



NERC

NORTH AMERICAN ELECTRIC
RELIABILITY CORPORATION

2022 Annual Report

February 2023

Contents

Year in Review: Letter from President and CEO Jim Robb	3
ERO Enterprise Vision Mission	5
Expanding Risk-Based Focus in Standards, Compliance Monitoring, and Enforcement	6
Cyber Standards	6
Energy and Reliability Standards	8
Facility Ratings	10
Assessing and Catalyzing Steps to Mitigate Known and Emerging Risks to Reliability and Security	11
Energy and Reliability Assessments	11
Supply Chain and Security Engineering Assessments	15
Building a Strong E-ISAC-Based Security Capability	16
Strategy	16
Information Sharing	17
Analysis	17
Engagement	18
Strengthening Engagement across the Reliability and Security Ecosystem in North America	19
North American Engagement	19
Outside North America	20
Capturing Effectiveness, Efficiency, and Continuous Improvement Opportunities	21
Align and the ERO Enterprise Secure Evidence Locker	21
ERO Enterprise Transformation	22
NERC’s 2022 Achievements	24
2022 ERO Enterprise Executive Committee	25
Regional Map	26
Letter from the NERC Board Chair	27

Year in Review: Letter from President and CEO Jim Robb

As I begin my fifth year as CEO, I can't help but reflect on the extraordinary transformation of the resource base that is occurring, the challenges associated with extreme weather systems, and the transformation of the ERO Enterprise toward operating as one synchronous machine. I'm pleased with how far we have come in a relatively short time with the complex and rapidly evolving risk and threat environment across North America.

The annual report provides us with the opportunity to look back at what we accomplished in 2022, celebrate our successes, and get ready for the challenges of 2023. I will highlight just a few of the accomplishments our team has achieved toward our goals this year and encourage you to read our report for more details.

We expanded our risk-based focus in Standards, Compliance Monitoring, and Enforcement with our work on supply chain risk mitigation and Critical Infrastructure Protection (CIP) standards improvements, and we began development of an inverter-based resource standard as well as our first efforts to shift the resource adequacy discussion toward energy sufficiency. We also began a collaborative process to identify ways to make our standards process more nimble.

We developed a series of cold weather preparation requirements, the first part of our standards actions as called for in the FERC, NERC, and Regional Entity joint report following Winter Storm Uri. Simultaneously, we continued our outreach efforts around winter preparation through webinars and a Level 2 alert. While there is more to be done, these requirements will reduce the likelihood of any surprises related to generator performance limitations/capabilities.

The ERO Enterprise developed a facility ratings document and toolkit for registered entities to strengthen their facility ratings programs while leveraging the expertise of the North American Transmission Forum to assist the Enterprise with the deployment of a maturity model to gain insights on industry progress. As new challenges and risks emerge that threaten bulk power system reliability, it is critical that industry take well-known risks, such as facility ratings, off the table. The ERO Enterprise toolkit and the North American Transmission Forum maturity model are great places to start.

The Electricity Information Sharing and Analysis Center (E-ISAC) continues to be a critical resource to the security ecosystem—expanding system monitoring services with programs like the Cybersecurity Risk Information Sharing Program (CRISP) and our new operational technology-focused programs and playing a key role in piloting the Department of Energy's Energy Threat Analysis Center. The E-ISAC also increased identification of malicious physical security activity and patterns that were then shared with industry and law enforcement organizations. These efforts provide better visibility and information sharing of our threat landscape for our stakeholders.

We completed the final implementation of Align for U.S. entities in 2022. We expect to bring in the Canadian provinces to the Align and Secure Evidence Locker (SEL) implementation in 2023.

We also developed a transformational budget and process in 2022 that substantially increases our capacity and capabilities over a three-year horizon. The plan aligns our initiatives in four strategic areas—Energy, Security, Agility, and Sustainability—that were shared with industry to ensure that our efforts were in sync with the needs of industry.



Jim Robb
President and CEO

And, of course, we cannot fail to mention our new D.C. Collaboration Hub that we opened to employees in November. We decreased our real estate footprint and reimagined the space to be one focused on collaboration—both internally and externally with industry and stakeholders.

Looking ahead, it is abundantly clear that the electricity ecosystem is going to have to come to grips with cost-effectively protecting lower impact assets from physical and cyber threats—such as coordinated attacks or supply chain compromises, getting inverter-based resources to support the reliability requirements of the grid as they continue to gain market share, effectively shifting the focus of resource adequacy from capacity on peak toward energy sufficiency 24x7 and provision of essential reliability services, and preparing the grid to operate reliably during periods of extreme weather.

NERC had an exemplary year with many other achievements that significantly help us reduce reliability risk in a quickly changing sector that you can read about in the pages of our *2022 Annual Report*. This was truly a transformational year for NERC, but our work does not end here—in fact, it is just beginning!



Jim Robb
NERC President and CEO



ERO Enterprise Vision | Mission

The vision for the ERO Enterprise, which is comprised of NERC and the six Regional Entities, is a highly reliable and secure North American bulk power system (BPS).

Our mission is to assure the effective and efficient reduction of risks to the reliability, resilience, and security of the grid.



Expanding Risk-Based Focus in Standards, Compliance Monitoring, and Enforcement

Annual Report Structure

This annual report is structured around the five key focus areas from the *ERO Enterprise Long-Term Strategy*:

- Expanding risk-based focus in Standards, Compliance Monitoring, and Enforcement
- Assessing and catalyzing steps to mitigate known and emerging risks to reliability and security
- Building a strong E-ISAC-based security capability
- Strengthening engagement across the reliability and security ecosystem in North America
- Capturing effectiveness, efficiency, and continuous improvement opportunities

Within these focus areas were several key objectives that informed the work performed in 2022 and addressed a transforming industry, allowing NERC to remain nimble in the face of emerging risks.

In its continuous pursuit of transformation, the ERO Enterprise has shifted to a holistic, risk-based approach to compliance with a focus on improvement, innovation, and value-driven efforts. By maintaining and expanding a risk-based focus in its operations, the ERO Enterprise is able to apply resources to the most significant reliability risks and better respond to emerging risks. However, as demonstrated over the past several years, compliance with NERC Reliability Standards remains fundamental to the ERO Enterprise's collective mission to maintain reliability, resilience, and security.

Cyber Standards

Cyber security remains at the forefront of addressing reliability risks. In 2022, NERC initiated and continued several Reliability Standard development projects that address virtualization and protect cyber assets and communications. NERC also examined its set of cyber standards to ensure that necessary controls are implemented into critical systems to maintain the reliability of the BPS.

Transmission Planning and Operational Cyber Risks

The North American grid is facing dynamic risks, making it critical that the ERO Enterprise and industry continue to take a risk-based approach to compliance and grid transformation. One of the Reliability and Security Technical Committee's (RSTC) primary objectives is to develop solutions that support technology and security integration into BPS planning and operations. To that end, the RSTC Security Integration and Technology Enablement Subcommittee (SITES) works with the E-ISAC and stakeholder groups to provide recommended practices for incorporation of cyber and physical security aspects into conventional planning, operations, design, and restoration activities across North America. SITES identifies potential barriers and supports the removal of these barriers to enable industry to adopt emerging technologies and develop cyber-informed engineering practices.

Another way that NERC is addressing these risks is by working collaboratively with industry experts to develop a cyber-informed transmission planning framework that can be used to integrate cyber security into steady-state and dynamic simulations of BPS reliability. In February, NERC's Board of Trustees (Board) approved a modification to CIP-014-3 – Physical Security, removing a unique compliance monitoring provision that is no longer needed following the adoption of the ERO Enterprise SEL and other tools for secure review of sensitive evidence. NERC submitted these [modifications](#) to FERC in February and received approval in June.

Supply Chain Risk Mitigation and Improvements to CIP Standards

The criticality of supply chain risk mitigation, which has been a NERC priority since 2016, has been highlighted even further over the past three years by a marked increase in supply chain compromises perpetrated by nation-state actors. Without trusted suppliers continually working with asset owners and operators, industry will struggle to increase or maintain reliability while directly addressing the ever-increasing security threats to the grid. The ERO Enterprise is particularly focused on addressing risks associated with grid transformation, extreme weather, and security threats.

In October, the Supply Chain Standards (CIP-005-7 – Cyber Security – Electronic Security Perimeter(s), CIP-010-4 – Cyber Security – Configuration Change Management and Vulnerability Assessments, and CIP-013-2 – Cyber Security – Supply Chain Risk Management) became effective. NERC is also pursuing new and improved CIP standards that are necessary to mitigate the dynamic nature of cyber security threats. In 2020, based on a NERC staff study of supply chain risks to low-impact Bulk Electric System (BES) cyber systems, the Board directed revisions to CIP-003-8 to address vendor remote electronic access connectivity. To address the Board directive, a standard drafting team developed CIP-003-9, which achieved industry approval and was adopted by the Board in November.



CIP Standard Improvements

- **Virtualization:** NERC is continuing revisions to address virtualized technologies and provides quarterly updates to FERC on the status of this project.
- **Transmission Owner Control Centers:** In 2021, the Board directed NERC to work with stakeholders to study the applicability of CIP Reliability Standards to certain control centers that perform Transmission Operator functions. Accordingly, a standard drafting team initiated a field test to study the impact of these control centers to determine whether their BES cyber systems should be categorized as medium or low impact.
- **Availability:** In Order No. 866, FERC directed revisions to CIP-012-1 to address protections for availability of communication links and data communicated between applicable control centers. This project is currently in active standards development.
- **Cyber Security Incidents:** The ERO Enterprise conducted a review of requirements to CIP-008-6 with respect to cyber security incident reporting, including on attempts to compromise. As a result of this review, NERC initiated a standards development project to further consider a minimum threshold for defining attempts to compromise, among other issues. Standards development work is underway.

Energy and Reliability Standards

Given the transformation and pace of change within industry, mandatory Reliability Standards have and will continue to play an integral role in addressing new and rapidly emerging risks to the reliability, resilience, and security of the grid. Modernization of the standards development process to enable greater agility is critical in order to keep pace with evolving risks.

Enhancements to the Standard Development Process and New Guidelines to Mitigate Risks

In February 2022, the Board directed staff to evaluate the Reliability Standards development process to keep up with the rapid transformation and pace of change within industry. Over the course of the year, NERC staff engaged a broad group of stakeholders in key committee leadership roles—the Standards Process Stakeholder Engagement Group—to develop ways to enhance the agility of the standards process and address an important missing authority for the Board that would enable them to direct the development of standards to address urgent reliability, resilience, or security issues. In November, the Board approved a series of resolutions to move the initiative forward in the following areas: Section 300 of the *NERC Rules of Procedure*, Appendix 3A to the *NERC Rules of Procedure Standard Processes Manual*, standing committee activities, and a review of the registered ballot body.

The Board also approved revisions to the *Standards Committee Charter*, clarifying the role of the committee as a procedural oversight body and reiterating how existing tools can be applied to address urgent reliability needs. Work is ongoing to ensure NERC's processes are as agile as possible to focus efforts on the most urgent reliability needs on a timely basis while still including vital industry collaboration.

Cold Weather Standards

Cold weather remains one of the most critical and high-priority challenges currently facing industry as identified in [NERC's Risk Registry](#). The primary purpose of Project 2021-07 – Extreme Cold Weather Grid Operations, Preparedness, and Coordination (the Cold Weather Standards Project) is to address reliability-related findings from the [FERC, NERC and Regional Entity Joint Staff Inquiry into the February 2021 Cold Weather Grid Operations report](#). The project scope addresses nine recommendations for new or enhanced NERC Reliability Standards proposed in the report. In recognition of the urgency to address this pressing reliability issue, the Board directed that the recommendations be finished in stages with the completion of the

first stage due to the Board by September 2022 and the second stage due by September 2023, which is consistent with the time lines recommended in the joint inquiry.

The resulting proposed Reliability Standards (EOP-012-1 – Extreme Cold Weather Preparedness and Operations and EOP-011-3 – Emergency Operations) address all four recommendations for Phase 1 and were built upon NERC's prior work, further advancing reliability and resilience through improved operations and generator cold weather preparedness requirements. The proposed Reliability Standards complement the improved generator cold weather operating information sharing requirements that were approved by FERC in TOP-003-5 and IRO-010-4. In late October, the Board adopted the standards that were subsequently submitted to FERC; currently, FERC has not yet issued an order approving the standards. Work is presently underway to address the remaining standards-related recommendations in the joint staff inquiry report. NERC anticipates filing new or revised Reliability Standards that address those recommendations by November 2023.



Background on EOP-012-1 and EOP-011-3

EOP-012-1 is a proposed Reliability Standard that builds on the cold weather preparedness plan and training requirements currently found in Reliability Standard EOP-011-2 to form a comprehensive framework for advancing the reliability and resilience of the BPS through improved generator cold weather preparedness. The proposed Reliability Standard includes requirements for freeze protection measures for both new and existing generation, the development of enhanced cold weather preparedness plans and annual training on those plans, and the development and implementation of Corrective Action Plans to address freezing issues.

Proposed Reliability Standard EOP-011-3 builds upon the improvements reflected in Reliability Standard EOP-011-2 to improve how Transmission Operators account for the overlap of manual load shed and automatic load shed in their emergency operating plans.



Inverter-Based Resource Standard Development

The speed of inverter-based resource (IBR) deployment on the grid continues to challenge grid planners, operators, engineers, and many other facets of the electric sector. Implemented correctly, inverter technology can provide significant benefits for the BPS; however, new technology can introduce significant risks if not integrated properly. It is critical that enhancements to standards keep pace with the rapid growth of IBRs and the potential risks that may be posed under such a swift change.

The System Planning Impacts of Distributed Energy Resource Working Group conducted a [comprehensive review](#) of all NERC Reliability Standards that received RSTC approval in September and was published in October. This review included recommendations for actions that should be taken to address identified issues. As a result, a number of mitigation steps were developed and deployed. NERC continues to drive improved resource performance through guidelines, disturbance reports, and Reliability Standard modifications. In 2022, this included a standard authorization request (SAR) to overhaul PRC-024-3 to ensure generator ride-through performance, the enhancement of numerous existing standards, and considerations for inverter-specific performance standards. NERC's [Quick Reference Guide: Inverter-Based Resource Activities](#) contains more details on all aspects of work in this area. Additionally, NERC has supported the development of [IEEE 2800-2022](#) and IEEE standards development efforts.



Recent FERC Action

At its November open meeting, FERC also took action on three items related to IBRs:

- Issuing an order directing NERC to submit a work plan to ultimately register certain IBRs
- A notice of proposed rulemaking directing NERC to develop new or modified Reliability Standards that address the following areas for certain IBRs: data sharing, model validation, planning and operational studies, and performance requirements
- Approving FAC-001-4 and FAC-002-4

This reinforces the activities presently underway and planned related to IBR registration and NERC standards enhancements.

Facility Ratings

The ERO Enterprise has been actively engaged in identifying and mitigating challenges associated with facility ratings programs that have been classified as a “risk element area of focus” in the annual Compliance Monitoring and Enforcement Program (CMEP) implementation plan since 2016. Facility ratings play a significant role in the reliable planning and operation of the BPS; therefore, they demand effective management to reduce associated risks and impacts. The impacts of incorrect facility ratings can range from operating with limited information to uncontrolled widespread service outages and fires. Facility ratings and system limitations also play a key role in modeling the grid as future BPS projects are contemplated to manage load growth and mitigate system constraints. To ensure a reliable, resilient, and secure grid, it is of utmost importance that registered entities have strong and sustainable facility ratings programs.

This past year, the ERO Enterprise focused its efforts, which included outreach, education, discussions at Regional Entity and NERC technical committee meetings, as well as monitoring, enforcement, and mitigation activities, on this topic. To further support stakeholders, the ERO Enterprise actively engaged in mitigating activities associated with facility ratings and identified four common themes that pose challenges to the sustainability of accurate facility ratings and created the [*ERO Enterprise Themes and Best Practices for Sustaining Accurate Facility Ratings*](#) report. The report, which was published in October, is intended to aid stakeholders in strengthening the accuracy and sustainability of their facility ratings programs.

Challenges to Accurate Facility Rating Sustainability

- Lack of Awareness
- Inadequate Asset and Data Management
- Inadequate Change Management
- Inconsistent Development and Application of Facility Ratings Methodologies



Assessing and Catalyzing Steps to Mitigate Known and Emerging Risks to Reliability and Security

As the nation's power supply portfolio continues to transform the BPS at a historic rate, the ERO Enterprise must identify and understand known as well as new reliability risks and respond by developing, prioritizing, and implementing actions that effectively and efficiently reduce those risks. The solution to these risks is not singular—rather, it is achieved through a collection of best practices that NERC has begun incorporating into its planning, recommendations, and assessments.

Energy and Reliability Assessments

Historically, industry measured capacity and reserve margins to ensure adequate electricity resources would be available to meet demand. As the resource mix has changed with variable energy resources and just-in-time generators supplying more electricity, resource capacity is less certain and focus must shift to energy availability. Events over the past several years have highlighted the need for energy reliability assessments that analyze all hours of a given study period rather than just the peak hours.

Transforming Resource Mix and Emerging Reliability Issues

After undertaking extensive industry stakeholder engagement, the Energy Reliability Assessment Task Force initiated two SARs in 2022 that were subsequently endorsed by the RSTC to mitigate reliability risks through energy assessments with corrective action plans. The SARs would require Reliability Coordinators and Balancing Authorities to conduct needed energy assessments to evaluate energy requirements in their respective areas. One SAR would require energy assessments for the long-term planning horizon (one to five years) with corrective actions plans toward ensuring sufficient amounts of energy are available for a select set of scenarios. The second SAR would require operational planning (one year or less) with energy surveys and actions that can be taken to ensure a sufficient amount of energy reserves are available to meet energy requirements. Subject to the standards development process as well as review and approval by the Board and FERC, these new requirements will provide important planning tools to help assure energy availability.



State of Reliability

The *2022 State of Reliability* report, published in July, examined 2021 grid performance and found that the grid withstood an unprecedented combination of challenges—including widespread, extreme, and sustained weather events; increasingly sophisticated and severe cyber and physical threats; and the urgent need to reliably integrate a rapidly growing fleet of IBRs. While these factors tested grid reliability, leading indicators show that the BPS remained highly reliable and resilient. One notable exception was the February 2021 Texas and South-Central United States cold weather event that led to the largest controlled load shed event in North American history. However, this exceptional event called attention to the potential challenges facing the BPS during the grid transformation in the coming years unless coordinated actions are taken by industry and regulators before the next challenge occurs.

2022 STATE OF RELIABILITY

The *State of Reliability* provides analysis of past bulk power system performance to identify system trends and emerging reliability risk. It also highlights the health of the interconnected bulk power system and the effectiveness of reliability risk mitigation activities.

Leading indicators show that the bulk power system continues to perform in a highly reliable and resilient manner overall with year-over-year improvement, demonstrating the success of industry actions. However, the rapidly changing risk profile requires new approaches to navigate reliability effectively. Significant events in 2021 highlight the need for aggressive action.



Extreme cold weather across South Central United States and Texas led to largest controlled load shedding event in North American history. Unserviced energy demand underscores the need for winterization requirements in power generation and addressing resource availability issues.



Severe weather—such as extreme cold and heat, hurricanes, and drought-related wildfires—challenged the bulk power system, underscoring the need for more robust resilience tools to withstand extreme events.



Electricity and natural gas industry interdependencies have evolved from an emerging risk to a realized one, requiring reconsideration of the regulatory framework and coordination between the two sectors.



Multiple solar loss events in Texas and California in 2021 demonstrated that unaddressed inverter issues increase reliability risk, particularly in those large assessment areas that have become dependent upon renewable resources to meet peak loads. New Reliability Standards under development will mitigate inverter risk.



The cyber security threat landscape continues to degrade as demonstrated by geopolitical events, new vulnerabilities, changing technologies, and increasingly bold adversaries. Continued vigilance and effective industry/government information sharing are essential.

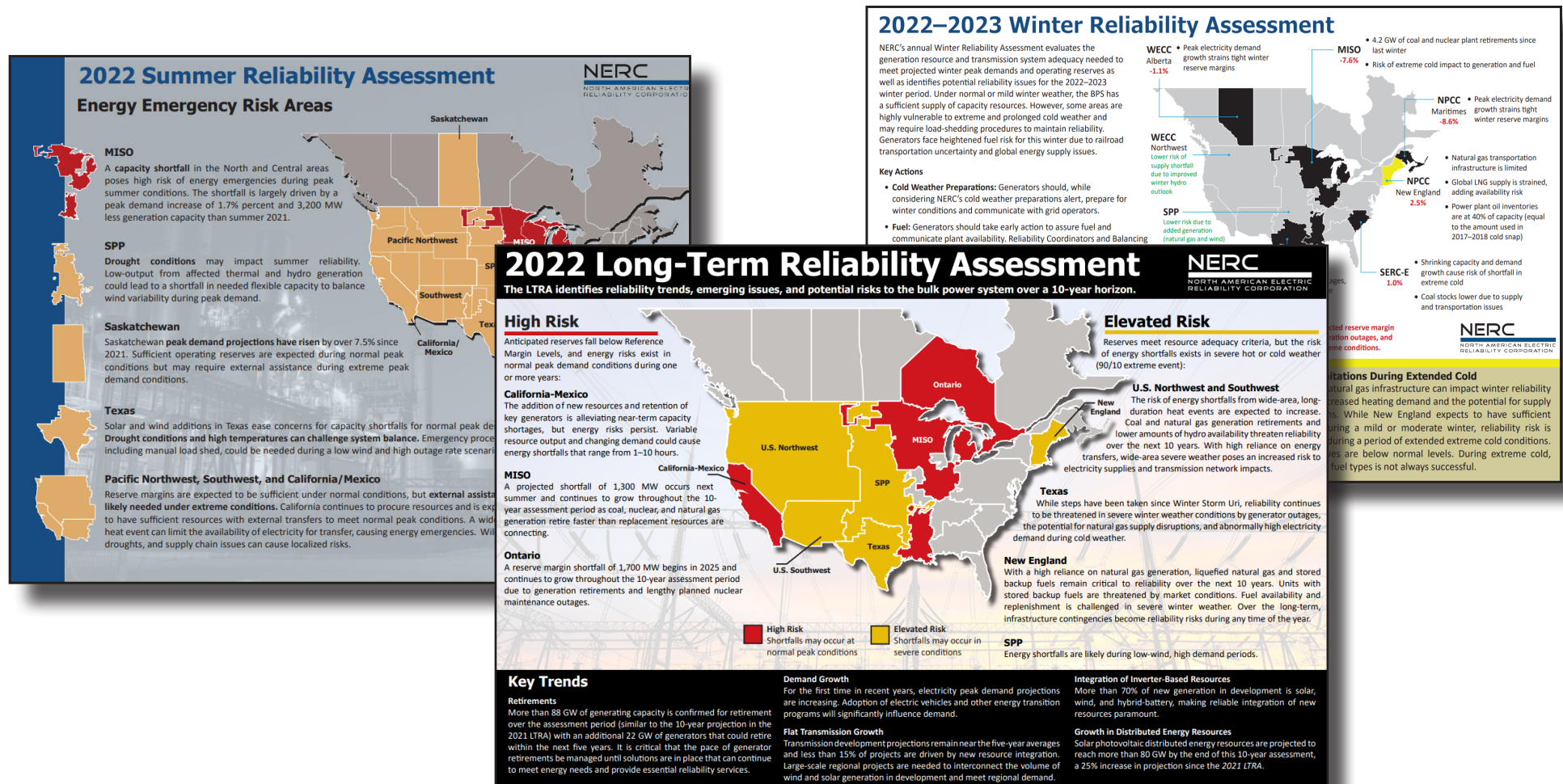
Reliability | Resilience | Security

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Seasonal and Long-Term Reliability Assessments

Each year, NERC is responsible for independently assessing and reporting on the overall reliability, adequacy, and associated risks that could impact the upcoming summer and winter seasons as well as the long-term (10-year period). By identifying and quantifying emerging reliability issues, NERC is able to provide risk-informed recommendations and support a learning environment for industry to pursue improved reliability performance. As a key component of the ERO Enterprise's reframing of resource adequacy and to provide oversight of the changing resource mix, NERC has begun including energy availability scenarios and probability-based analyses to assess potential energy limitations from extreme events in its assessments.

The [2022 Summer Reliability Assessment](#) was one of the first assessments to include these scenarios and received a tremendous amount of engagement across industry; this was evidenced by the resulting 77 media engagements and 407,434 impressions on social media. NERC's [2022 Summer Reliability Assessment](#), [2022–2023 Winter Reliability Assessment](#), and the [2022 Long-Term Reliability Assessment](#) pointed to the disorderly retirement of traditional generation (with its inherent ability to provide essential reliability services and balance energy reserves) as one of the biggest challenges facing the grid. As the pace of these retirements outstrips the development and deployment of other forms of generation that could provide such capability (i.e., wind, solar, batteries, hydrogen, advanced demand side management), it presents a highly complex reliability issue for industry.

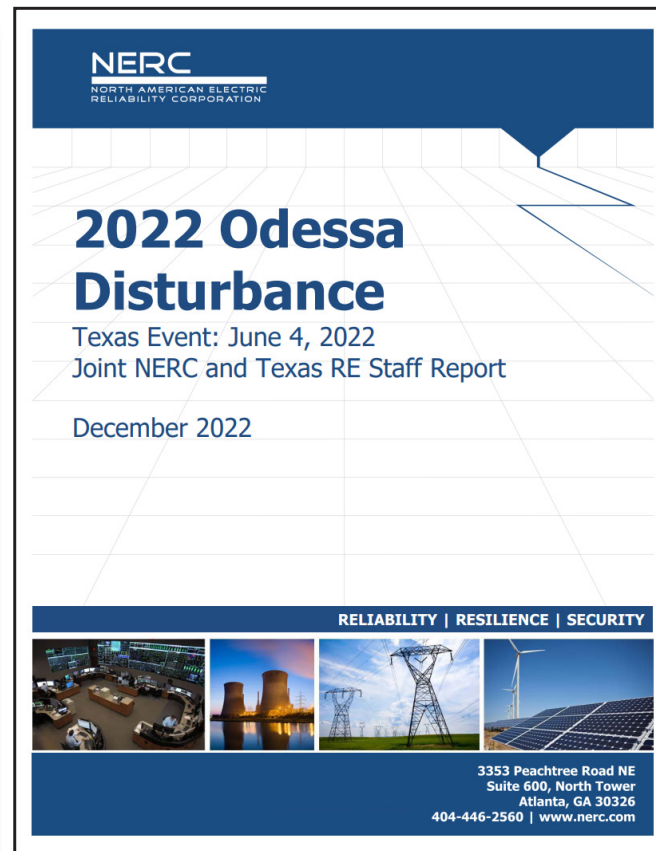
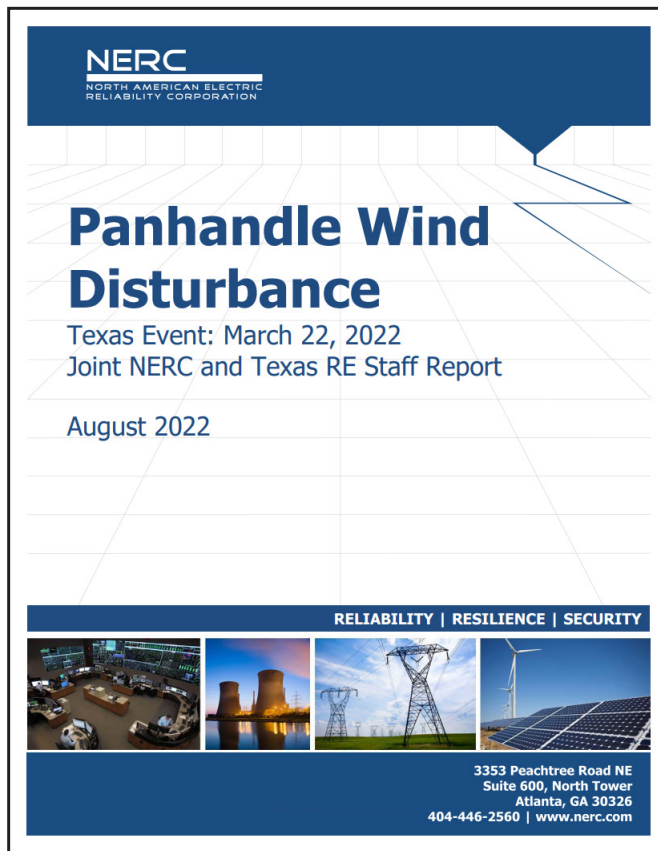


Inverter-Based Resource and Distributed Energy Resource Strategies

As noted in the [Inverter-Based Resource Standard Development](#) section, technological advances in IBRs, inclusive of distributed energy resources (DERs), are having a major impact on generation, transmission, and distribution systems. In 2022, NERC developed strategies for both IBRs and DERs as these resources pose specific challenges for the reliable operation of the BPS, and it is paramount that their performance issues are proactively and immediately addressed.

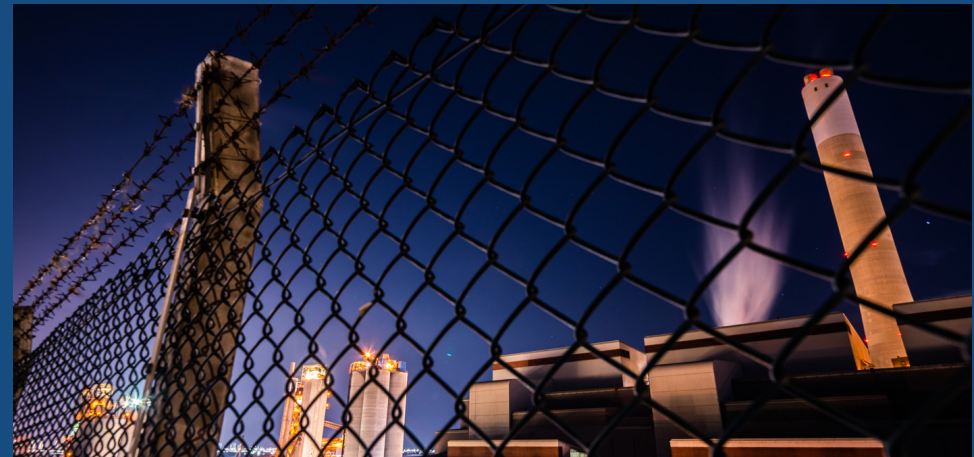
In September, NERC published the [Inverter-Based Resource Strategy](#) comprised of specific mitigation activities under four core tenets: risk analysis, interconnection process improvements, best practices and education, and regulatory enhancements. In November, NERC published the [Distributed Energy Resource Strategy](#) comprised of current and future strategic actions necessary to ensure reliable operation of the BPS. The core tenets of the current DER risk mitigation strategy focus on modeling capabilities, studies, operational impacts, and regulatory considerations. NERC also produced two quick reference guides that contain more details on all aspects of work in these areas—[Quick Reference Guide: Inverter-Based Resource Activities](#) and [Quick Reference Guide: Distributed Energy Resource Activities](#).

Additionally in 2022, NERC issued two reports about disturbances that involved inverter-based resources—the [Panhandle Wind Disturbance](#) report and the [2022 Odessa Disturbance](#) report. These disturbances and their resulting reports illustrate the need for immediate industry action to ensure reliable operation of the BPS with the ever-increasing penetrations of IBRs.





Jim Robb discusses the 2022 Summer Reliability Assessment on MSNBC's "Morning Joe" (May)



Supply Chain and Security Engineering Assessments

In recognizing the complex and evolving nature of supply chain risks and implementing the recommendations from the [FERC, NERC and Regional Entity Joint Staff Inquiry into the February 2021 Cold Weather Grid Operations](#), the ERO Enterprise took numerous actions to identify and mitigate potential risks over the course of 2022. This included the establishment of a [Natural Gas–Electric Reliability Forum](#) with several meetings held over the year; the development and publication of NERC’s [Security Integration Strategy](#) and the IEEE-NERC technical report addressing cyber security risk scenarios for BPS planning, engineering, and operations; and the collection and review of data to make initial recommendations for improvements to bright-line criteria or identify enhanced approach; among many others.

In May, the Supply Chain Working Group presented an update to the Board on the November 2021 supply chain risk management (SCRM) standards effectiveness survey, which found that entities are expanding their SCRM principles to include cyber assets outside of compliance requirements; however, there are still questions regarding audits and vendors. Respondents also reported that SCRM takes significant resources and impacts other areas, including CIP resources. Most respondents felt that the solution to the supply chain issue would require engagement with other critical industries, not just the electric industry.

In November, the Board accepted the recommendations outlined in the [Low-Impact Criteria Review Team white paper](#) that identified risks and management strategies to better protect low-impact BES cyber systems. This white paper is an important step forward in addressing the critical risk of a coordinated attack on multiple points on the BES. Additionally, the Supply Chain Working Group and the RSTC have developed numerous security guidelines that provide best practices pertaining to the supply chain and will continue to do so.



Approved Supply Chain Security Guidelines

- [Cloud Computing](#)
- [Cyber Security Risk Management Lifecycle](#)
- [Open Source Software](#)
- [Provenance](#)
- [Vendor Incident Response](#)
- [Vendor Risk Management Lifecycle](#)
- [Secure Equipment Delivery](#)
- [Supply Chain Procurement Language](#)

Building a Strong E-ISAC-Based Security Capability

As seen in 2021, the threat landscape continued to demonstrate adversaries' potential capability to disrupt critical infrastructure in North America. Increasingly bold adversaries regularly employ new tactics, techniques, and procedures; they are also exploiting new and legacy vulnerabilities. As a result of sector interdependencies, grid evolution, and an expanding supply chain, the threat surface as well as the potential magnitude of impacts has increased. Geopolitical tensions in 2022 resulted in a "Shields Up" posture, reinforcing the need for increased industry collaboration, communication, and coordination. Throughout North America as the year drew to a close, the need for continued vigilance was thrown into sharp focus with attacks on substations in North Carolina and in the Pacific Northwest.

Throughout 2022, the E-ISAC team worked to stay ahead of these challenges by developing new and innovative products, platforms, and services as well as increasing efforts around existing information sharing and initiatives that provide collective defense in depth.

Strategy

A collective defense approach to cyber and physical security was a guiding principle as the E-ISAC continued to build and maintain its strategic partnerships. The Energy, Finance, and Communications sectors (Tri-Sector), which consist of ISACs and sector coordinating councils, worked closely together throughout the year. This followed the activation of the Tri-Sector All-Hazards Playbook in response to unfolding events in Russia and Ukraine. The E-ISAC took a lead role in these efforts and, along with the Electricity Subsector Coordinating Council and other Tri-Sector partners, is updating the Playbook based on lessons learned from this year's coordination. The E-ISAC continued to expand its cross-border cooperation with Canadian industry and government by signing a revised information sharing agreement with the Canadian Centre for Cyber Security to update the data and services available. In addition, the E-ISAC worked with the Independent Electricity System Operator and Electricity Canada on common security interests and expanded relationships with the Royal Canadian Mounted Police and Natural Resources Canada.

The E-ISAC also partnered with the U.S. Department of Energy to create its new Energy Threat Analysis Center (ETAC). This construct, while still in pilot mode, is a very effective venue to review and exchange intelligence and share information with the sector. It also serves as a link to the Joint Cyber Defense Collaborative hub at Cybersecurity and Infrastructure Security Agency to ensure joint collaboration between the energy sector and other critical sectors.

This year, the E-ISAC enhanced its collaboration with partners, including coordination with the Tri-Sector ISACs and outreach to the natural gas industry all while increasing the products and services offered to its membership.



Defining "Shields Up"

The "Shields Up" campaign, launched by the Cybersecurity and Infrastructure Security Agency and the DHS, is a collective reminder to immediately improve cyber defenses and be more vigilant.



ETAC Focus

The ETAC is focused on collaborating with electricity industry partners and government agencies through the DHS's Cybersecurity and Infrastructure Security Agency Joint Cyber Defense Collaborative.



E-ISAC staff—Andrea Baptiste, Frank Honkus, and Irene Tzinis—attending NRECA’s Tech Advantage Conference (March)



Information Sharing

The diversity, significance, and volume of information products offered to E-ISAC members continues at near-historical levels. In 2022, the E-ISAC shared a significant amount of timely and actionable information regarding a variety of cyber and physical threats. These products and briefings included the Critical Broadcast Program, All-Point Bulletins for cyber security considerations related to the Russian invasion of Ukraine, critical software vulnerabilities in VMWare and Confluence, security awareness for the 2022 mid-term election, and information about physical attacks on substations.

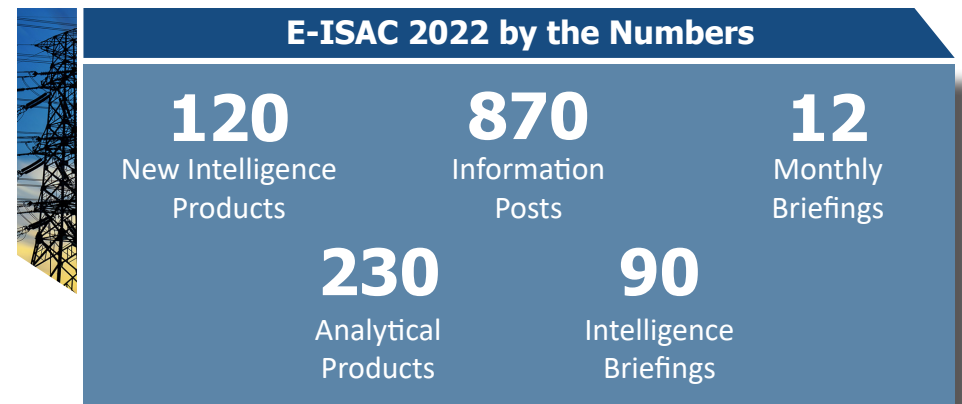
The E-ISAC developed these products and initiated various threat hunts to identify malicious behavior in operational technology networks. The E-ISAC launched a new portal with enhanced self-service capabilities and shared more than 870 information posts with partner ISACs. Lastly, the E-ISAC finalized the *GridEx VI Lessons Learned Report* and developed action plans for stakeholders to address recommendations from the exercise. Reflecting on the importance of security, the E-ISAC enhanced the coordination of its security information sharing with the Regional Entities.

The E-ISAC’s CRISP expanded its membership by 14% and continued to grow its capabilities to provide cyber threat intelligence and government-informed reporting to assist North American asset owners and operators with threat detection.

In addition, the E-ISAC expanded its focus on information sharing with public utilities and cooperative members and their partners, the National Rural Electric Cooperative Association, and the American Public Power Association. The E-ISAC now produces a weekly report for small- and medium-size utilities curated that includes the most critical cyber threat intelligence threat-hunting analysis as well as the E-ISAC Watch assessment of phishing trends, industrial control system vulnerabilities, and key physical threats.

Analysis

In 2022, the E-ISAC developed more analytical products for its members, provided original analysis and threat hunting, and continued to analyze activities in the Operational Technology environment and ransomware groups. The E-ISAC published more than 230 analytical products and provided more than 90 intelligence briefings. The delivery of new intelligence to members through channels, such as the E-ISAC member portal, increased in 2022 with 10 new intelligence products per month on average, many of which included technical details and mitigation recommendations.



In addition, the E-ISAC provided members with a data-driven analysis of security incidents and activity clusters observed by the E-ISAC; the E-ISAC leveraged CRISP, Neighborhood Keeper, the E-ISAC Portal, open-source material, government sources, and other security vendor information as input. The increased focus on original analysis means that the E-ISAC provided intelligence that members and partners could not obtain elsewhere. Most recently, using its unique data sets and analytical assessments, the E-ISAC produced and shared with its members an in-depth assessment of ballistic attacks against North American substations.



The intelligence contained trend analysis, mitigation strategies, and visual representations of the data to make the report more communicative and user-friendly for E-ISAC members. This unique capability is helping utilities spot threats and fix vulnerabilities before they become widely known, increasing the security and resilience of the industry. The E-ISAC continued to track cyber threat actor activity and events and delivered timely intelligence to its members. A recent trend report that focused on operational technology environments provided a snapshot view of anomalous activity. The E-ISAC continuously monitors reporting, data, and member-shared information to assist its members with cyber security risk reduction and exposure.

Engagement

The E-ISAC's member profile reflects the diversity of the industry in the United States and Canada. Membership in the E-ISAC has grown to more than 1,598 member organizations; a total of 204 new organizations joined in 2022 with almost all growth coming outside of the large investor-owned utility segment. Reflecting the interdependencies between natural gas and electric, more than 50% of American Gas Association members are also E-ISAC member organizations. The E-ISAC also rolled out a process to incorporate natural gas sector entities into E-ISAC membership and involvement in the CRISP program.

In 2022, the E-ISAC launched its new Portal for member and partner organizations with enhanced features, such as easier access to content, simplified information sharing options, and new tools to manage and protect accounts. In tandem with the Portal, the E-ISAC also debuted a new version of its public website, www.EISAC.com, which provides up-to-date information on E-ISAC events and programs, industry resources, and more.

In April, the [GridEx VI Lessons Learned Report](#) was released. Communications, collaboration, and coordination were among many policy recommendations the report highlighted as being key to industry's success during a severe security event. GridEx VII will be held on November 14–15, 2023.

In October, more than 750 security experts from across North America participated in the eleventh annual security conference, GridSecCon. The three-day conference—hosted by NERC, the E-ISAC, and ReliabilityFirst—focused on the current grid security environment and grid security planning and preparedness. Over the year, the E-ISAC held four physical security vulnerability workshops and facilitated six Industry Engagement Program events. The Industry Engagement Program events had 91 participants and achieved a net promoter score of 58 from attendees, ranking the program as “Excellent.” Additionally, stakeholder outreach in the form of presentations at industry, regulatory, and governmental meetings was significant with more than 150 engagements undertaken.

Recognizing the supply chain's critical role in BPS resilience, the E-ISAC created its Vendor Affiliate Program to improve collaboration between manufacturers and software companies with the industry. This program is open to security vendors and original equipment manufacturers that support the electric and other critical infrastructure industries and is focused on facilitating increased information sharing and best practices in a trusted environment.



Strengthening Engagement across the Reliability and Security Ecosystem in North America

Rapid growth in variable and distributed generation presents new reliability challenges across North America. Because these emerging issues are largely driven by policy decisions at state and provincial levels, strengthened engagement with policymakers remains a critical priority. Only through effective communication can NERC and the ERO Enterprise provide policymakers with the timely and actionable information they need to reliably navigate the energy transition.

North American Engagement

In 2022, NERC continued to elevate engagement with state and provincial energy leaders. In July, Jim Robb addressed the risks of the changing resource mix with hundreds of state regulators assembled at the summer meeting of the National Association of Regulatory Utility Commissioners (NARUC). In May, Robb and NERC staff held similar discussions at the annual meeting of CAMPUT, Canada's association of energy regulators. The Board also had strategic engagements with the NARUC Board of Directors and the Committees on Electricity and Gas. These discussions focused on the energy sufficiency challenge and ways NERC can continue to support the states and provinces as they navigate the energy transformation.



Jim Robb attending the United Nations Economic Commission for Europe meeting in Geneva, Switzerland (March)



Jim Robb briefing Department of Energy Secretary Jennifer Granholm (right) on the 2022 Summer Reliability Assessment (June)

Throughout the year, subject matter experts frequently briefed state and provincial regulators on NERC reliability assessments and technical reports where seasonal risk was a particular focus. In late 2021, FERC, NERC, and the Regional Entities published the joint report into the severe cold weather events in February 2021 that affected Texas and the Central United States. To operationalize the report's call to action, NERC invested considerable effort in communicating the report findings with regulators and other policymakers. A key engagement was NERC's co-sponsorship of the April 27 joint technical conference on improving winter readiness of generating units. Convened with FERC, NERC, and the Regional Entities, the conference assembled vital stakeholders for discussions about the previous winter performance, lessons learned, and best practices. Outreach around NERC's *2022 Summer Reliability Assessment* achieved new milestones, attracting unprecedented attention by media and among policy stakeholders at every level, including a briefing with Jennifer Granholm, U.S. Department of Energy Secretary. Additionally, NERC co-sponsored a National Academy of Engineers workshop in October that brought together industry, regulators, and academia to provide insights on the topic of "Creating A Sustainable National Electric Infrastructure While Maintaining Reliability and Resiliency of the Grid." The resulting final report, including next steps and mitigations, will be provided to government partners.

ERO Enterprise staff and leadership continued to work to strengthen relations with stakeholders in Canada. Conversations and information exchange around technical and regulatory matters included on-site visits and activities with key partners, such as the Canadian Electricity Association, Natural Resources Canada, the Ontario Energy Board, and ongoing engagement with CAMPUT, among others.

In August, more than 20 regulators from six Canadian provinces and Canada's federal government joined the Board in Vancouver, British Columbia, Canada (in-person and virtually). Discussions covered managing risks during the generation mix transformation, renewable energy deployment in Canada, cyber security threats across critical sectors, and efforts to make the standards development process more agile to address the reliability challenges of the transforming grid. Session participants, including CEOs from Regional Entities with Canadian territory in their footprints, discussed important coordination activities within the ERO Enterprise. In November, NERC leadership participated in Electricity Canada's Senior Executive Security Tabletop Exercise. NERC continually works with its partners to assure reliability for nearly 400 million North Americans.

Outside North America

Throughout the year, NERC held information exchanges with partners beyond North America, including an on-site visit to the European Union in Brussels. NERC staff also completed a NARUC engagement with the West Africa Partnership, providing technical assistance to the Economic Community of West African States' Regional Electricity Regulatory Authority and assisting with the development of a reliability and market functional model. NERC and the E-ISAC participated in the Cyber Resiliency Challenge 2022, which was organized by the United States Energy Association with United States Agency for International Development funding and included participation from Eastern European countries. Engagements were also conducted with industry and policy stakeholders from Chile and Colombia. Executives from the Chilean System Operator, NERC, and the E-ISAC met in Washington, D.C., to exchange ideas regarding implementation of a cyber security framework.

Capturing Effectiveness, Efficiency, and Continuous Improvement Opportunities

The ERO Enterprise embraces consistency, quality, efficiency, and timeliness of results and recognizes that improvements in these areas are essential to mitigating the ongoing cost of maintaining and improving the effectiveness of ERO Enterprise operations. Recognizing that the energy transformation requires effective tools to manage rapidly emerging reliability risks, NERC is focused on innovations for becoming more effective.

Align and the ERO Enterprise Secure Evidence Locker

Two such innovations are the Align Project and the ERO SEL. Align moves all compliance monitoring and enforcement business processes to a common standardized platform, resulting in a consistent application of the ERO Enterprise CMEP and a more secure method of managing and storing CMEP data. The ERO SEL—a key component of the reimagined suite of CMEP work and data management tools—provides a secure, isolated environment to collect and protect compliance monitoring and enforcement evidence that significantly reduces the risk of loss or exposure of evidence, and it harmonizes the evidence collection processes.

The rollout of Align and the ERO SEL began in 2021 and continued through 2022. In June, the ERO Enterprise launched Release 4.0 of Align, which included enhancements for compliance monitoring, audit, and scheduling activities. Release 4.5, which included features to enable development of inherent risk assessments and compliance oversight plans, was deployed in November. These rollouts were supported by stakeholder outreach and education, end-use training, and business unit readiness activities to best support a seamless transition for the ERO Enterprise.

History of the Align Project

The Align project is a culmination of strategic efforts that began in 2014 with the goal of improving and standardizing processes across the ERO Enterprise in order to enhance the efficiency of ERO Enterprise operations and improve the effectiveness of executing statutory functions.



ERO Enterprise Transformation

Faced with a rapidly changing reliability landscape, the ERO Enterprise is transforming to meet those challenges by further leveraging resources, enhancing communication and collaboration, and ensuring grid reliability across North America. Over the course of 2022, the ERO Enterprise engaged in a collaborative process to accelerate its transformation through diverse activities, including ERO Enterprise-wide town halls, joint leadership training sessions, work among ERO Enterprise collaboration groups, and a successful May Leadership Workshop.

ERO Enterprise Commitments

- Working together as one team and honoring each of its roles
- Actively supporting ERO Enterprise activities while eliminating unnecessary duplication of work
- Collaborating to develop clear and consistent guidance across the ERO Enterprise
- Sharing information, knowledge, and resources across the ERO Enterprise
- Developing and sharing harmonized messages across ERO Enterprise communications
- Supporting innovation, initiatives, and the sharing of best practices across the ERO Enterprise

Business Plan and Budget

This transformative mindset is also evidenced through NERC's [2023–2025 Business Plan and Budget](#), which was submitted to FERC in August and approved in November. The new plan is proactive in its approach and focuses on investments where NERC can most influence change. In the last quarter of 2021, NERC leadership and the Board examined industry dynamics, conducted analyses, and aligned on strategic priorities and focus areas. Through the first half of 2022, NERC leadership and the Board conducted extensive outreach with industry stakeholders to share and gain feedback on the 2023–2025 areas of focus. In parallel, NERC leadership developed budget assumptions to support the three-year plan that were shared in detail with the Board and discussed with key stakeholders, including the Member Representatives Committee Business Plan and Budget Input Group, the E-ISAC's Member Executive Committee, and industry trades and forum representatives.

At its November meeting, the Board approved the 2023 ERO Enterprise Work Plan Priorities, which strive to keep NERC at the forefront of the transformation of the grid by focusing on four key areas: Energy, Security, Agility, and Sustainability.

2023 ERO Enterprise Key Focus Areas

- **Energy:** Tackle the challenge of grid transformation; climate change-driven, extreme weather; and inverter performance issues
- **Security:** Move the needle by focusing on supply chain, Information Technology and Operational Technology system monitoring, cyber-informed grid planning and design, and evolution of the CIP standards
- **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
- **Sustainability:** Invest in ERO systematic controls, eliminate single points of failure, strengthen succession planning, and ensure robust cyber security protections for all systems



NERC 2.0 | Invented Future

In 2021, NERC launched an initiative known as “NERC 2.0 | Invented Future,” which encompasses a variety of different efforts intended to build an engaged culture within the company. Over the past two years, NERC has conducted engagement surveys and focused on developing people leaders; launched four employee resource groups (ERGs)—the Black and African-American ERG, Elevate ERG, Caregiver ERG, and Mental Health ERG; created an innovation committee and an engagement committee; and leaned into the processes of performance management to assure alignment with strategy and goal development and assure productivity.

One main component of NERC 2.0 is the Connected Workforce model, which gives staff more flexibility and supports a better work/life balance while investments in new technology and processes ensure that employees are able to engage and stay connected with each other. After looking at how employees use their work space under this new model, NERC procured new D.C. office space—the NERC Collaboration Hub. The NERC Collaboration Hub reduced the amount of space needed by 26%, leading to an initial annual savings of more than \$400k while still providing a space for the ERO Enterprise and stakeholders to connect and collaborate. This new space was intentionally designed over the past two years to offer flexibility, collaboration, and connection in a sustainable environment and provide what NERC needs to work successfully toward its mission of a secure and reliable BPS.

NERC Collaboration Hub Priorities



Flexibility: NERC answered the call with its Connected Workforce model to support a better work-life balance and to help retain talent, while opening up pathways to attract new talent.



Collaboration: In the new virtual world, collaboration efforts are key to keeping relationships with each other and NERC stakeholders intact; for forging new relationships; and for keeping NERC’s culture at the forefront. The new design looked at ways to capitalize on engagement—with NERC staff and stakeholders.



Sustainability: While connecting people was the ultimate goal, NERC also focused efforts on being more conscious of its own environmental footprint.

NERC's 2022 Achievements

The following word cloud represents NERC's 2022 achievements according to a poll of the NERC team during an end-of-year Town Hall.



2022 ERO Enterprise Executive Committee



Jim Albright
President and CEO
[Texas Reliability Entity](#)



Jason Blake
President and CEO
[SERC Reliability Corporation](#)
2022 ERO EC Co-Chair



Manny Cancel
Senior VP, NERC
CEO, E-ISAC



Charles Dickerson
President and CEO
[Northeast Power Coordinating Council](#)



Melanie Frye
President and CEO
[WECC](#)



Tim Gallagher
President and CEO
[ReliabilityFirst](#)



Kelly Hanson
Senior VP and Chief Administrative Officer
NERC



Mark Lauby
Senior VP and Chief Engineer
NERC



Sonia Rocha Mendonca
Senior VP, General Counsel, and Corporate Secretary
NERC



Sara Patrick
President and CEO
[Midwest Reliability Organization](#)



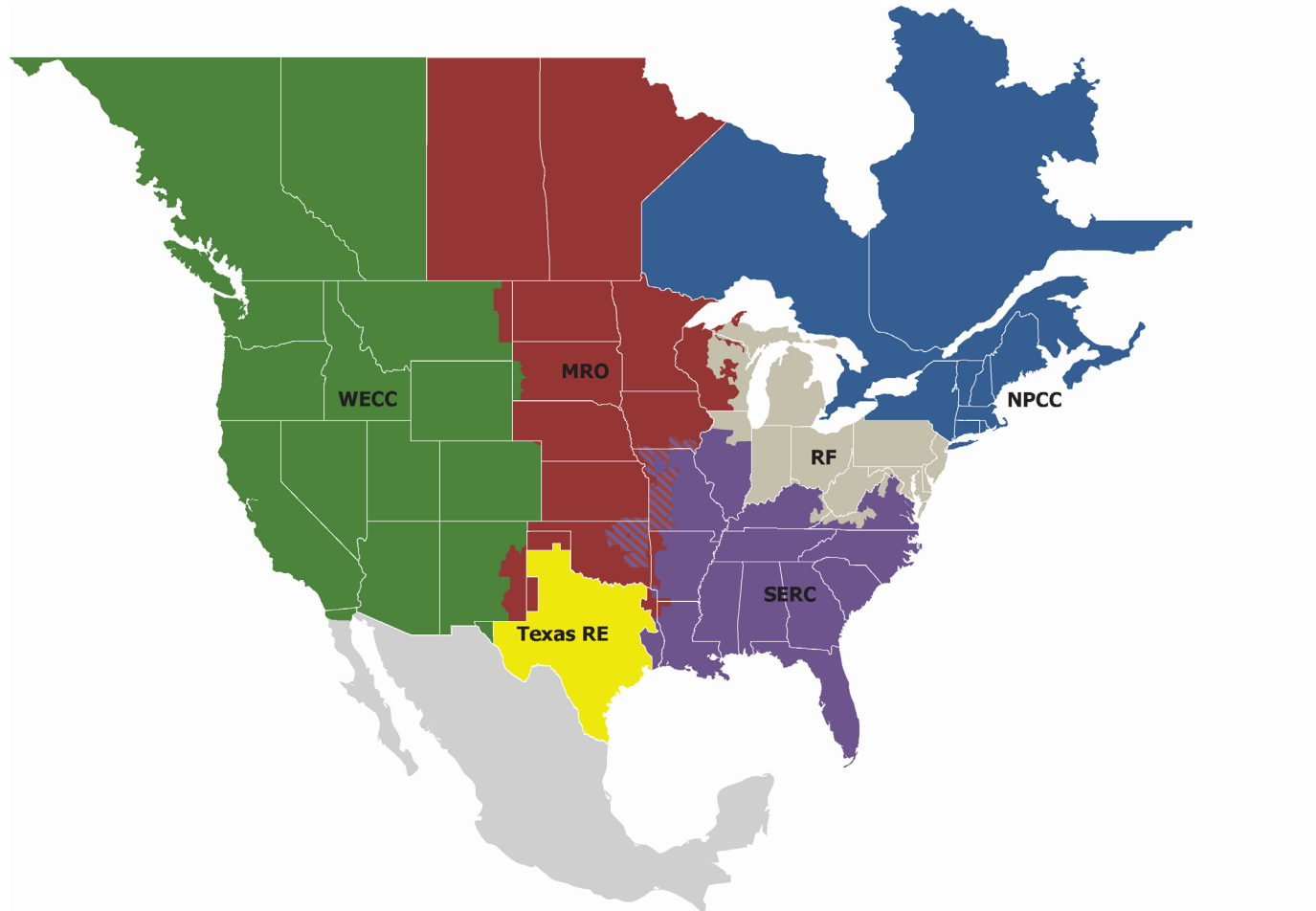
Jim Robb
President and CEO
NERC
2022 ERO EC Co-Chair



Janet Sena
Senior VP,
External Affairs
NERC

Regional Map

The North American BPS is comprised of six Regional Entities plus NERC.



[Midwest Reliability Organization \(MRO\)](#)

[SERC Reliability Corporation \(SERC\)](#)

[Northeast Power Coordinating Council \(NPCC\)](#)

[Texas Reliability Entity \(Texas RE\)](#)

[ReliabilityFirst \(RF\)](#)

[WECC](#)

Letter from the NERC Board Chair

The Board and the management team met and took a deliberate and strategic approach in 2022 to better position NERC's focus on energy, security, agility, and sustainability. It had become very clear to the Board that we could no longer plan year-to-year if we wanted to be more effective and efficient in the way we address the changing ecosystem.

The Board asked the NERC leadership to develop a three-year plan to address these challenges, which was identified, communicated, and acted upon through open, continuous, and collaborative outreach to our stakeholders. FERC approved the 2023 budget in November, and we are very grateful for the communication and support of our stakeholders in this effort. The Board will hold NERC management accountable through the 2023 work plan priorities, but they will also look to the stakeholders for their collaboration and shared commitment for these reliability priorities.

Fulfilling NERC's statutory mandates and tackling the new challenges before us requires a step change in how we fulfill our mission. This step change requires all of us to look differently at NERC's priorities and the resources required to accomplish these shared goals. It will require all of us to take a look at things through a new lens—one focused on agility, adaptation, and aggregated approaches. Managing the pace of change is a challenge for reliability, and we need to ensure that our own efforts adapt to this pace when appropriate.

A key efficiency initiative focused on standard process improvement. The Board directed this activity, and a broad-based group of stakeholders developed a well-reasoned and comprehensive set of consensus recommendations for standard process improvements. The majority of the recommendations were supported, including proposals for changes to NERC's rules, but the Board did adjust some proposals based on stakeholder feedback. Importantly, the Board clarified that its proposal for a new directive authority would only be used in extraordinary circumstances. Work on this initiative, including vetting the proposed rules changes through NERC's stakeholder processes, will continue in 2023.

In addition, the Board focused on improving our own process effectiveness keeping in mind our first duty is to meet our fiduciary responsibilities. We focused on three primary areas: how to enhance engagement with our growing and evolving group of stakeholders, how to capture efficiency without sacrificing effectiveness, and how and where to build agility in governance.

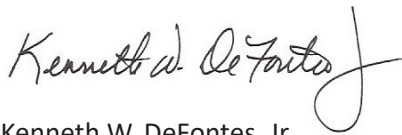
Several key steps were identified: leveraging our committee time to allow for more transparency, freeing up the Board for more informal conversations with stakeholders by optimizing meeting frequency and technology, and focusing agendas on governance actions and continuously assessing priority areas. These actions result in change, and they are change in the right direction for our times. Restructuring the Board calendar to focus on three meetings is a major step that will show significant benefits. The in-person meeting in February will start the year off with a focus on elections and departures as well as a return to a hosted stakeholder dinner that will facilitate a collective outreach for all of our stakeholders. Our August in-person meeting will continue to be held in Canada and further develop our partnership within the North American footprint and enhance our outreach as unified partners in guiding our progress toward a reliable bulk power system.



Kenneth DeFontes, Jr.
Board Chair

The Board's relationship with the MRC is important; thus, the May meeting will focus on a Board/MRC in-person meeting with a virtual/hybrid option for all other stakeholders. This will allow for more time for the Board and the MRC sector representatives who play a key advisory role to the Board, but maintain an open meeting for all participants.

The actions identified in 2022 are intended to result in more effective engagement with all stakeholders; more efficient, effective, and agile governance processes; and a more effective use of our time and more efficient use of resources. All of the efforts in 2022 were based on a continued commitment by the Board to the critical mission of NERC and all its stakeholders to assuring the reliability, resilience, and security of the BPS. This effort will ensure we stay at the forefront of key issues impacting the BPS and NERC itself.

A handwritten signature in black ink, reading "Kenneth W. DeFontes, Jr." with a stylized flourish at the end.

Kenneth W. DeFontes, Jr.
NERC Board of Trustees Chair

2022 Board of Trustees



Kenneth
DeFontes, Jr.
Chair



George Hawkins
Vice Chair



Jim Robb



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