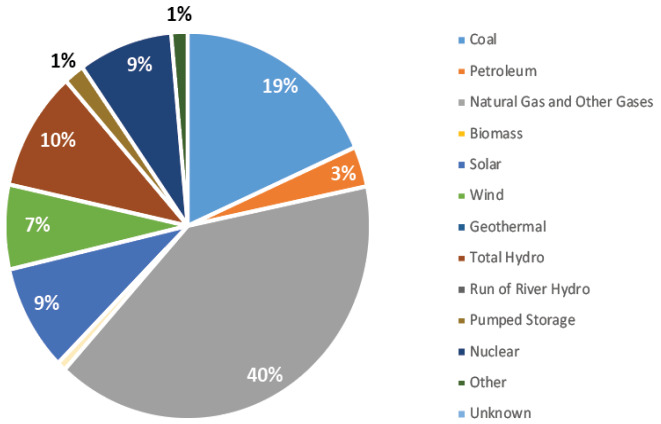
- The objective of this Indicator is to provide forward looking grid attributes affected by changes in the resource mix which may demonstrate areas for further analysis and monitoring by the ERO and industry. This is a new indicator for 2021.

Indicator 10: Measure of the Changing Resource Mix

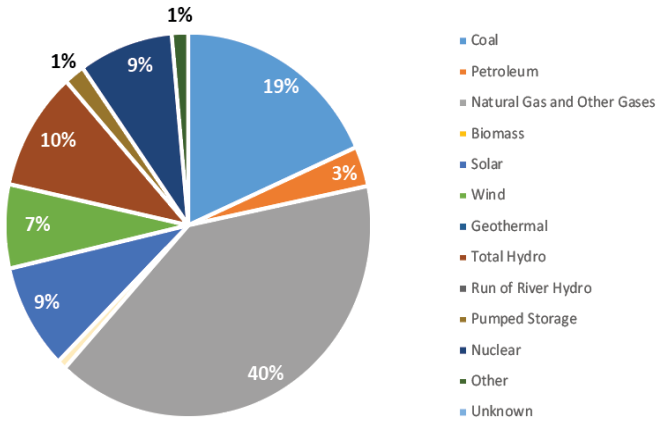
2011 Resource Mix



2021 Resource Mix



2031 Resource Mix



Questions and Answers