RESPONSE TO AI AND ENERGY WORKING GROUP

REQUEST FOR INFORMATION

May 15, 2025

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The Honorable Julie Fedorchak
1607 Longworth House Office Building
Washington, District of Columbia 20515

Representative Fedorchak,

Thank you for your recognition of the transformational change that Artificial Intelligence (AI) is driving across the global economy and of the critical importance of American leadership in developing and deploying AI technologies. Affordably addressing the energy demand from the rapid growth of AI, data centers, domestic manufacturing, and electrification is critical for maintaining American competitiveness and supporting economic development.

The GridWise Alliance is a membership organization founded in 2003 by the U.S. Department of Energy (DOE) and the Pacific Northwest National Laboratory (PNNL) in the advent of DOE's Smart Grid program as a means of engaging the electric grid industry. GridWise has since become an independent organization with members across the grid ecosystem, from utilities of all business models to grid equipment manufacturers and technology solution providers to engineering and consulting companies and national laboratories. Our members include data center owners and operators, engineers who help design data centers and the grid, and utilities servicing some of the nation's largest data center "alleys." Our mission is to articulate the benefits and challenges of grid modernization to support the enhanced reliability, security, and affordability of transmitting electricity to consumers. We are pleased to submit the following response to your Request for Information (RFI) on AI and energy demand.

We look forward to working with you on this important issue.

Sincerely,

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THE GRIDWISE ALLIANCE
RESPONSE TO AI AND ENERGY WORKING GROUP REQUEST FOR INFORMATION

I. American Energy Dominance and AI Energy Demands

Much of the focus of meeting AI energy demand has been on how to generate more electricity to power the rapid growth of AI data centers. The GridWise Alliance is agnostic on the fuel resources producing the electrons that move across the electric grid. Our focus is on how to maximize the capacity, reliability, efficiency, security, and affordability of the grid to serve as a platform for policy and economic goals, like winning the global AI race. We urge policymakers not to ignore the critical role of grid modernization investments to support new investments in generation resources to meet AI energy demand.

The GridWise Alliance released a "Vision for an Integrated Grid" in 2024 in which we ***emphasize the need for a coordinated strategy for maximizing the capacity of the current transmission and distribution system while awaiting the benefits of an expanded transmission network. We also recognize the importance of optimizing the contribution of local resources (i.e., distributed energy resources), in addition to utility-scale resources, that can contribute not only energy but essential grid services and flexibility to meet AI electricity demand.***

Our answers to your RFI are based on this vision statement and efforts by the GridWise AI Working Group to document how utilities are adopting AI across their business enterprise. We would be pleased to expand on our responses in any areas of interest to your AI and Energy Working Group.

• In what ways can American energy resources, including those produced on federal lands, be optimized to meet these demands while ensuring energy security and economic competitiveness?

As we note in our Vision statement, meeting AI energy demand will require developing new generation resources across the transmission and distribution systems, as well as prioritizing flexibility and energy efficiency. Connecting utility-scale generation will in many cases require the construction of new transmission lines, especially if developed on federal lands. It will also require increasing the capacity of the existing transmission system through reconductoring and the deployment of Grid Enhancing Technologies (GETs) and storage.

Utilities are increasingly relying on local resources like aggregated distributed energy resources (DERs) that can provide power either to distribution-level consumers or into the bulk power system. FERC Order 2222 is designed to open the bulk power market to these local resources, which will be essential to meeting growing electricity demand. See the GridWise report on the grid investments necessary to support FERC Order 2222 for additional background. We will expand on these necessary investments in our answers to your Securing the Grid questions; however, ***it is essential to recognize that to meet electricity demand across the nation, investments in modernizing the distribution grid must occur alongside transmission upgrades.***

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II. Securing the Energy Grid

• What measures are necessary to modernize and secure the energy grid against cyber and physical threats in light of increasing AI energy demands?

Cyber and physical attacks on the grid are increasing, according to the North American Electricity Reliability Corporation (NERC)[1], with the number of nodes on the grid susceptible to attack growing each year. Disruptions in the delivery of electricity have significant economic and human costs regardless of whether a utility is serving data center load, so utilities of all sizes and locations must strengthen their defenses.

Specifically, to modernize and secure the energy grid against rising cyber and physical threats, especially in light of growing AI-driven energy demands, GridWise member utilities are enhancing both digital and physical protections in alignment with the NIST Cybersecurity Framework (CSF). This includes implementing Zero Trust principles, hardening substations, increasing surveillance and threat detection, and managing supply chain risks.

GridWise members emphasize the importance of collaboration and information-sharing between private industry and the federal government in strengthening the security of the grid. This collaboration has been facilitated by the Cybersecurity Information Sharing Act of 2015 (CISA 2015), which expires on September 30, 2025.

CISA 2015 is a cornerstone of American cybersecurity. It enhances businesses' ability to respond swiftly to today's cyber threats, including tackling cybersecurity issues and addressing them at scale. Lawmakers must send the CISA 2015 reauthorization legislation to the president to continue ensuring that businesses have legal certainty and protection against frivolous lawsuits when voluntarily sharing and receiving threat indicators and taking steps to mitigate cyberattacks.

Since the implementation of CISA 2015, collaboration in cybersecurity has improved significantly in several ways, including encouraging the development and/or the expansion of information sharing and analysis centers, or ISACs, across multiple sectors. These centers serve as hubs for sharing cybersecurity information within specific industries, thereby enhancing sector-specific threat detection and response capabilities.

To protect the grid against cyber and physical threats, Congress must reauthorize CISA 2015 before it expires on September 30, 2025.

• How can investments in grid resilience and smart infrastructure be prioritized to support both current and future technological advancements?
• Which investment priorities are most critical for ensuring both expanded capacity of the energy grid and the advancement of domestic energy production?

In the GridWise Alliance Technology Portfolio whitepaper, we present fundamental capabilities that are essential to a modern, reliable, secure and affordable grid:

• **Integrated planning** helps with forecasting electric load growth and how grid infrastructure may need to be upgraded to support new loads;
• **System visibility** and advanced sensors send data grid conditions from customer through delivery systems and generation resources for situational awareness;

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[1] US electric grid growing more vulnerable to cyberattacks, regulator says | Reuters

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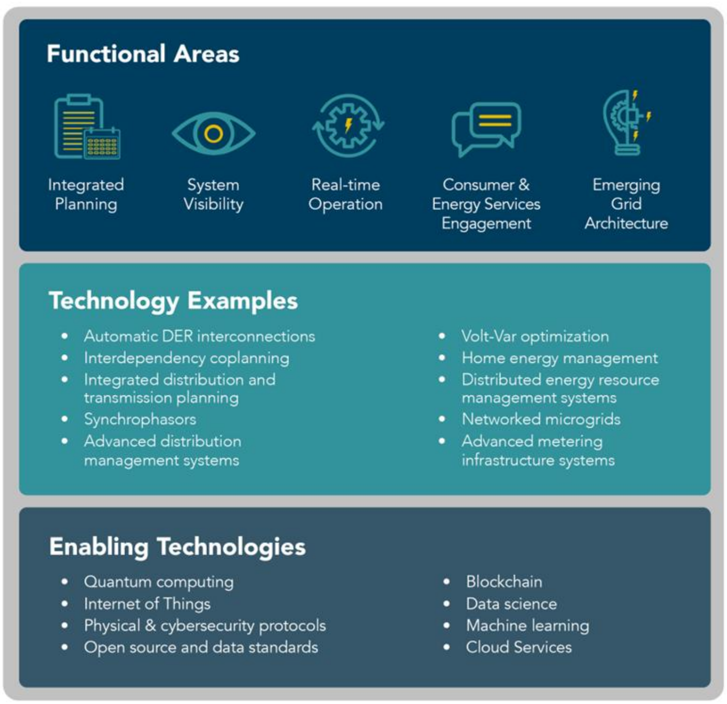
• **Real-time operation** links grid operators to grid conditions, changing demand, and available resources, allowing them to maintain key grid reliability services and optimize grid functions. Grid modernization technologies available today can monitor and respond to grid conditions, immediately correcting operational problems related to voltage, current, frequency, and outages.
• **Consumer and energy services engagement is** critical to ensuring a smooth interface to interact with customers or aggregation services; and
• **Emerging grid architecture models**, such as a networked microgrid, will likely benefit from sending dynamic pricing signals to electric vehicles to support operation when the system isolates from the grid, either using the vehicle as an energy source or sink as needed.

All of the technologies needed to meet desired outcomes are available today, but innovative technologies will continue to improve grid functions.



Real-time operational capabilities required for a modern grid must facilitate and automate dynamic optimization of grid assets, integrate renewable and distributed energy resources, and quickly detect and respond to weather, cyber, or security disturbances. Digitized technologies, autonomous switches connected with advanced distribution management systems and management systems, and advanced metering infrastructure are among needed components of the future grid. ***Note that these systems require enhanced, high-speed communications and data analytics to enable the real time control necessary for managing the increasingly complex power grid of the future.***

GridWise Alliance recommends a no-regrets approach to grid modernization technologies, where new technologies are interoperable with legacy technologies and serve as a platform for layering additional technologies in the future.

Distributed energy resources (DERs) like solar and storage, usually owned by the customer and installed behind the meter, are increasingly providing electricity to the grid. One balancing authority stated that >95% of their 50GW of interconnect requests are for DERs. However, while these resources can generate power, they often cannot provide the essential reliability services that maintain power quality on the grid that conventional generators with large rotating mass do. There is a need for additional research and development to reassure the data center industry and its customers that DERs are capable of “firm-fixed” dispatch to ensure grid reliability and adequate power for large customers. GridWise member Oak Ridge National Laboratory (ORNL) is already working to address the critical research area of grid inertia and electromagnetic transients, while leading the industry in the development and testing of small modular nuclear reactors (SMRs), heat pumps, and other technologies that will demonstrate improved grid inertia over inverter-based resources along.

ORNL focuses on energy/water/gas/real estate availability and affordability modeling to address concerns from rate payers and grid customers who are often placed at the periphery of today’s GenAI revolution. ORNL models load variability of data centers and “grid-cognizance” of load variability based on AI-task classification to demonstrate the concept of the data center itself as a grid-stabilizing critical asset, as opposed to large inverter-based load that injects synthetic inertia.

Another priority need DOE can address is profiling how grid conditions vary with geographical location, which would help grid owners, operators, states and others prioritize investments in grid modernization. The GridWise Alliance periodically publishes the Grid Modernization Index, a survey of states’ progress to modernize the grid. The next version of the GMI is scheduled to be released in Fall 2025, and we look forward to discussing our results with you.

Profiling grid conditions across geographical locations is essential because regions vary significantly in characteristics like infrastructure age, weather exposure, and modernization levels, all of which shape grid reliability and resilience. Coastal areas, for example, face hurricanes and storm surges, while inland regions may deal with tornadoes or ice storms, necessitating region-specific infrastructure solutions. Simply comparing data from locations with differing profiles can yield misleading results, as it overlooks these contextual differences. Data-driven profiling—integrating historical outage and restoration times from systems like EAGLE-I, surveys such as ORNL’s Grid Technology Modernization Index (GTMI), regional characteristics (e.g., urban vs. rural, terrain), and device profiles (e.g., transformer age, smart grid adoption)—provides a robust framework for assessing grid performance. This approach enables fair comparisons among utilities and regions with similar profiles across dimensions like outage frequency, recovery duration, and infrastructure robustness. The critical next step is transforming this diverse, voluminous data into systematically usable profiles, empowering grid owners, operators, and policymakers to identify vulnerabilities, benchmark progress, and drive targeted investments in grid modernization.

• **To what extent do supply chain considerations factor into our ability to deploy grid infrastructure advancements?**

The utility sector is experiencing significant supply chain constraints affecting the cost and timeline of grid infrastructure deployment. The price of grid components and the time to delivery have both increased dramatically in the last several years, raising the costs of grid modernization projects and requiring additional lead time for procuring required equipment. While the shortage of distribution transformers has received the most attention, GridWise members have emphasized that supply chain bottlenecks are occurring across their business enterprise. One GridWise utility member provided the following table of price increases and delivery lead times for illustration:

Grid Component	Price Increase since May 2020	Delivery time
Primary Distribution Conductor	62%	12- 16 weeks
Insulators	58%	8-12 weeks
Crossarms	103%	12 weeks
Surge Arrestors	89%	16-20 weeks
Distribution Transformers	99%	26 weeks
Cut-Outs	58%	8-12 weeks
Secondary Wires	32%	8 weeks
Guy Wire	89%	12 weeks
Ground Wire	51%	8-12 weeks
Three Phase UG Transformer	**93%**	**58 weeks**
Underground Primary	93%	26 weeks
Underground Pedestals	113%	16-20 weeks
PVC pipe	38%	8-12 weeks
Meters Cans	68%	20 weeks
Voltage Regultors	**133%**	**52 weeks**
Distribution Automation Switches	**236%**	**72 weeks**
Power Transformers	**158%**	**128 weeks**
Circuit Switchers	**185%**	**72 weeks**
Distribution Breakers	**176%**	**26 weeks**
Bold indicates excessive lead times		

Supply chain constraints are exacerbated by the increasing competition for grid components from data centers. Developers are increasingly purchasing grid equipment for data center construction, such that in some areas of the country, utilities are no longer the primary purchaser of this equipment.

Most of this equipment is manufactured in whole or in part outside the United States.
While growing a domestic manufacturing base for grid equipment will help address supply chain challenges, this is a longer-term solution to an acute, immediate problem. Any federal actions, such as tariffs or trade restrictions, that increase the cost of grid components or time of delivery will exacerbate current shortages. Tariffs on steel and aluminum create additional cost pressures on broad range of finished products, including grid equipment, even in the absence of direct tariffs on that equipment.

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• **What best practices or emerging technologies can enhance the reliability and security of the energy grid?**

Reliability: Wide Area Monitoring Systems (WAMS) are instrumental in enhancing the reliability of utilities by providing real-time data and actionable insights into the performance and stability of power systems. WAMS employ Phasor Measurement Units (PMUs) to capture data at high frequencies. These PMUs generally measure electrical parameters at intervals ranging from 10 to 60 samples per second, which translates to measurement intervals of 16.67 milliseconds (60 samples per second) to 100 milliseconds (10 samples per second). This high-frequency data collection is crucial for providing real-time insights into the grid's performance and stability, enabling utilities to respond quickly to any anomalies or disturbances. Here are several ways in which WAMS contribute to reliability:

1. **Real-Time Monitoring**: WAMS offer continuous monitoring of the power grid, enabling utilities to detect anomalies and disturbances as they occur. This real-time visibility helps in quickly identifying and addressing issues before they escalate into major problems.
2. **Grid Stability**: By monitoring key parameters such as voltage, current, and frequency across large geographical areas, WAMS help utilities maintain grid stability. This is crucial for preventing outages and ensuring consistent power delivery.
3. **Improved Fault Detection**: WAMS can pinpoint the location and nature of faults more accurately, allowing for faster response and repair times. This minimizes downtime and reduces the impact of faults on the grid.
4. **Enhanced Decision Making**: The data collected by WAMS supports better decision-making processes by providing utilities with detailed information about grid performance. This helps in optimizing operations and planning maintenance activities effectively.
5. **Integration with Renewable Energy**: As utilities integrate more renewable energy sources, WAMS assist in managing the variability and unpredictability associated with these sources, ensuring they do not compromise the reliability of the grid.
6. **Predictive Analytics**: WAMS enable utilities to leverage predictive analytics, forecasting potential issues before they arise and implementing preventive measures to maintain reliability.

Overall, WAMS play a critical role in ensuring the robustness and reliability of utility operations by enhancing visibility, supporting quick response to issues, and facilitating effective management of complex power networks.

Security: Zero Trust Security is a cybersecurity model that can significantly enhance the security posture of electric utilities. Here's how it can be beneficial:

1. **Enhanced Protection**: Zero Trust operates on the principle of "never trust, always verify," meaning that no device or user, whether inside or outside the network, is trusted by default. This approach helps prevent unauthorized access and reduces the risk of cyberattacks, which is crucial for protecting critical infrastructure like power grids.
2. **Network Segmentation**: By segmenting the network into smaller, manageable sections, Zero Trust reduces the attack surface. This means if a breach occurs, it can be contained within a segment, minimizing potential damage and preventing lateral movement across the network.
3. **Continuous Monitoring and Verification**: Zero Trust requires continuous monitoring and verification of users and devices accessing the network. This ongoing scrutiny helps detect and respond to threats in real-time, ensuring that any suspicious activity is promptly addressed.
4. **Identity and Access Management**: Strong authentication mechanisms, including multi-factor authentication (MFA), are central to Zero Trust, ensuring that only verified users can access sensitive

systems and data. This is vital for electric utilities to maintain control over who accesses critical infrastructure.

5. **Data Protection**: Zero Trust emphasizes encryption and secure data handling practices. By ensuring that data is protected both in transit and at rest, utilities can safeguard customer information and operational data from potential breaches.
6. **Compliance and Regulatory Adherence**: Implementing Zero Trust helps utilities meet stringent regulatory requirements related to cybersecurity, providing a framework for compliance with standards like NERC CIP (North American Electric Reliability Corporation Critical Infrastructure Protection).
7. **Reduced Impact of Insider Threats**: By limiting access based on roles and continuously verifying user actions, Zero Trust can mitigate the risk posed by insider threats, which are particularly concerning for utilities where internal sabotage could have severe consequences.

Overall, Zero Trust Security provides a robust framework for electric utilities to protect their networks and critical infrastructure against evolving cyber threats, ensuring operational integrity and reliability.

• What are the timelines for data center, electric generation, and transmission construction, respectively? What does this say about the importance of our existing infrastructure?

GridWise members report that data centers in their service territories can be built in 12-18 months, whereas it can take 3 years for new generation and more than 5 years, and often closer to 10, to build new transmission. Providing power to new data centers varies depending on a utility's excess generation capacity, which varies by location. A recent industry survey[2] found that about 50 percent of respondents could energize their facilities in under 3 years, but wait times for other facilities ranged from 4-6 years (32 percent) to 7-9 years (11%).

Delays in providing power to new data centers occur not only because a utility need to build new generation; investments across the transmission and distribution grid (new lines, new substations, etc.) may also need to occur before a data center can be fully connected to the grid. Access to power is not the only factor in timelines for data center construction: developers also must go through siting and permitting processes, obtain access to water for cooling, and address other state, local and federal issues.

In some locations, the mismatch in timing between building a data center and accessing power for the facility is leading some developers to consider co-locating on-site generation (typically natural gas turbines or solar/storage). Some developers may see this as a bridge measure until the utility can build new generation, others may view co-location as a permanent solution. GridWise members, which include data center developers, believe that few if any data centers will be "off-grid," meaning that we expect virtually all data centers to be connected to the grid even if they are generating their own power. Co-location does not necessarily reduce consumers' share of the costs of meeting data center energy demand: natural gas prices could increase, and utilities will still have to make upgrades to the grid to provide reliable back-up power and to manage the impacts of large loads on the system. Regulators and policy-makers must carefully consider requests for co-location and weigh benefits and costs to both data center developers and other consumers. The GridWise Alliance will release a more comprehensive statement on co-location of generation resources and large load in the next month.

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[2] Before AI. After AI: Surveying the Data Center Industry as It Enters a New Age of Constrained Energy Supply. April 25, 2025.

• What gaps and/or roadblocks exist in current policy frameworks that could hinder America's ability to meet the energy demands of the AI era?

As mentioned in the previous answer, fairly allocating the costs of grid upgrades (including generation) among consumers of all sizes is critical for maintaining affordable electricity that supports economic development and national security. A number of states have put forth innovation rate structures for cost allocation—see answer to the next question. DOE can provide technical support to states and further analyses to help develop innovative cost allocation tools. DOE has a long history of successfully providing such technical assistance without influencing specific rate cases.

Siting and permitting reform is essential for addressing the long timelines of building new grid infrastructure. Significant improvements in coordination between federal, state, and local governments and agencies are needed to reduce permitting process inefficiencies. Every Republican and Democratic administration over the last 2 decades has attempted to improve this coordination, but unless Congress enacts siting and permitting reform, these efforts will continue to result in minimal improvements. At the federal level, multiple agencies have overlapping and sometimes conflicting roles in implementing the numerous statutes governing siting and permitting (National Environmental Policy Act, Clean Water Act, Endangered Species Act, land conservation and historic preservation, etc.). ***Congressional committees also have overlapping and sometimes conflicting oversight over these statutes, so meaningful siting and permitting reform must be multi-jurisdictional, with multiple committees contributing to an overall legislative approach.***

• Are there state-level or international regulatory models that offer insights for effective policy adaptation in this space?

States are at the forefront of regulatory innovations to ensure energy affordability through new tariff structures. For example, stand-alone data center tariffs (rather than rate case increases) can insulate the ordinary consumer from rate increases associated with grid upgrades to meet AI energy demand. These tariffs can include a commitment by data center developers to procure grid equipment with assurances that any excess energy will be supplied back to the wholesale market only.

III. Strategic Competition: Outpacing China

America's global economic competitiveness is driven by affordable electricity. To keep power affordable, it is critical that all energy consumers use that energy as efficiently as possible. Data center developers must continually strive to minimize energy per computation, adopting measures like liquid cooling, digital twin systems, and waste heat recovery to reduce energy demand.

America's competitiveness depends on a skilled workforce, and U.S. innovation is threatened by a lack of workers proficient in specialized skills required for both advancing AI technologies and modernizing the electric grid. The U.S. must address these skills shortfalls by strengthening training and educational pipelines for students and current workers through expanded STEM education, public private partnerships, and reskilling programs.