Request for Information Related to Department of Energy's Responsibilities on Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence

Department of Energy, Office of Critical and Emerging Technologies
Docket Number DOE-HQ-2024-0007

Comments of the North American Electric Reliability Corporation regarding the AI Executive Order

The North American Electric Reliability Corporation ("NERC")[1] submits comments on the Department of Energy request for information on how artificial intelligence can improve electric grid reliability, security, operations, and planning, among other areas. This request for information will assist the Department of Energy in carrying out certain responsibilities under the Executive order titled ''Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence'' issued on October 30, 2023, including development of a public report.[2]

These comments focus on the potential benefits of artificial intelligence in supporting the reliability of the Bulk Power System,[3] particularly considering the rapid grid transformation. Section I provides a description of NERC and the Regional Entities, collectively the "ERO Enterprise," and their role in maintaining the reliability of the Bulk Power System. Section II provides NERC's comments on the potential benefits of artificial intelligence in Bulk Power System operations, planning, regulation, and security. Section III provides a brief conclusion.

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[1] The Federal Energy Regulatory Commission ("FERC") certified NERC as the electric reliability organization ("ERO") in accordance with Section 215 of the Federal Power Act, 16 U.S.C. § 824o. *N. Am. Elec. Reliability Corp.*, 116 FERC ¶ 61,062 (2006).

[2] *Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*, Exec. Order No. 14,110, 88 FR 75191 (Oct. 30, 2023), https://www.federalregister.gov/documents/2023/11/01/2023-24283/safe-secure-and-trustworthy-development-and-use-of-artificial-intelligence [hereinafter AI Executive Order].

[3] Under Section 215 of the Federal Power Act, FERC regulations, and the NERC Rules of Procedure, the Bulk Power System is defined as "(A) facilities and control systems necessary for operating an interconnected electric energy transmission network (or any portion thereof); and (B) electric energy from generation facilities needed to maintain transmission system reliability. The term does not include facilities used in the local distribution of electric energy." See 16 U.S.C. 824o(a)(1); 18 C.F.R. § 39.1; and NERC Rules of Procedure, Appendix 2, available at https://www.nerc.com/AboutNERC/RulesOfProcedure/ROP_Appendix%202_20220519.pdf.

While these comments focus on the benefits of artificial intelligence, NERC notes that it is committed to identifying and monitoring the risks of implementation of artificial intelligence, such as the increased load demand and potential need for heightened cybersecurity measures. Nevertheless, NERC is supportive of the electric industry leveraging new technologies to enhance the efficiency and effectiveness, and therefore reliability, of the Bulk Power System.

I. DESCRIPTION OF NERC AND THE ERO ENTERPRISE

NERC is a not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the North American Bulk Power System. NERC's area of responsibility spans the continental United States, Canada, and the northern portion of Baja California, Mexico.

In the United States, FERC certified NERC as the designated ERO under Section 215 of the Federal Power Act.[4] As the ERO, NERC is charged with developing and enforcing mandatory Reliability Standards applicable to owners, operators, and users of the Bulk Power System; assessing current and future reliability trends; analyzing system events; and recommending improved practices.[5] NERC's mandatory and enforceable Reliability Standards, which are approved by FERC in the United States, define the reliability requirements for planning and operating the North American Bulk Power System. NERC accomplishes its mission with the support of the six Regional Entities.[6] The six Regional Entities support reliability across differing interconnections with specific needs and characteristics by conducting compliance monitoring, enforcement, analysis, and outreach activities, among other things.

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[4] 16 U.S.C. § 824o.

[5] These terms are defined in NERC's Glossary of Terms Used in NERC's Reliability Standards, available here: https://www.nerc.com/pa/Stand/Glossary%20of%20Terms/Glossary_of_Terms.pdf.

[6] The six Regional Entities include the following: Midwest Reliability Organization, Northeast Power Coordinating Council, Inc., ReliabilityFirst Corporation, SERC Reliability Corporation, Texas Reliability Entity, Inc., and Western Electricity Coordinating Council.

In addition to its role of developing and enforcing mandatory Reliability Standards, NERC is responsible for independently assessing and reporting on the overall reliability and adequacy of, and risks to, the Bulk Power System. NERC regularly performs seasonal assessments (for the summer and winter seasons) and long-term assessments (for the upcoming 10-year period). As emerging risks to reliability are identified, NERC also conducts special assessments to assess these risks and their potential impact, and to identify steps that utilities and policymakers may take to address these emerging risks.

By identifying and quantifying emerging reliability issues, NERC provides risk-informed recommendations and supports a learning environment for industry to pursue improved reliability performance. These recommendations, along with the associated technical analysis, provide the basis for actionable enhancements to resource and transmission planning methods, planning and operating guidelines, and NERC Reliability Standards.

Aside from NERC's duties as the ERO, NERC also operates the Electricity Information Sharing and Analysis Center ("E-ISAC") on behalf of the electricity industry. The E-ISAC provides its members and partners with resources to enhance situational awareness and disseminates threat intelligence to help reduce cyber and physical security risks to the North American electricity industry.

II. COMMENTS

As noted above, as the ERO, NERC's sole mission is supporting the reliability, resilience, and security of the Bulk Power System. To that end, NERC monitors the state of the electric grid and identifies any challenges facing the reliability of the electric grid. In its *2023 ERO Reliability*

Risk Priorities Report,[7] NERC highlighted challenges associated with the transformation of the grid, including from the use of new technologies that are changing the way the grid operates. For instance, rapid load growth due to electrification, the proliferation of data centers, and other drivers has resulted in changing load characteristics. The electricity industry must adapt to these changing conditions to maintain reliability. This transformation of the grid leads to the Bulk Power System becoming more complex with the need to model, analyze, and operate the Bulk Power System at a higher fidelity. Considering this transformation, NERC, the Regional Entities, and their industry and government stakeholders must consider how to support grid operations, grid planning, and implementation of regulatory responsibilities.

NERC's comments focus on ways that artificial intelligence can help address the challenges of grid transformation to support reliability now and in the future. The comments are organized as follows: Section A describes ways artificial intelligence can enhance data analysis for Bulk Power System operations; Section B addresses ways artificial intelligence can enhance grid planning; Section C provides considerations for enhancing the regulatory function of NERC and the Regional Entities; Section D describes ways artificial intelligence can enhance cyber security in the industry.

A. Artificial Intelligence Can Enhance Data Analysis for Bulk Power System Operations

Timely and accurate data is essential for real-time operations of the Bulk Power System. Grid operators use gross and net real power capability information from generators as inputs to

[7] NERC, *2023 ERO Reliability Risk Priorities Report*, at 23 (Aug. 2023) https://www.nerc.com/comm/RISC/Related%20Files%20DL/RISC_ERO_Priorities_Report_2023_Board_Approved_Aug_17_2023.pdf.

system models.[8] Grid operators also verify that voltages are maintained within limits through steady-state analysis.[9] Entities responsible for higher-level grid monitoring, such as Transmission Operators and Reliability Coordinators, monitor whether the system within their footprint may exceed certain limits. Each of these is an example of how grid operators rely on data to assess the health of the system under their control. As more resources are integrated into the grid and demand for electricity grows, the amount of data and analysis needed to operate the grid will increase. The ability of artificial intelligence to manipulate and analyze this data could make it an important tool in enhancing grid operators' use of data to oversee their systems.

NERC is in the process of assessing potential uses for and the benefits of artificial intelligence to the Bulk Power System. Based on a review of publicly available information on potential applications, however, NERC's preliminary view is that artificial intelligence could potentially enhance Bulk Power System operations data analysis in the following areas:[10]

- Operation of power systems like unit commitment, hydro-thermal coordination, economic dispatch, congestion management, maintenance scheduling, state estimation, and power flow.
- Control of the power system like voltage control, stability control, power flow control, and load frequency control.
- Management and control of power systems, given the transformation to smaller generation and large loads.
- Automation of power system like restoration, management fault diagnosis, and network security.
- Predict power demand with high accuracy by analyzing historical consumption data, weather patterns, and other factors, which could help optimize generation schedules and reduce the operational costs of power plants.

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[8] FERC, *Reliability Primer*, at 60 (2020), https://www.ferc.gov/sites/default/files/2020-04/reliability-primer_1.pdf (discussing NERC's MOD Reliability Standards).

[9] *Id.*

[10] *See e.g.,* Bittu Goswami, *Artificial Intelligence in Power System,* at slide 22 (Apr. 26, 2016), https://www.slideshare.net/BittuGoswami/artificial-intelligence-in-power-system. In addition, NERC reviewed other publicly available information to select this list of applications, including review of some information generated by artificial intelligence.

- Forecast energy production (particularly for renewable energy sources like solar and wind) and optimize its integration into the grid, which aids in balancing supply and demand effectively and can also support electric vehicle grid integration, both for charging and discharging.
- Predictive maintenance to analyze data from various sensors to predict equipment failures before they occur, which could reduce downtime, increase efficiencies, and extend the lifespan of assets.
- Analysis of real-time data to facilitate instant decision-making to manage load, control voltage, and mitigate risks, thereby improving operational efficiency.
- Dynamically adjust to changing loads to ensure efficient distribution of power and minimize losses.

In its *2023 ERO Reliability Risk Priorities Report*,[11] NERC identified that the transformation of the grid creates certain risks that require attention. For instance, the Bulk Power System is becoming more complex, and the need to model, analyze, and operate the BPS at higher fidelity further exacerbates training, staffing, and workforce issues. Competition for available skilled workers is becoming a roadblock and an emerging risk. Artificial intelligence could help address these workforce needs in operating the grid by streamlining data analysis and manipulation.

Moreover, artificial intelligence could be applied to system protection settings to make them adaptive instead of requiring people to change the protection settings. These analytical tools powered by artificial intelligence would permit operators with less experience to perform tasks of a more senior operator and make more efficient use of the electric industry workforce. In so doing, artificial intelligence could help address the challenge of needing a larger skilled workforce to handle the increase in data analysis required by the grid transformation.

[11] NERC, *2023 ERO Reliability Risk Priorities Report,* at 23 (Aug. 2023), https://www.nerc.com/comm/RISC/Related%20Files%20DL/RISC_ERO_Priorities_Report_2023_Board_Approved_Aug_17_2023.pdf.

B. Artificial Intelligence Could Enhance Planning

Grid planners perform studies of the transmission system under certain system conditions to inform future system needs or identify any vulnerabilities that may need to be factored into development of the transmission system.[12] Often these studies require simulation of various scenarios, such as generator or transmission outages, among others, to determine future needs of critical infrastructure.[13] In addition, these studies may need to consider impacts of extreme weather.

Artificial intelligence could help enhance planning of the power system. Generation expansion planning, power system reliability, transmission expansion planning, and reactive power planning through the use of adaptive modeling could all be improved with the application of artificial intelligence to the data analysis and result assessment. With the right inputs, planners could train artificial intelligence to predict certain scenarios. For instance, planners could train artificial intelligence to determine the likelihood of certain faults, such as those that contributed to the Blue Cut fire in California[14] based on past event data. Similarly, planners could enhance their ability to factor in effects of extreme weather, such as those experienced in Winter Storm Uri in 2021[15] and Winter Storm Elliott in 2022.[16]

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[12] FERC, *Reliability Primer*, at 62-3 (2020), https://www.ferc.gov/sites/default/files/2020-04/reliability-primer_1.pdf (discussing NERC's TPL Reliability Standards).

[13] *Id.*

[14] *See* NERC, *1,200 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report: Southern California 8/16/2016 Event* (June 2017), https://www.nerc.com/pa/rrm/ea/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_/1200_MW_Fault_Induced_Solar_Photovoltaic_Resource_Interruption_Final.pdf (analyzing the Blue Cut fire system disturbance).

[15] FERC- NERC-Regional Entity Staff, *The February 2021 Cold Weather Outages in Texas and the South Central United States* (Nov. 2021), https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and.

[16] FERC-NERC-Regional Entity Staff, *Inquiry into Bulk-Power System Operations During December 2022 Winter Storm Elliott* (Oct. 2023), https://www.ferc.gov/media/winter-storm-elliott-report-inquiry-bulk-power-system-operations-during-december-2022.

C. Artificial Intelligence May Support Regulatory Functions

As noted above, the ERO Enterprise is responsible for monitoring compliance with and the enforcement of applicable Reliability Standards. As part of compliance with applicable Reliability Standards, over 1,800 entities registered with NERC[17] maintain documentation as evidence of compliance with over 100 Reliability Standards,[18] leading to an enormous amount of compliance data and information. The ERO Enterprise reviews this evidence, either through sampling methodologies or in its entirety, to monitor compliance. With the addition of certain inverter-based resources to the compliance registry over the next few years, the number of entities will increase, and the amount of evidence NERC and the Regional Entities need to review will likewise grow.

NERC and the Regional Entities may consider appropriate use of artificial intelligence to assist in conducting compliance monitoring activities. For instance, NERC and the Regional Entities could consider whether artificial intelligence can help provide compliance assessments of more day-to-day compliance, with NERC and Regional Entity staff reviewing any flagged instances of non-compliance. Furthermore, entities responsible for compliance could consider whether artificial intelligence tools could help them better maintain compliance, improve their controls, and self-report any violations.

D. Artificial Intelligence Can Enhance Cyber Security

Against the backdrop of a changing grid and resource mix, there continues to be a dynamic and complex cyber threat landscape.[19] Artificial intelligence is a known emerging risk given the

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[17] NERC maintains a list of active registered entities, known as the NERC Compliance Registry, where entities are provided a unique identification number. The NERC Compliance Registry is available at https://www.nerc.com/pa/comp/Pages/Registration.aspx.

[18] The complete set of Reliability Standards are available at https://www.nerc.com/pa/Stand/Reliability%20Standards%20Complete%20Set/RSCompleteSet.pdf (updated as of January 1, 2024).

[19] E-ISAC, 2023 End of Year Report (Feb. 2024), https://www.nerc.com/pa/CI/ESISAC/Documents/2023%20E-ISAC%20End-of-Year%20Report.pdf.

rapid change in technology being connected, used, and leveraged to operate the Bulk Power System. NERC is working collaboratively with industry to develop guidance on how to deploy these technologies in ways that enhance reliability and resilience.[20]

While artificial intelligence is not a new concept in industry or cyber security (in fact large language models and deep learning is used throughout by a variety of government agencies and vendors), the development of generative artificial intelligence creates both threats and opportunities for industry's cyber security. Artificial intelligence can recognize anomalous activity patterns in data that are not readily apparent, such as the "living off the land" techniques used by advanced persistent threat actors from China and Russia. Artificial intelligence can also scale up and rapidly detect and share malicious indicators and tradecraft with government, ISACs, and vendors to make networks more secure. Such uses of artificial intelligence could enhance grid security and uncover nefarious activity in order to prevent breaches and large-scale outages.

Specifically, NERC considers the following applications to be ways artificial intelligence could potentially enhance Bulk Power System cyber security:

- Artificial intelligence could be used for security orchestration, automation, and response to automate security responses to events and detect malicious or anomalous activity to help alert security personnel and enable better defense of networks.
- Artificial intelligence could be used for security information and event management to enable network defenders to better detect, analyze, and manage security threats to information technology and operational technology networks.
- Vulnerability detection and fixing could be accelerated and possibly automated and scaled very quickly, minimizing the vulnerability of a particular asset or system.
- Models using artificial intelligence can help balance user experience and security, particularly around access management, by validating access based on user behavior and proactively evaluating the risk of login attempts against the baseline.

[20] NERC, *Security Integration Strategy: Ensuring Security of the Bulk Power System through Cyber and Physical Security Integration into Planning, Design, and Operational Engineering Practices*, at 7 (Dec. 2022), https://www.nerc.com/comm/Documents/NERC_Security_Integration_Strategy_2022.pdf.

- Enhancing defenses against social engineering, like phishing, brute forcing, "waterholing," and other tactics, is another potential benefit that artificial intelligence can bring to network defenders in both IT and OT spaces.

While artificial intelligence certainly presents a significant challenge to industry and national security, the use of artificial intelligence as part of a defense and resilience strategy will be necessary to keep pace with the change in technology and adversary behavior. Artificial intelligence could also help address cybersecurity workforce needs in defending the grid, automating defenses and analyses that previously were very human dependent. NERC anticipates that the use of artificial intelligence could help address these challenges through its ability to automate and orchestrate cyber defenses faster and more accurately, thereby requiring fewer or less skilled staff.

III. CONCLUSION

NERC respectfully requests that the Department of Energy consider these comments in its development of public report to satisfy the AI Executive Order.

Respectfully submitted,

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