Testimony of Todd Ramey

Senior Vice President Markets and Digital Strategy

Midcontinent Independent System Operator, Inc. (MISO)

Before the House Committee on Energy and Commerce

Subcommittee on Energy, Climate and Grid Security

"Powering America's Economy, Security and Our Way of Life:
Examining the State of Grid Reliability"

September 28, 2023

Executive Summary

MISO, the nation's first Federal Energy Regulatory Commission-approved Regional Transmission Organization, operating in a 15-state region. We are resource and fuel type agnostic, independent, and do not own generation or transmission. We manage electric reliability through functional control of utility member assets. Utilities and governments are establishing aggressive sustainability and decarbonization goals in response to state and federal energy policy, environmental regulations, and customer preferences which have direct implications for reliability of the high-voltage grid, which is MISO's responsibility. Controllable, dispatchable resources are being retired and replaced primarily with weather-dependent, non-dispatchable, and variable generation types to achieve carbon reduction goals.

These weather-dependent generators are increasing reliability risks in the form of:

- Declining accredited (i.e., firm) capacity – Declining reserve capacity in the MISO region has eliminated a "cushion" to manage uncertainty. Weather-dependent generators receiving lower capacity accreditation is creating the potential for accredited capacity shortfalls. Adding to this risk are multi-year delays for many new generators, driven primarily by supply chain issues and regulatory processes.
- Diminishing resource attributes – Certain resource attributes – such as the ability to start up expediently, ramp output up or down quickly, and produce electricity at a high volume for long periods of time - are required to maintain reliability. Those attributes have historically been provided by the traditional resources that are now being retired at an accelerating pace, and very few planned new generators possess them. Until new technologies reach commercial maturity, generators currently capable of providing needed reliability attributes will be required.
- Increasing operational challenges – Higher penetrations of renewable resources result in higher levels of operational complexity, driving the need for additional transmission to move both the renewable generation and flexible resources to where they are needed.

No less important is the objective of affordability. MISO does not have a role in setting customer retail rates, but conducts system planning that considers the total cost of resources. A lot of focus is put on the "free" fuel that weather-dependent resources enjoy, but that does not translate to free electricity as the cost of construction, backup/reserve generator capacity, and transmission must also be borne by the consumer. Transparency and consideration of all costs is needed to ensure affordability.

This is an industry that routinely exhibits tremendous teamwork and coordination to restore power in the aftermath of significant weather events. That same type of focus and effort is required on a comprehensive, coordinated plan to ensure we can keep the lights on both during and after the industry transition. MISO is engaged on a broad set of priorities under our Reliability Imperative to transform the grid and our markets, operations, and technology to enable member goals and strategies. But successfully navigating the dramatically changing energy landscape will take engagement from across the industry, beginning with utilities and states maintaining and investing in resources with needed reliability attributes.

Good morning, Chairman Duncan, Vice Chairman Curtis, Ranking Member DeGette, and members of the Subcommittee. I am Todd Ramey, senior vice president of markets and digital strategy at the Midcontinent Independent System Operator, Inc., or MISO. It is a pleasure to be with you today as you examine the state of grid reliability. I hope the insights I share with you today about the increasing risks and implications to reliability of the electric industry transformation will be useful to your work of shaping U.S. energy policy.

I know this committee is interested in hearing about the factors that are rapidly changing the energy landscape, and the implications, risks, and opportunities related to grid reliability, given the direct impact on the nation's economy and security, and our way of life. Before I discuss MISO's perspective on these matters, I'd first like to provide a little background about our organization.

MISO Overview

The Federal Energy Regulatory Commission's (FERC) Order 2000, issued in 1999, established Regional Transmission Organizations (RTO) to be independent entities that plan and operate the electric grid on a regional basis to maintain reliability and maximize efficiency. MISO was the first RTO to receive FERC approval in 2001.

MISO is a 501(c)(4) not-for-profit social welfare organization with responsibility to ensure the reliability of the high-voltage electric transmission system to deliver low-cost wholesale energy to consumers. The wholesale markets that MISO manages are the largest in North America in terms of geographical scope, serving about 45 million people across all or parts of 15 states, stretching from the Canadian border to the Gulf of Mexico. They are also among the largest in

the world as measured by transactional value, with more than $40 billion in annual gross market charges. MISO also serves as the reliability coordinator for the Canadian province of Manitoba.

Currently, the MISO market region contains about 75,000 miles of high-voltage transmission lines, as well as 190,000 megawatts of electric generating capacity. MISO does not own any of these assets. Instead, with the consent of our asset-owning members and in accordance with our FERC-regulated tariff, MISO exercises functional control over the region's transmission and generation resources with the aim of utilizing them to ensure reliability in the most cost-effective manner possible. MISO has a robust and strong stakeholder process that allows asset owners, state regulators, load-serving entities, and end-use customers to provide input and guidance to MISO on a regular and ongoing basis.

MISO's mission is to facilitate the reliable delivery of low-cost wholesale energy for distribution to end-use customers in our footprint. We achieve this through innovative wholesale market operations, and transmission grid planning and reliability monitoring. Through execution of those functions on a regional basis, across a large geographic footprint, MISO creates significant value for the region, which is quantified in the MISO Value Proposition[1] study. In 2022, annual savings were over $4 billion, and total cumulative value created since 2005 surpassed $40 billion. This is achieved through several value drivers, including improved reliability, optimization of member's existing assets, and a dramatically reduced need for new assets as a result of being able to take advantage of system diversity to share resources. As an organization in place for the public good, MISO is proud of our track record of increasing levels of value

[1] https://www.misoenergy.org/about/miso-strategy-and-value-proposition/miso-value-proposition/

creation, achieved in coordination with members and stakeholders, even as the energy industry landscape has become very dynamic.

Electric Industry Transformation

Electricity has taken on a greater importance in people's lives over the years with the growth of electronic devices, smart home products, and electric vehicles. Further progress towards electrification will deepen our reliance on this service. There is a societal expectation of uninterrupted electric delivery at all times. While the industry has achieved a very high level of power availability, an ongoing industry transformation is bringing about a level of complexity and risk that is unprecedented.

Prior to MISO, each individual balancing area carried excess, or reserve capacity, to ensure they could serve customers even in the case of a plant outage or other issue. With the creation of MISO, the needed reserve level became based on region-wide risks and needs. This resulted in a much lower reserve requirement and the existence of significant excess capacity on the system. However, over the last decade, excess and underutilized capacity was slowly removed from the system, almost always in the form of traditional, controllable resources. In parallel, the frequency of weather events impacting large portions of the region's generation fleet began increasing. So as operationally-challenging scenarios became more frequent, a key tool to manage them was being drawn down.

During this time, renewable resources, primarily in the form of wind generation, were also being added to the system at a fairly modest pace. MISO was generally able to accommodate these resources with incremental enhancements to markets, tools, and processes. However, given the momentum of the trend, it was obvious there would come a point where the volume of weather-

dependent generation on the system would cause significant operational and other challenges that would require more transformative change. In early 2020, MISO launched the Reliability Imperative[2], a broad set of initiatives spanning MISO's business to enhance the transmission system, and our markets, operations, and technology to enable member and state clean energy goals and strategies. MISO periodically develops a range of potential future outcomes, which we refer to as Futures, to provide bookends that we plan and execute our work within. At that point we were weighing the least aggressive scenario in terms of a transition to weather-dependent resources as the most likely based on what we were seeing in our members' plans.

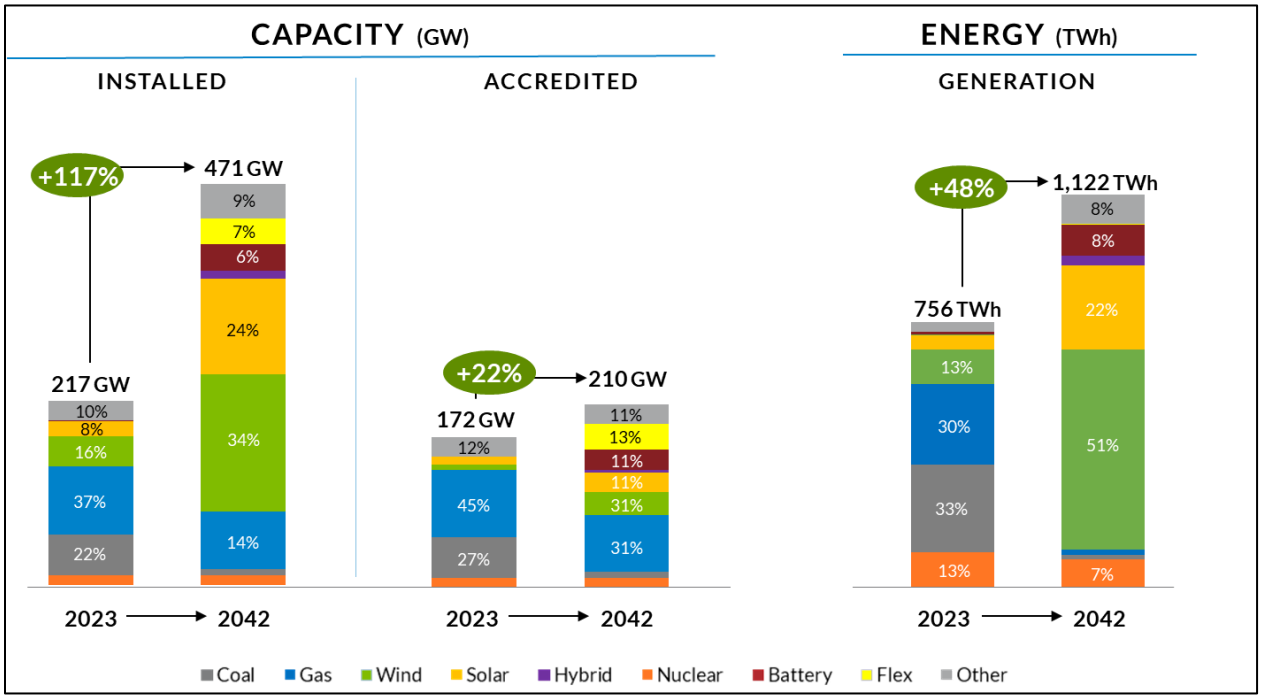
Within two years, the pace of fleet change increased substantially due to environmental regulations, and a number of other pressures on fossil-fueled generation. In response, MISO expeditiously elevated the priority on a number of key initiatives. We also refreshed our planning scenarios to ensure our efforts to prepare the region account for the higher magnitude of change on an accelerated timeline in many members' plans.

Implications and Challenges

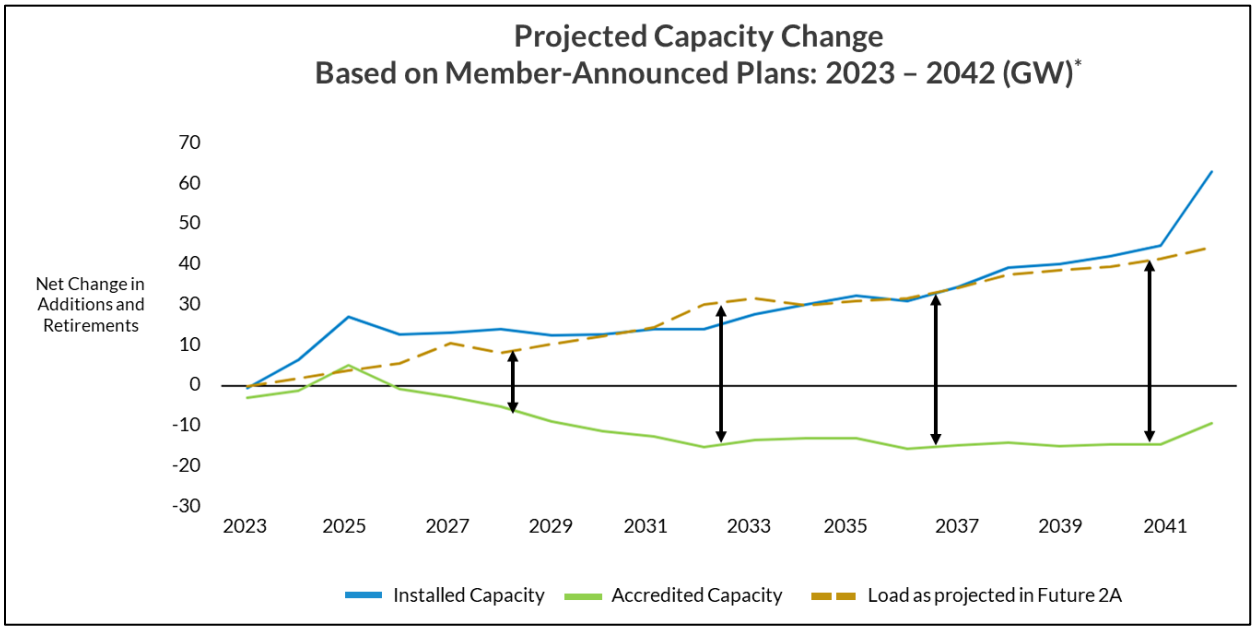
The accelerated pace of change is presenting an Energy Trilemma, with the objectives of sustainability, reliability, and affordability currently at odds. The graphic below illustrates how sustainability goals and strategies are significantly altering the composition of the region's generation fleet over a 20-year horizon under our currently targeted scenario. These projections start with information in member plans, and supplements that with a model-selected set of resources based on economics to reach an overall generation portfolio that enables all state sustainability goals and is also reliable. Installed capacity will more than double, with the

[2] https://www.misoenergy.org/about/miso-strategy-and-value-proposition/miso-reliability-imperative/

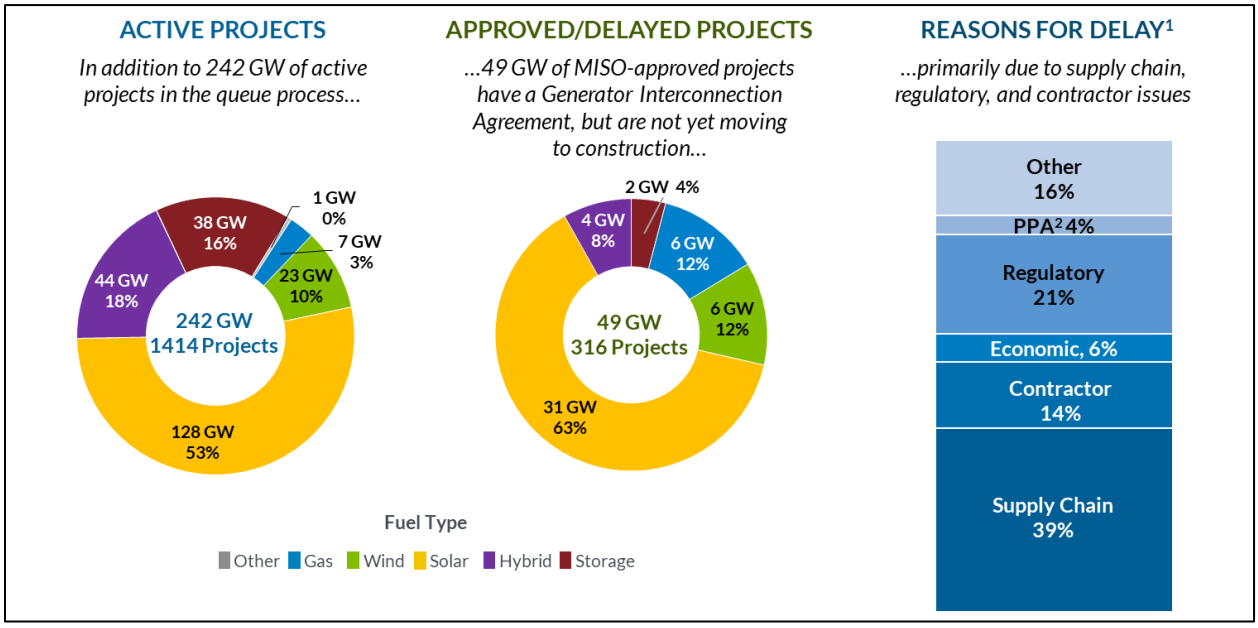
majority of the increase in the form of weather-dependent generation. However, overall capacity "value", or accredited capacity, increases much less. Accreditation is a process designed to account for a generator's historical performance and outage frequency to reflect their actual availability. This serves to provide an expected value that we can plan for with much higher confidence than the full capability of the resource. Because weather-dependent generation requires the cooperation of Mother Nature to operate, their accreditation is a much lower percentage of their full capability than traditional resources that have far greater of their level of output. Energy production increases significantly to accommodate demand growth resulting from electrification, with 80% of electricity coming from weather-dependent sources in 2042. That is more than double the projected output from renewables under the scenario we were previously planning towards and is expected to result in a greater than 90% reduction in carbon emissions compared to 2005.



Another tool MISO uses is the Regional Resource Assessment, which provides a snapshot in time of publicly announced member plans. The figure below shows one aspect of the data provided publicly by members in 2023. It removes the impact of model-selected resources to demonstrate what is actually being planned now. Accredited capacity declines as a result of resource additions being predominantly weather-dependent. The result is a significant and growing gap over time between accredited capacity and demand, even though installed capacity keeps pace. Load Serving Entities, with oversight from state regulatory agencies, are predominantly responsible for resource adequacy, or ensuring they have enough capacity to serve their demand. They also decide when to retire generators and determine the type of any new generator additions. MISO is agnostic as to generator / fuel types. But we are responsible for reliability and our "tool" to provide that is the functional control we are provided over member assets. While we would expect member plans to evolve over time this figure illustrates one risk we are seeing with the current pace of the transition and the retirement of dispatchable resources without full replacements in place.



Adding to the concerns about a shortfall in capacity is the challenging environment for new generation construction. Members in the MISO region currently hold approximately 190 gigawatts of generation capacity. We currently have 242 gigawatts of requests for new generators to connect to our system. From that stat one might conclude that resource adequacy is not an issue at all. However, it will take significant time to assess this volume of requests, and even generators that have already been approved to connect to our system are experiencing challenges. Nearly 50 gigawatts of approved new resources are experiencing multi-year delays, with supply chain and regulatory process issues stated as the primary drivers.



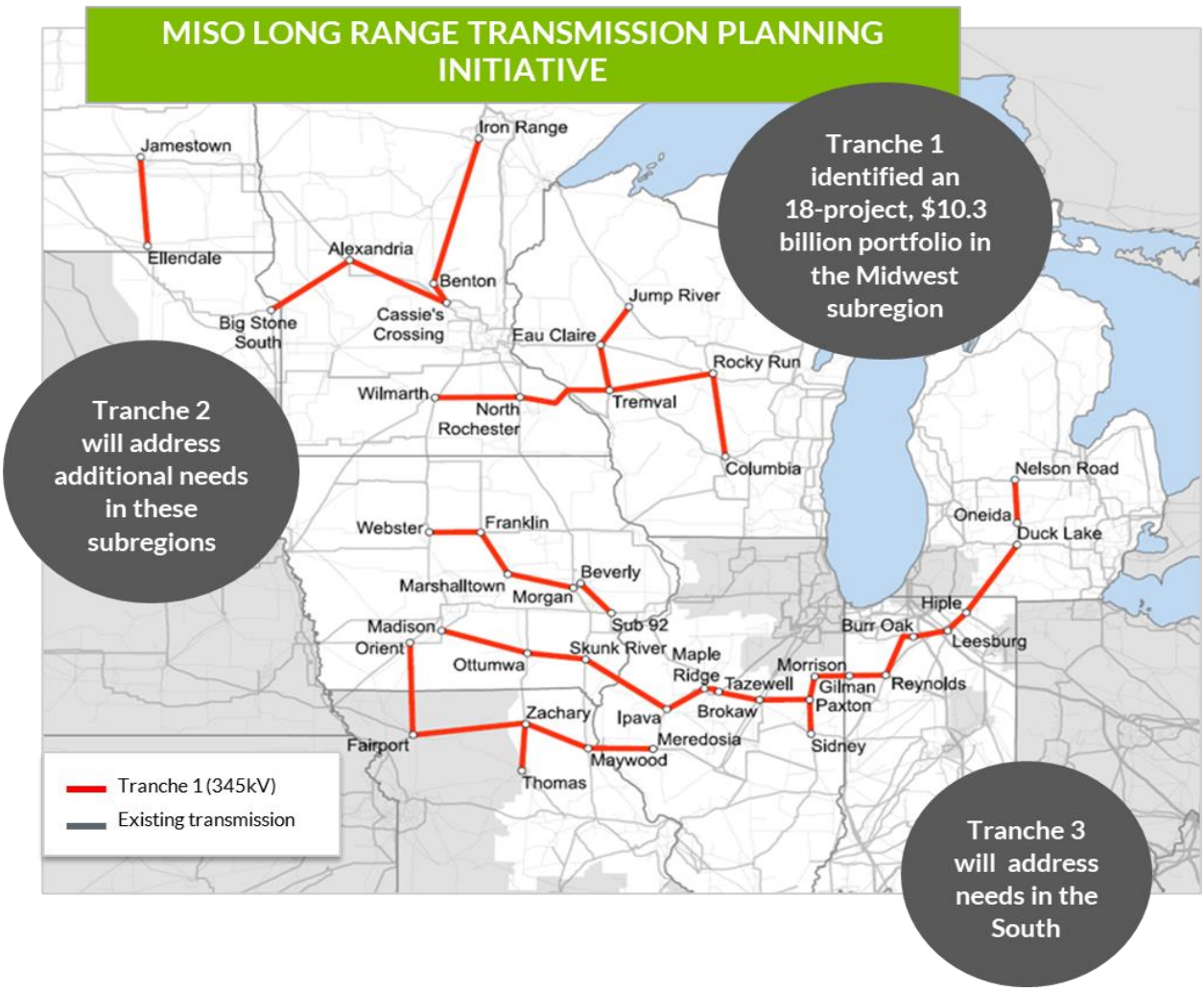
In addition to sufficient overall capacity, maintaining reliability is also dependent on ample amounts of key resource capabilities, or reliability attributes existing on the system. These include the ability to start up expediently, ramp output up or down quickly, and produce electricity at a high volume for long periods of time. These attributes will become even more critical going forward to manage increasing variability on the system from more weather-dependent resources. These attributes have historically been provided by traditional,

dispatchable generators, which are being retired at an accelerating pace. Of the requests we have received for new generators to connect to the grid in our region, very few are dispatchable or have the ability to operate at high output for long duration. We are seeing some requests for battery storage, but those are mostly limited to a 4-hour duration, which could be beneficial in some scenarios but would not be able to provide the durable, long-duration output that is increasingly needed. This combination is creating a risk of near-term gaps. New technologies will undoubtedly develop or advance, but none have reached commercial maturity at this point. That leaves natural gas generators as our best source of these attributes currently and maintaining and investing in those resources is of great importance. The role of these gas-fired generators will change significantly, however. They will become much like an insurance policy – used very infrequently, but critical in those times of need.

Keeping the Lights On

The Reliability Imperative has been MISO's response to the increasing reliability risks associated with the fleet evolution. This set of priorities spans our business with transformative work to support and enable member and state fleet strategies and sustainability goals. Evolving the transmission grid is one component of this work, and a critical requirement of this industry transition. When state Renewable Portfolio Standards drove the first phase of wind generation additions in the region, MISO launched an innovative long-term aspect of its transmission planning process to find regional solutions that allow renewable generation to be sited in efficient locations and to have their output maximized, enable transfers of both weather dependent and dispatchable generators' output to where it is needed on the system, and mitigate operational risks and challenges.

We are once again executing this aspect of our overall process with the Long Range Transmission Planning initiative. The first phase, Tranche 1, yielded a $10.3 billion portfolio of projects to address reliability issues in MISO's North and Central Regions, which was approved by our Board and is in process now. While the cost is significant, the 18 projects included in the portfolio have an average benefit-to-cost ratio of 2.6 so the value will far exceed the investment. The benefits include congestion and fuel savings, reduced capital costs, and carbon emissions reductions. This portfolio of projects is expected to enable the reduction of an additional 677 million metric tons of carbon, with a value of up to $17 billion. We are now in the second phase, which will likely result in a significantly larger investment, perhaps in the range of $20-$30 billion.



No less important is the objective of affordability. MISO does not have a role in setting customer retail rates, but conducts system planning that considers the total cost of resources. A lot of focus is put on the "free" fuel that weather-dependent resources enjoy, but that does not translate to free electricity for the consumer as capital, transmission, and other costs are significant. Without transparency and consideration of all costs, the affordability objective will be at risk.

Work under the Reliability Imperative is also focused on redefining our markets to ensure incentives are aligned with system needs and providing the right signals in both the planning and

operating horizons to inform member decisions and actions related to their generation portfolios. We are also enhancing our operations processes, tools, and expertise to improve our ability to manage increasing uncertainty. Underpinning all of these initiatives are significant technological upgrades to handle dramatically increasing complexity and risks.

In addition to this internally-focused set of priorities, MISO is also allocating considerable resources to using our unique perspective as a grid operator for a region that contains very diverse perspectives, goals, economies, and generating fleets to inform and educate other entities on the risks and implications of their decisions and actions. We engage routinely with member utility leadership, state regulatory agencies and other stakeholder groups. Given the role environmental regulations have played in accelerating the fleet transition we have also conducted outreach to the Environmental Protection Agency (EPA).

At the urging of MISO and some of our peer grid operators, EPA made a number of changes to its final Good Neighbor rule that significantly reduced our reliability concerns with it. More recently, MISO submitted public comments individually and jointly with other grid operators on EPA's proposed carbon standards for existing and new coal and natural gas resources. Both sets of comments express concerns over the timing and reliability implications of EPA's proposed rule. The agency's proposed standards could have major impacts on coal generation in MISO's footprint, with upwards of 25 gigawatts subject to carbon-capture and storage (CCS) or gas co-firing requirements. Additionally, approximately 11 gigawatts of existing gas capacity in MISO could be subject to either CCS or hydrogen co-firing requirements. While CCS and hydrogen co-firing technologies show promise, they are not yet commercially or economically viable on a grid-scale basis—and there are no assurances they will become so on EPA's optimistic timeline. If EPA's proposed rule drives coal and gas resources to retire before enough replacement

capacity is built with the critical attributes the system needs, grid reliability will be compromised.

This is an industry that routinely exhibits tremendous teamwork and coordination to restore power in the aftermath of significant weather events. That same type of focus and effort is required on a comprehensive, coordinated plan to ensure we can keep the lights on both during, and after the industry transition. MISO will continue to engage with our stakeholder community on the broad set of priorities under our Reliability Imperative and will refine those focus areas as the landscape changes. But successfully navigating the dramatically changing energy landscape with the lights still illuminated will take engagement from across the industry, beginning with utilities and states resisting the pressures being exerted on fossil generators and maintaining and investing in natural gas generation.

RTOs have a unique role in the industry and bring a unique perspective to the challenges we face. We are policy takers – we don't advocate for any particular policy, but instead work with the states, utilities and all other stakeholders in our regions to ensure any policy is implemented reliably and in the most efficient manner. MISO has utilized this role to create over $40 billion in benefits for our region over the past two decades while positioning it to navigate the continuing evolution of the industry. We appreciate the opportunity in front of us to help our region through this change and to inform the discussions that will shape the path forward.