Enhanced Renewables in the State/RTO Nexus: A Heartland Case Study

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1. Introduction

1.1. Statement of Purpose and Project Objectives

The energy landscape is in the midst of a rapid and significant transition from carbon-based fuels for electricity generation to renewable energy, both in the Midwest and throughout the United States. The rapid emergence of non-carbon energy sources onto the grid, coupled with stakeholders' complex policy and economic interactions, has turned the electricity sector into a frontier of innovation.

However, as the industry shifts toward renewable energy sources, economic and technical challenges, as well as issues associated with governance, must be addressed in order for renewable energy sources to provide reliable and efficient service. This investigation provides a high-level assessment of the key factors that will influence the policies needed to govern this transition effectively. The research centers on addressing the principal question, "what are the key governance and policy issues associated with the adoption of renewable sources of electricity into the Midcontinent Independent System Operator's (MISO)'s generation and transmission portfolio?"

The purpose of this Capstone is to assess the Midwest electricity policy landscape and present the R Street Institute with recommendations on how to effectively promote the increased deployment of utility-scale renewable energy and distributed energy resources (DERs) across the Midwest. This evaluation focuses on the electric power industry's governance framework in the MISO region. The overall research topic has been subdivided into three modules: planning of new generation and transmission, operations of current generation and transmission assets, and integrating distributed energy resources. Given the interrelated nature of jurisdictions and entities within the MISO footprint, key actors include public utility commissions (PUCs), particularly the Indiana Utility Regulatory Commission (IURC), state legislatures, independent system operators (ISO)/Regional Transmission Organization (RTO), particularly MISO, the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC), large industrial and commercial consumers, local regulatory bodies, retail end-consumers, distributed electricity generators, independent operator utilities (IOUs), and environmental advocacy groups. This evaluation will focus on the following major stakeholders: PUCs, state legislators, ISOs/RTOs, MISO, FERC, retail end-consumers, electricity generators, and IOUs.

As energy technology continues to rapidly advance, agencies and organizations must reevaluate and expand previously held roles to meet the challenge of integrating renewable generation into the grid. The research groups immersed themselves in the complexity of the energy policy, market, and infrastructure as it currently stands in order to reimagine and recontextualize the landscape of energy. No one group or stakeholder involved in this issue has the answer to the complex challenges and questions posed to the energy community today, and this paper does not seek to provide those answers. Rather, the opinions and recommendations herein outline possible new perspectives on the challenges and possible new roles or positions that stakeholders might hold relative to one another. In doing so, the hope is that by stepping outside of traditional boundaries in the analytical process, offering new perspectives and positions will help to bring about productive change.

1.2. Framing the Challenge

The impetus for this analysis is the sweeping changes taking place throughout the electricity markets in the United States today. Hybrid and co-locational generation now account for over 10% of connection applications to ISOs in the country, and the nature of these resources demand innovation for the grid and stakeholders (Nicholson, 2020). As the technological challenges become clearer, it is apparent that the laws and policies governing electricity generation and transmission must also change. What is possibly the most pertinent issue is a redefinition of the roles of various stakeholders involved in the system as the energy transition progresses.

The problem of grid integration of DERs is not strictly a technical one - integration of DERs into the transmission grid is technologically possible. The challenge lies in how to achieve the goal of DER integration without marginalizing stakeholders in the current structure of energy markets while also providing an equitable platform for players who are working to bring hybrid and renewable distributed energy resources into energy, capacity and ancillary service markets. Additionally, the aim of grid integration is not only a question of magnitude but of efficiency and resilience as well - considering the non-dispatchability and lack of remote control of current DERs, the challenge lies in determining the point at which maximum DER capacity can be integrated without adversely impacting efficiency, reliability and cost of electricity supply.

This report considers scenarios involving transmission planning, formalized communication channels between different stakeholders, DER aggregations, processes for net metering, DER participation in both wholesale and retail markets and frameworks to avoid double-counting of DER services in terms of the gaps in current legislation and policies, and how current and future stakeholders will be impacted from any change from the energy status quo. Although the primary focus is on how the integration will happen in wholesale markets so as to lower wholesale rates of electricity while building resilience and reliability, the question of DER participation in retail markets is also raised to ensure the most optimal outcomes are achieved.

Specific to the MISO region, many independent operating utilities still function with monopolistic power in the electricity markets. MISO and state regulatory powers are attempting to create a functional market that is equitable to utilities, consumers, and supports the vital transition to carbon-free energy generation. In order to do so, MISO and the state regulators must adjust their roles and interactions in this market in order to achieve results.

Information features heavily in the potential for stakeholders to expand cooperation and allow for ratepayers to have more control over their electric rates. Challenges exist in safely sharing information; however, the various stakeholders will benefit from eliminating information asymmetries.

1.3. Previous Work and Approach

Climate change mitigation strategies have become an increasingly salient topic, all strategies fall in the context of system constraints including the economy, global markets, the speed at which change can occur. There is also an overarching goal, set within the Paris Climate Accords, to limit the warming of the earth to 2 degrees Celsius at its maximum. All of these aspects add constraints to recommendations for the power sector. Under these circumstances, vast and numerous research efforts have been focused on the reliable integration of renewable energy technology to the grid. Researchers from the National Academies of Sciences, Engineering, and Medicine, Department of Energy (DoE), American Wind Energy Association (AWEA), Americans for a Clean Energy Grid (ACEG), the IURC Energy Policy Development Task Force, and others make up the vast body of knowledge on this topic. This past work provides fundamental insights for this project and future works. The following provides highlighted recommendations and results of previous organizations' work which include nation-wide goals, institutional innerworkings, and state-specific concerns.

The National Academies of Sciences, Engineering, and Medicine released a report in the beginning of 2021. This report highlights essential national recommendations for increasing the deployment of renewable energy technologies. These recommendations included the initiation of a national clean energy standard, increased wind and solar energy targets for 2030 at five times the current capacity, expanded long-range transmission networks, and enhanced local distribution networks (National Academies of Sciences, Engineering, and Medicine, 2021). In considering the nation's electricity grid, the Department of Energy has highlighted key opportunities to bolster grid reliability. These include specific opportunities for DERs to integrate communication and data sharing capacity to aid grid operators in distribution. DoE suggests increased efficacy for planning models and a unified framework for modeling resources. Additional visualization tools for increased visibility for transmission and distribution operators are also recommended. These recommendations seek to bolster and maintain the current level of reliability of the U.S. electric grid.

While the business of integrating renewable energy is a national problem, there are various regional entities involved in the solution. Each entity has a specified jurisdictional domain which constrains them. In understanding the control and impact of specific institutions on integrating renewable energy there are a vast number of resources with which to confer. The following are two highlighted studies with respect to ISOs and FERC and deal with the complexities of electricity transmission. ISOs deal in regional electricity transmission and FERC can provide rules and guidance for regional transmission and the wholesale market. There have been highlighted opportunities from other organizations which recommend changes within the existing framework of these institutions' policies and procedures. Beginning with Americans for a Clean Energy Grid's (ACEG) recent report which focuses on rules that FERC can implement to ensure cost effective transmission infrastructure. These suggestions include requiring ISO planning to use the best available data and forecasting, require net benefit maximizing regional planning, FERC taking up a larger role in guaranteeing transmission investments are cost-effective, and FERC employing increased oversight in local transmission planning. Turning toward the ISO purview, the American Wind Energy Association has identified a variety of rules and procedures within ISO wholesale markets that may presently inhibit the integration of renewable electricity resources with respect to hybrid and co-located resources. These suggestions are broadly applicable to each ISO of the nation. With that in mind, each ISO can and has taken varied approaches to integrating renewable energy technology. AWEA has reported on several facets of this issue and describes several optimal outcomes in terms of market participation rules, interconnection procedures, and market power mitigation methods. Market participation outcomes include allowing hybrid resources to utilize a single operating ID and maintaining full operational control of the resource with the owner of the facility. In interconnection procedures, AWEA calls for reducing the administrative burden of interconnection requests. Further, AWEA suggests ISOs should collaborate with co-located resource owners to develop flexible guidelines facilities must follow to ensure injection limits are not surpassed at points of interconnection (Nicholson, 2020). These highly specified accounts of recommendations for these two regional institutional stakeholders illustrates the deep complexity and interdisciplinary nature of increasing the integration and deployment of renewable energy technologies.

Public Utility Commissions (PUCs) make-up additional institutional stakeholders who have varying priorities compared with the preceding institutions and these commissions are specifically concerned with maintaining reliable electricity to their respective state's consumers. It is vital to note that in some states, such as Indiana, policy is provided to PUCs by the state legislature, therefore major policy changes are beyond the jurisdiction of PUCs. State-level research has been conducted by the 21st Century Energy Policy Development Task Force. The Task Force has described central aspects of the energy transition with respect to Indiana. Chief among these aspects is the fundamental acknowledgement that reliability, resilience, stability, affordability, and environmental sustainability are all inextricably connected; modifications to one will ripple through all five of these pillars of state energy policy (Indiana Legislative Services Agency, 2020). This crucial understanding remains relevant within the context of this project in determining the most important facets of increasing renewable technology deployment.

This project builds upon this body of work with the enumeration of key factors fundamental to the overarching goal of integrating renewable technologies, constructing scenarios of these fundamental factors, providing detailed discussion of the unique outcomes from scenarios through the lens of various stakeholders, and policy recommendations to illicit these outcomes. This discussion will provide another perspective to the weighty topic of increased renewable energy technology deployment.

The research approach to accomplish the project goal was guided by a framework of a qualitative scenario analysis. This effort was initiated by engaging in dialogue with several of the most important stakeholders central to the objective of this project. These stakeholders included MISO, FERC, IURC, and a local IOU. With these informational meetings complete, the project was split into three research areas referred to as "modules". These modules are: 1) the planning of new generation and transmission ("planning"), 2) the current operational aspects of the generation assets ("operations"), and 3) the addition of new distributed energy resources in the generation mix ("DERs"). Staff within each of these modules performed topic-specific research to understand the key aspects that would most impact each domain in the pursuit of increased renewable energy and DER integration with the grid. These aspects were then developed into "factors", defined as a principal driver, or set of circumstances that influence activities in each module. Each factor was characterized to determine its level of importance in implementing changes. After interpreting these factors, module-specific "scenarios" were constructed to explore how the implementation of combinations of the enumerated factors might influence an outcome. From these scenarios, a preferred sequence of scenarios is considered to best meet the challenges of integrating renewables with the grid. The stakeholders and their respective policy recommendations are elicited from the outlined scenarios.

The remaining sections of this report will further describe the analytical approach adopted for this project. Key definitions used in this research will be described along with the explanation for using specific considerations in pursuit of the project objectives. A complete list of the developed scenarios will be provided and analysis of this suite of scenarios will be described. Finally, this report concludes with key findings and recommendations that can be implemented to further the deployment of utility scale renewable energy and distributed energy resources.

2. Analytical Approach and Methodology

This project utilizes scenario-based analysis in order to research and evaluate the varying degrees of influence that simulated factors exert on each other and on the given circumstance. In order to achieve the scenario-based analysis phase, the team began with the identification and compilation of the interconnected factors that relate to the primary objective of this project (presented in Figure 1). Throughout this process, the team communicated with R Street Institute staff and other stakeholders to understand their current and projected concerns. These concerns were then prioritized within each of the three research modules: Planning, DERs, and Operations. The results of each cohort's modular assessment are an in-depth review and analysis of the factors identified at the outset of the project as they relate to each of the topical areas. A factor analysis was conducted by characterizing desired outcomes for comparison. The results were then utilized in the process of framing scenarios and identifying centers of influence, meaning the most consequential stakeholder groups or institutions. Because of the qualitative nature of the data gathered and research, each module decided to omit numerical modelling, complex modelling, and technical evaluations from the analysis. Rather, the factors and subsequent scenarios that were constructed using the factors to assess possible desired outcomes, are all qualitative and subjective in nature. Each assessment is based on the perspectives of the student researchers and provides potential value from an external perspective.

As the modules developed and identified key stakeholders and pivotal issues, a ranking was assigned to factors based on the likelihood, influence, impact, and certainty of policies or actions. Keeping these attributes in mind, each factor was evaluated with reference to relevant stakeholders' perspectives and desires. The feasibility of the various scenarios being implemented were ranked according to an aggregate measure of benefits to, and therefore supported by, all of the primary stakeholders to achieve Pareto-optimality.

In summary, the analytical approach culminates a set of scenario outcomes that are contrasted and evaluated for desirability and efficacy. Based on feedback provided by R Street Institute staff, the team made revisions and modifications to the evaluation and analysis of projected scenarios.

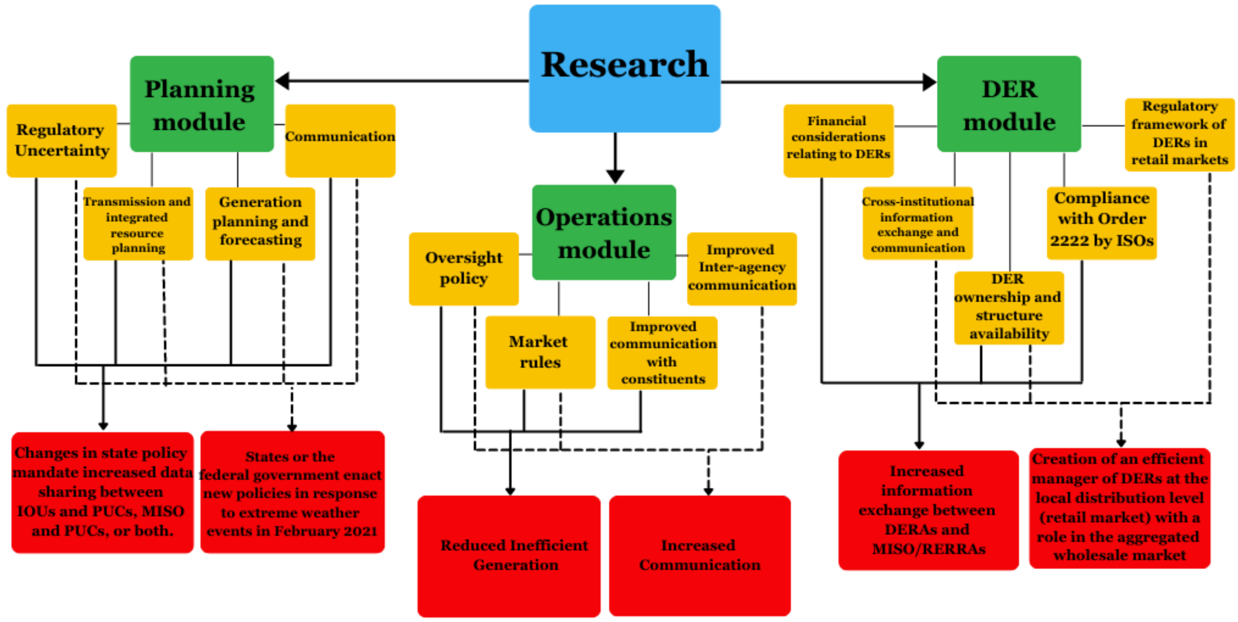

Fig. 1 *The investigation was divided into the modules shown in green squares. These modules determined factors shown in yellow squares. From these factors, two scenarios were created from each module. The dotted line shows factors relevant to one scenario and the solid line depicts the factors relevant to a second scenario for each module.*

2.1. Factors: Components to Achieving Desired Outcome

The three research modules (Planning, DERs, and Operations) have compiled and ranked a list of factors. These factors were used as the basis for the scenarios that were constructed for analysis of possible outcomes. Each factor has attributes that were characterized and described. Each factor characteristics includes likelihood of occurrence, level of influence, and impact. *Likelihood of occurrence* is the possibility that a specific factor outcome will occur, gauged as high, medium or low. The *level of influence* describes the magnitude of the effect of implementation. Finally, *impact* describes the manner in which a factor outcome will help achieve the desired outcomes of each module and is categorized as negative, neutral, or beneficial. The table describing these factor attributes is referred to as the matrix characterization. These matrices were created to quickly show the reader the key takeaways of each factor concerning its role in possible implementation. In addition to the characteristics of each factor, the detailed background, factor challenges or interdependencies, factor outcomes, outstanding questions, and resource references are itemized for each factor. The factors have been grouped by module.

The **Planning module** explored the potential synergies between state utilities' integrated resource planning (IRP), generation/transmission processes, procurement processes, and MISO's regional future outlook, with the goal of balancing reliability and cost minimization. To achieve this goal, the module has outlined four factors most relevant to optimizing processes, resources, and synergies.

The **Operations module** evaluated how MISO and state-level jurisdiction interacts with generators, market and policy rules influence renewable grid integration, and on developing a framework to reduce inefficient generation. In order to achieve this goal, the module identified four factors which targeted major aspects of utility operations.

The **DER module** investigated the economic potential of Distributed Energy Resources (DERs), researched the best methods for RTO compliance with FERC Order 2222, identified the institutional and policy framework that can assist in the increased deployment and integration of this technology. To achieve this goal the module has outlined five factors most relevant to DER integration and deployment.

i. Planning Factors

The factors are ranked by importance as follows:

1. Regulatory Uncertainty
2. Transmission and Integrated Resource Planning (IRP)
3. Generation Planning and Forecasting
4. Communication

The factors explored in the Planning module are detailed in the following sections. Each factor's relationship to integrating renewable energy resources into the grid under the context of 'planning' is explained. Each factor may have one or more implementations that are discussed. Figure 2 provides an overview of these factor implementations. Figure 2 also presents each factor implementation on a chart using the likelihood of occurrence as the vertical position and the potential impact of the factor implementation as the horizontal position. The most upper left implementations could be considered those of extreme importance. The following provides an in-depth introduction to each factor and their implementations.

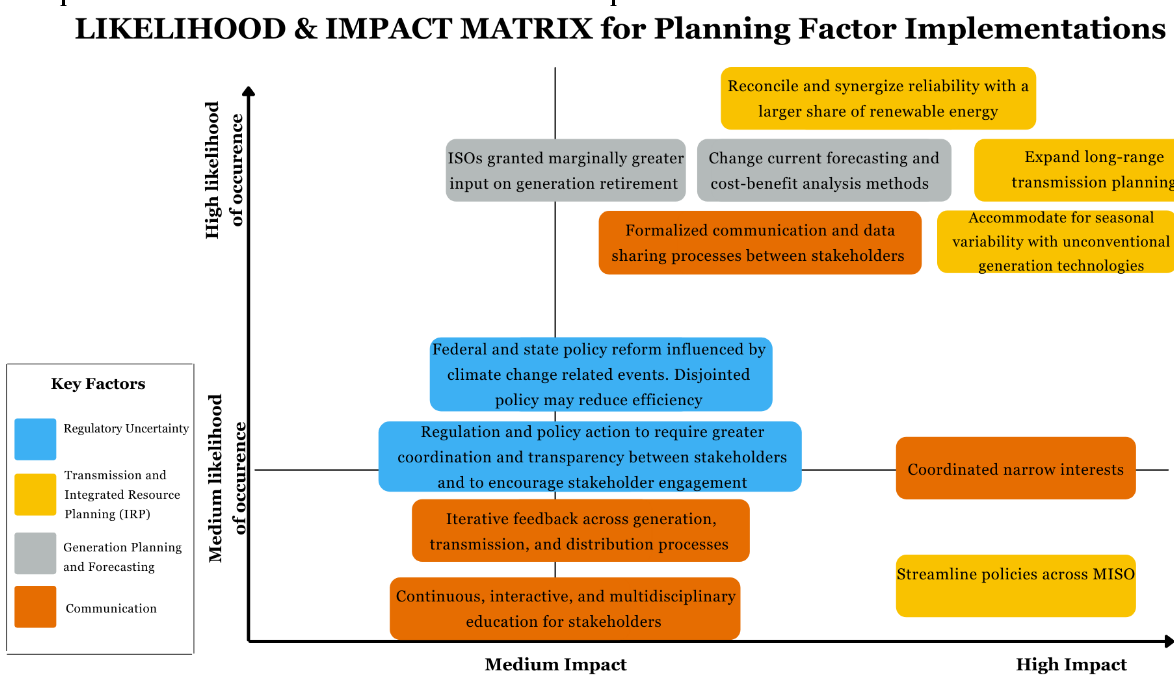

Fig. 2 *Estimation of the likelihood of occurrence and relative impact for the Planning module factor implementations.*

1. Regulatory Uncertainty

Concerns over regional electricity market regulation from state legislators and regulators has increased due to recent extreme weather events. Creating a cohesive stakeholder engagement has proven to be difficult based on changes in state policy. Because of the vast nature of the electricity market, investor-owned utilities and RTO/ISOs are stretched across multiple state jurisdictions where differences in state policies have imposed a regulatory burden on market actors. There are many disconnects between the multi-layered system of stakeholders. FERC

Order 2222 are key components leading the effort to allow competition in all regional organized wholesale electric markets. House Bill 1520 is striving to increase reliability mechanisms and metrics on Indiana's monopoly operating utilities. These policy actions allow for innovation and technology to be a driving force in lowering costs for consumers while enforcing the reliability of electric services. Regulatory action, enforcement, and active engagement can only be achieved through the alignment of stakeholder interests and goals set by the states (NARUC, 2021). Investor-owned utilities are regulated by legislation but are dependent on MISO for coordination. Molding relationships with key stakeholders such as IOUs would influence policy change when goals are aligned.

Weatherization of generation and transmission supporting the interstate wholesale electricity market is not new, yet the frequency and severity of variations in the weather which exceed the historic design bases of those facilities due to the rapid onset of climate change are increasing. The addition of guidance or details on weatherization planning and increasing cooperation between state regulation commissions, IOUs, and MISO from FERC is currently in its infancy and remains to be seen (FERC, 2021). Implementation of greater data sharing and transparency between stakeholders from HB 1520 faces the challenge of influencing full engagement and commitment to frequent communication. Interdependencies are found to positively affect long range planning in both transmission and generation from improved data sharing and integrated resource planning. Operational aspects are also affected by increased information sharing across institutions creating efficiencies in system management and workflow.

Table 1. Regulatory Uncertainty Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Federal and state policy reform influenced by climate change related events. Disjointed policy may reduce efficiency.	Medium	Medium-High	Beneficial
Regulation and policy action to require greater coordination and transparency between stakeholders and to encourage stakeholder engagement.	Medium	Medium	Beneficial

Implementation of these factors is heavily reliant on FERC and NERC coordination and their ability to utilize authority under the Federal Power Act to order a standard of conduct on weatherization and reliability. These standards will develop a more uniform approach in coordinating planning obligations aimed to address reliability and efficiency while facing climate change. Uniform policy could create an interdependency between states, relying on greater stakeholder engagement and coordination through data sharing to align goals and reduce costs.

2. Transmission and Integrated Resource Planning (IRP)

This factor primarily pertains to the spatial/geographic distribution of renewable energy resources that constrains transmission and resource planning as well as project siting. The basic problem concerns the uneven distribution of generation coupled with transmission constraints and resource planning considerations. When combined these factors significantly limit the penetration of renewable energy systems into the grid's energy mix.

IOUs are the most influential actor in the MISO footprint, as transmission and generation planning are inextricably linked. The differing objectives and incentives of PUCs and FERC during generation and transmission planning causes inefficiency in the processes. Analysis has found a low likelihood of completely removing jurisdictional inefficiencies, as states have diverse issues and coordination of policies take years to implement. MISO has the capability to provide incentives for states to comply with an overarching regulation, such as increasing the viability of transmission projects.

Uneven policy implementation has caused renewable generation to be concentrated geographically, causing backlogs on regional transmission lines. MISO wielding its interstate influence could lessen the asymmetry of renewable energy on the grid. This influence would also serve to mitigate system vulnerability, as adding a spatial component to IRP writing and planning. Redefining reliability and incorporating storage into the grid would compensate for renewable intermittency. The same issue can be identified in whether or not renewables alone can manage the grid load in peak and seasonal demand, and the imbalance between MISO states which do or do not prioritize the green energy shift.

Table 2. Transmission and IRP Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Streamline policies across MISO	Low-Med	High	Beneficial
Expand long-range transmission planning	High	High	Beneficial
Reconcile and synergize reliability with a larger share of renewable energy	High	High	Beneficial
Accommodate for seasonal variability with unconventional generation technologies	High	High	Beneficial

Streamlining policies across MISO would minimize clustering of renewables but would also limit state independence and limit more ambitious policies. Expansion of long-range transmission would create more uniform RE distribution, increase regional reliability, but would be difficult to achieve as it requires substantial consolidation of power into MISO's hands over states' rights, which may require an amendment to the Federal Power Act. Synergizing and upgrading RE reliability would remove grid solvency corners but may be time consuming or prohibitive. MISO is also reluctant to shift reliability requirements or paradigms. The final factor may run into obstacles if conventional generators do not become uneconomic once RE overcomes seasonal variability.

The factors one through four above are further divided and can exist on their own and become useful to other scenarios. However, when combined sequentially, the factors also exist in a continuum to support transmission and resource planning holistically as they happen concurrently.

3. Generation Planning and Forecasting

State regulators utilize the "used and useful" test to make decisions regarding ratemaking and investment recovery. Increasingly, state policy is changing to give regulators authority to approve utility resource plans and certificates of need (Indiana HB 1520, for example). ISOs are responsible for operating capacity markets and must evaluate planned generator retirements regarding must-run reliability considerations. Creating a reliable grid is done by several stakeholders and their roles in determining plant usefulness and adhering to regulatory reliability requirements. How these regulations and the stakeholders' roles are changed will be crucial to enabling renewable energy integration. To further support renewable integration, forecasting and cost-benefit analysis methods must be utilized to prepare generators for extreme weather or other system shocks.

State legislators currently have and could delegate more authority to PUCs to permit utilities to build or retire generation units; however greater input from MISO would increase system efficiency by analyzing generation planning at a multi-state level (Navigant Consulting, Inc., 2014). NARUC and NASEO have both endorsed this framework, and Indiana has introduced legislation to require utilities to meet planning reserve margin requirements created by MISO (Indiana General Assembly, HB1520, sections *i* and *h*). Although such legislation would likely be technology-neutral, the low cost of renewable generation creates a strong incentive for investment (Soliday, 2021). Granting ISOs more input and consultation power would make retirement of generators more efficient.

Extreme weather events are at the forefront of planning and forecasting issues, as the rate of incidence is increasing under climate change. Implementing changes to CBA and forecasting models will increase the efficiency of planning and better reflect predictions for energy distribution across the grid in the coming decades (NARUC-NASEO, 2021). Given the diversity of climate conditions in the region administered by MISO and the lack of data sharing between regulatory bodies, the ability to compare cost-benefit analyses regarding regional transmission generation and climate considerations will produce more impactful and relevant insights. These insights can then more accurately steer all stakeholders in future decision making. NARUC and NASEO already support this measure as a highly valuable tool for decision making.

Table 3. Generation Planning and Forecasting Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
ISOs granted marginally greater input on generation retirement	High	Med-High	Beneficial
Change current forecasting and cost-benefit analysis methods	High	High	Beneficial

Barring exorbitant or prohibitive costs, these two factors should have largely positive outcomes for transmission and generation planning. If states and generators remain largely uncommunicative in planning transmission (NARUC-NASEO, 2021), this may result in inadequate planning, weatherization, and grid congestion which increase the risk of problems occurring in the MISO region similar to those which befell Texas in February of 2021. A lack of comprehensive models and CBA will leave the grid vulnerable to high demand, weather, and other factors. Indiana HB 1520 is predicted to be signed into law given that it is a Republican-sponsored bill in a similarly partisan state. However, further analysis is necessary to determine whether it will be an administrative burden to PUCs and IOUs or will succeed in bridging planning gaps between MISO and the states. After the events in Texas, it is no longer a question of whether these changes to regulation will change, but what impact these inevitable changes will have.

4. Communication

Communication is a driving factor that contributes to the success in working with a variety of public and private entities. While state legislators may not have specialized energy policy backgrounds, effective collaboration between state legislators and PUCs is critical to efficient grid operation and regulation (Shea, 2020). Collaboration starts with transparency in the consistent reporting of future plans and goals and open dialogue about policy reform (NARUC-NASEO, 2018). State Energy Portfolio Requirements and Integrated Resource Plans could serve as coordinating foci between jurisdictions and serve as coherent statements of intent in response to MISO's goals and priorities. Although increased communication and data sharing would aid in many aspects of planning, reconciling the narrow interests of various stakeholders is a daunting process (Ditto, 2019).

Communication disconnect exists on a micro and macro level between IOUs, ISOs, and agencies, as well as between generation, transmission, and distribution processes. Improving internal communication through feedback loops across generation, transmission, and distribution processes allows for coordination in order to problem solve (Ditto, 2019). By iteratively sharing real-time expected load, generation capacity, and transmission capacity data, generation, transmission, and distribution activities are made more efficient. Improving external communication (between regulators and regulated parties) is critical to reducing knowledge and information disparities across stakeholders (NARUC-NASEO, 2021). Significant data are available to ISOs and utilities that are not made available to state regulators. As such, regulated parties have valuable information concerning grid operations and future expectations that is not shared with state regulators. Resolving information disparities between grid operators and regulators, as well as establishing iterative feedback loops, represents a significant challenge. However, transparent, symbiotic relationships can coordinate each stakeholder's interests to drive energy policy and operations in a forward-looking direction.

Table 4. Communication Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Formalized communication and data sharing processes between stakeholders	High	High	Beneficial
Coordinated narrow interests	Med	High	Beneficial
Iterative feedback across generation, transmission, and distribution processes	Med	Med	Beneficial
Continuous, interactive, and multidisciplinary education for stakeholders	Low	Med	Neutral

The outcomes from communication factors vary based on interdependencies among sub-factors. Improving load data sharing processes increases the accuracy of forecasting models as well as the efficiency of future infrastructure investment decisions (Ditto, 2019). Improving forecasting models by establishing multi-party data sharing processes will increase the effectiveness of long-range transmission planning (NARUC-NASEO, 2021). Improving multi-party data sharing processes will also enable the creation of iterative feedback loops across processes. If generation capacity, transmission capacity, and demand data can be provided in real time, utilities and ISOs will be able to more efficiently manage the grid.

ii. Operations Factors

The factors are ranked by importance as follows:

1. Market rules
2. Oversight Policy
3. Improved communication with constituents
4. Improved communication between agencies

Next, the Operations module factors are described. As with all module's factors, the operations module factors have multiple implementations that stem from a single factor. These implementations range in potential impact and likelihood of occurrence. A representation of factor implementations is displayed in Figure 3.

LIKELIHOOD & IMPACT MATRIX for Operations Factor Implementations

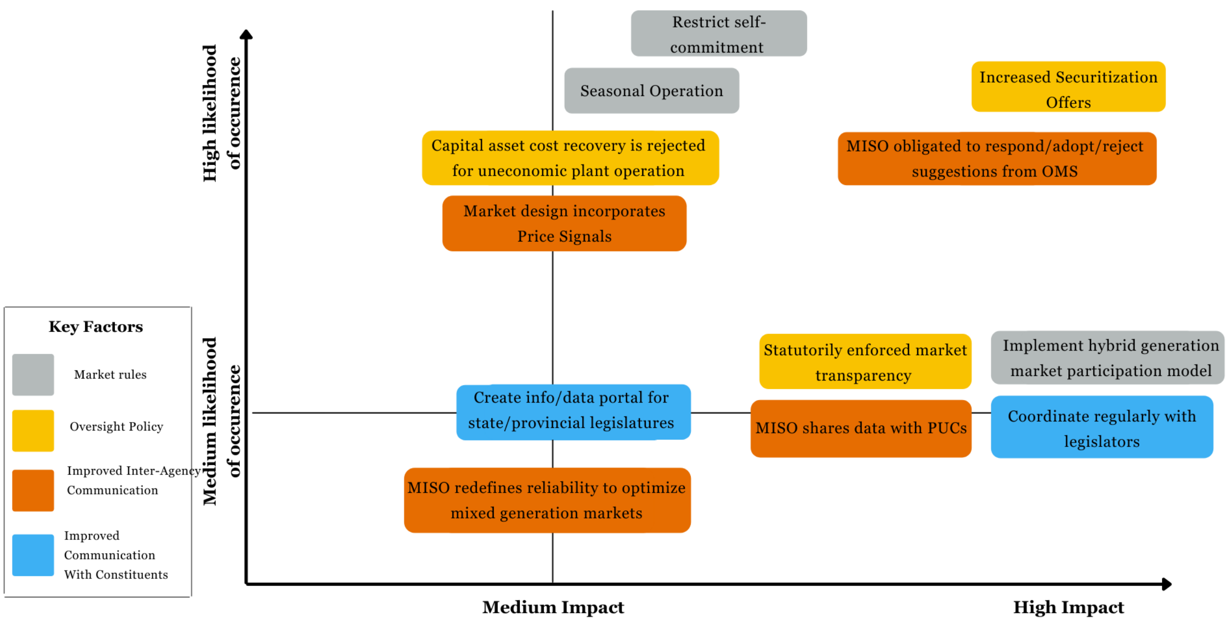

Fig. 3 *Estimation of the likelihood of occurrence and relative impact for the Operations factor implementations.*

1. Market Rules: Increase Storage and Minimize Self-Commitment

Two issues related to market rules that have hindered the onboarding of renewable energy generation are self-commitment of coal plants and a lack of hybrid generation market participation. IOUs have been allowed to self-commit certain generators which operate at significant losses, rather than allowing MISO to determine generation needs for reliability purposes or allowing MISO to schedule generation based on the day-ahead market (Daniel et al. 2020).

An important long-term and market paradigm-shifting technology is energy storage paired with renewable generators (Trabish, 2018). Formalizing hybrid generation market participation is crucial in supporting hybrid generators to fully integrate into the grid and day-ahead markets. Currently the rapid influx of non-dispatchable generators is creating greater ramping demand within the MISO footprint; therefore, incentivizing battery investment with a new participation model will reduce grid and generator stressors.

The relationships between stakeholders operating within the market will heavily influence outcomes and participation in that market, as reducing self-commitment of coal plants and introduction of a formal hybrid participation model will incentivize IOUs to invest in hybrid generation. Stronger ancillary and day-ahead markets will promote better price signals and rates for customers. Reduction of self-commitment is a long-term gain for the states as well, as PUCs and legislators will have political and policy leverage to better manage the fuel trackers and cost recovery of IOUs. More effective regulation will incentivize the seasonal operation of coal plants, in times of the year when prices and demand are consistently and predictably high. While this change is highly likely to occur, the level of influence will be medium, as the 'bad actors' of self-commitment are few in number (Potomac Economics, 2020).

Issues arise between MISO limiting self-commitment and states forcing IOUs to internalize inefficiency costs, as much of the information needed by the state PUCs and legislatures is highly protected and sensitive, especially in a free market setting. This will require maneuvering by all agencies to ensure the protection of data while eliminating the information asymmetry. This market change also has effects on the planning which states undertake to meet reliability requirements from multiple regulators. Taking coal generators offline will require substantial investment in other electricity generation, which can be aided by the hybrid generation. However, the economic relationship between renewables and storage may take time and further oversight to stabilize (Dorsey et al., 2020).

Table 5. Market Rules Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Implement a hybrid generation market participation model	Medium	High	Beneficial
Restrict self-commitment	High	Medium	Beneficial
Seasonal Operation	High	Medium	Neutral

If none of these factors were implemented, and the status quo remained, IOUs will not be held accountable for inefficient generation and ratepayers would be forced to continue shouldering the financial burden (Fisher et al., 2019; Daniel et al. 2020). It would increase the timeline of introducing renewable generation by a substantial amount of time as well. The same would play out for hybrid generation market rules. The price of battery or storage units would remain high without incentive to invest, ramping demand would not be met efficiently, and renewable generators would remain non dispatchable and less competitive with fossil fuel generators.

Implementing a hybrid generation market model will incentivize storage investment and allow IOU and IPP hybrid generators to participate fully in day-ahead markets and compete with fossil fuel generation (Chen, 2016). Low-cost renewable energy will also make investment more attractive and bolster ramping markets to support non-hybrid renewable generation (Energy Storage Assc., 2020). The full effects of integrating hybrid generation into the market will take time but introducing the model sooner will mean greater stability and gain in the future (Dorsey et al., 2020).

Minimizing self-commitment and negotiating for seasonal operation of coal plants is a relatively straightforward and direct method of forcing IOUs to internalize the costs of running inefficient coal generation units. It will open the door to implementing other factors discussed in this paper and will protect ratepayers from higher costs. Seasonal operation of coal plants is a valuable intermediate step towards full decommission and retirement of fossil fuels from the grid.

Based on this analysis, the preferable outcome is one wherein the hybrid generation market participation is created and rolled out in stages. In the interest of MISO's preference for reliability and enhancement of important ancillary markets, refocusing on storage and hybrid generation must occur within the next five years in order to handle the load of renewable generators on the grid. Under a scenario in which DERs become more concrete and commonplace, they will benefit from a strong ramping market and a day-ahead market which has levelized the hybrid electricity generation costs (Energy Storage Assc., 2020). Coal plants that are consistently unprofitable can be operated seasonally and shut down when not needed. Self-commitment should be restricted so that the wholesale energy markets can work as intended.

2. Oversight Policy

This factor investigates causes and impacts of uneconomic generation incentives and explores policy means to incentivize economically efficient generation. Effective oversight and policy targeting information asymmetries provides an opportunity for states to address rate making, resource portfolio composition, and effects on the market occurring based on self-suppliers.

Sharing utility operations data and behind the meter data with state regulators (while protecting proprietary information) would reduce the current information asymmetry inhibiting adequate market oversight. Furthermore, existing information asymmetries between utilities and regulators may be reduced through effective incentives and regulatory measures, such as investigatory dockets and disallowance of clearly inefficient generation costs. The foremost challenge regulators face in establishing greater transparency is defining *what* data should be shared, *who* owns this data, and *how* such data will be disseminated and protected from misuse. Mandates to share data points with entities who cannot shield data is likely to cause conflict among utility stakeholders. Data may not be a perfect fit for statutory requirements but still enable transparency in less formal coordination forms. Transparency measures might create dispatch equity requirements making reliability and response to demand more difficult. PUCs and state legislators may lack the capabilities or will to enact proper financial incentives on investor-owned utilities in their markets. Increased coordination between MISO and PUC policy-makers would yield more information regarding uneconomic operation. An example of coordinated policies could be statutory requirements for ISOs to share masked market data points within markets in order to provide operational transparency. Legislators would also have an interest in pursuing diversified energy resources if they had access to real-time market data.

Securitization of coal plants is the fastest and most efficient way of removing coal from the grid, according to industry experts. In states that approve securitization legislation, IOUs will be incentivized to use this tool to recover stranded asset costs. This is particularly likely as both federal and state commitment to addressing environmental issues grows and coal becomes less and less profitable in comparison to other energy sources (O'Boyle and Marcacci 2020). Paying IOUs to remove their inefficiently run and costly coal generation plants will free market space for more renewable generators to come online, particularly if energy storage becomes cheaper within the MISO footprint. It will also help struggling communities make the transition from fossil fuels to renewable generation (Handler and Bazilian, 2020). Generators are likely to be supportive of cost recovery, but IPPs may oppose a 'bail out' on the grounds that the state is giving preference to IOUs. Securitization is also a difficult recourse for IOUs and ratepayers, as the sunk cost fallacy often interferes with sound business and economic decisions.

Attention on recent FERC requirements might narrow focus among stakeholders promoting coordination regarding FERC 2222 but reducing focus and coordination on other issues. Compliance with FERC 2222 is a major challenge for ISOs. Should the FERC mandate information sharing among stakeholders, compliance issues are likely to arise within ISO environments. Such an order might spark political/interest group mobilization in order to support or challenge the order in court. Stakeholders would likely benefit from advanced coordination with FERC regarding categories, security, and ownership of market data. It is possible the inclusion of DERs in future IRPs could drive stakeholder interest in increased transparency measures. Generators of all types will likely be interested in the development of new energy sources in the market. While current stakeholders would benefit from knowing more, they also may be more protective of their data than willing to accept equitable transparency policies. Market transparency significantly alters the market environment as it could become a motivator for DER onboarding and erode "resource agnosticism" among regulators, grid operators, and shift public interest toward specific sources. Cost recovery policies would likely create unanticipated inefficiencies elsewhere or incentivize other uneconomic behaviors either offsetting gains or making situation worse

Table 6. Oversight Policy

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Statutorily enforced market transparency	Medium	High	Beneficial
Capital asset cost recovery is rejected for uneconomic plant operation	High	Medium	Neutral
Increased Securitization Offers	High	High	Beneficial

If generators continue to self-commit resources, despite inefficiencies and unprofitability, ratepayers will continue to pay millions in unnecessary energy costs and coal will continue to "cut in line" and crowd out cleaner power sources. MISO could share data that is currently not public with the PUCs so that they can provide more effective oversight. Regulators cannot do their job without sufficient information that will allow them to determine the extent to which a utility is prudently managing its assets. With more information, regulators can disallow imprudent costs, setting important precedents that make it clear to utilities that bad management is unacceptable.

A major point of concern among stakeholders is likely to be the ownership of data and competitor exposure in the marketplace. Utilities are unlikely to share their organizational capabilities among competitors. Absent additional policies addressing competitive framework assurance, stakeholders and interest groups probably possess different motivations and goals with regard to transparency. Transparency is not only an issue regarding physical capabilities, but by defining public, private, and protected information points, transparency regulations will touch multiple sub-factors within the marketplace.

Securitization is an attractive offer to IOUs and will incentivize them to more quickly retire coal plants. However, if securitization is done in an unstructured manner or before other plants are capable of handling the load, the grid may experience more instability. In addition, unless experts representing ratepayers and communities are included in negotiations, the terms of the proposed securities may favor the interests of utilities and their shareholders over ratepayers and affected workers (Trabish 2021). Many states also suffer from staunch political opposition to securitization, and greater pressure and support from MISO would hasten the removal of those barriers.

Based on the comparisons made here, it is recommended that MISO begin legal, and policy moves to make operation and efficiency data available for access with other stakeholders. In addition, state legislatures should authorize securitization to refinance uneconomic coal plants that have not been fully depreciated. MISO would aid in this transition by requesting a larger budget from FERC for issuing funding for securitization. In addition, collaboration between MISO and the Organization of MISO States would help coordinate retirement.

3. Improved Communication with Constituents

Although state legislators make many of the long-lasting statutes that guide energy policy within a state under MISO's jurisdiction, they are often balancing these energy needs with several other competing interests in politics. To improve communication with constituents, PUCs should synthesize the subjects of technical information presented to legislators so that the most important points are easily communicated. PUCs must be prepared to revise their explanations to legislators to facilitate wider understanding of what is being discussed. This in turn will allow legislators to have a stronger understanding of what information must be communicated to the general public. In addition, IOUs must be aware not to alter the messaging from legislators enough to the point that it completely changes the legislators' intended message. IOU communication should instead be limited to explaining how the individual utility's participation would work so constituents have specific examples to look to.

In terms of challenges, some communication may fall victim to political opportunism, and state legislators should be wary of implementing policies recommended from entities managing more than one individual state. Furthermore, utilities usually prefer operating with little to no regulation, which can lead to issues such as self-commitment. IOUs will often communicate dissatisfaction with MISO and PUC regulation to legislators, before legislators have come to understand the reasons regulators have enacted these policies. Finally, MISO is one of the largest ISOs in North America, covering fifteen states and the Canadian province of Manitoba, posing a difficult task to provide effective regulation and guidance for its different member jurisdictions in a way that addresses all of the diverse needs of its footprint.

Table 7. Improved Communication Matrix

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Coordinate regularly through reports and schedule periodic virtual or in-person meetings with legislators	Medium	High	Beneficial
Create info/data portal for state/provincial legislatures	Medium	Medium- High	Neutral

If none of these factors were to come into play, there would be no incentives to change constituents' behavior, nor would there be a proactive way to address problems that arise from poor grid management. Additionally, constituents may not necessarily do much with the information provided to them, even if it is understandable. With some communication from legislators to constituents, the public may become more aware of the roles of MISO and PUCs in managing the grid and ensuring electricity is delivered in a timely manner. This information would be useful to constituents looking for ways to be more energy efficient and potentially implement renewables into their daily lives. Although this communication would be limited to constituents that are invested, it will provide a strong base from which future communications can grow.

By communicating directly with constituents on a regular basis about the roles of MISO and PUCs as well as the behaviors constituents can change in order to facilitate the technical objectives that MISO and PUCs strive to achieve, a much wider base of constituents would be receiving information that is relevant to their daily lives. A drawback of this approach is that it requires a much larger devotion of time and resources for all parties involved. This increased time spent on formatting communications could be seen as unnecessary, particularly given the multitude of tasks PUCs, MISO, and legislators already contend with on a regular basis. However, the increased communication will likely yield a much greater resulting participation by constituents in the energy efficiency market and create a better understanding of the grid's operation in general. The preferred outcome of implementation would be direct and consistent communication with constituents as it is the most all-encompassing and ensures the largest audience possible is exposed.

4. Improved Inter-Agency Communication

Consistent interaction between PUCs, independent power producers, utilities, and MISO are generally lacking in the present regulatory structure. This is generally due to the different incentives each of these players have. A lack of technical data sharing makes PUCs' decisions on generator operation asymmetrical and incomplete. In order to correct this asymmetry, MISO must design a policy platform which legally transfers industry information to PUCs while continuing to protect generators' trade information. Important stakeholders include PUCs, IOUs, MISO, Organization of MISO States (OMS), and ratepayers. PUCs review utilities' rates for consumers, approve and reject a utility's rate structure or reimbursement for operation based, and approve IRPs. The OMS is a valuable group to approach to streamline multi-value projects and acknowledge state power over generation issues (Organization of MISO States, 2020). MISO has the information and ability to share their utility's fuel cost and rate information. This could be done in a shared portal which MISO could grant access to on a need-to-know basis. Once information about fuel costs is passed on to public and state knowledge, ratepayers may make more informed decisions about utilities and express opinions to legislators and the PUCs (Chung et. al, 2017). By aligning MISO and PUC incentives, consumers will benefit by having better transparency of price signals and with better information they may pressure utilities into open market competition.

Some of the options to increase communication and transparency include: a shared information portal, a chat system such as Cisco Jabber, or face-to-face meeting on a platform such as Zoom or Microsoft Teams. However, it may be difficult to convince all PUCs and MISO to get on board with one way to share information. Chat websites such as Cisco Jabber are confidential, but do not offer ways to archive information and can't provide records of the shared information. One issue with sharing information between MISO and PUCs is that in a competitive market, utilities do not want to share information of their cost share or inputs. In a competitive market these decisions govern some of the MISO rules of what can be shared and what cannot. Before data sharing can be fully embraced in a competitive market, rules and regulations need to be established for protection of utility competition data provided to regulators which would have economic value to competitors if disclosed to them.

Table 8. Improved Inter-Agency Communication Matrix

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
MISO shares data with PUCs	Medium	High	Beneficial
Market design incorporates Price Signals	High	Medium	Beneficial
MISO obligated to respond/adopt/reject suggestions from OMS	High	High	Beneficial
MISO redefines reliability to optimize mixed generation markets	Low	Medium	Beneficial

A factor outcome would be that MISO shares fuel cost and operational efficiency data with the PUCs so that they can provide more effective oversight and rate structures. With more information, regulators can disallow imprudent costs to the consumer and better information for rate structures and oversight of PUCs on utilities (Houghton et. al, 2019). In addition, in order for the regulatory process to work the PUC has to be sufficiently informed about utility information, including best management practices and best plan practices. This information can be delivered by MISO to the PUCs to increase regulatory frameworks. For data sharing, the current known solutions are: Information sharing on a website where PUCs and MISO upload on a monthly basis and chat websites (Jabber) to share information instantly and face to face meetings.

MISO must design a market which legally transfers industry information to PUCs while continuing to protect generators' trade information. In order to do this, there must be an alignment of PUC, utility, and MISO incentives. One method of aligning incentives would be by incorporating price signals to drive reliable behavior of market participation (SEIA, 2021), as utilities will operate with more economic efficiency, which in turn pressures MISO into improving market function. This drives communication of fuel cost between PUC and MISO. Creating a portal to share information will increase market participation and improve market design and performance. Competitive markets are the primary regulatory apparatus for MISO; therefore, price signals are a valuable tool.

In this new era of grid flexibility and restructuring, it is in MISO's best interest to collaborate with states and find a new definition of reliability which encompasses a hybrid generation market and DERs. MISO has not fully recognized or optimized the power which the OMS holds to influence the communication and cooperation between states. While OMS has several committees and strategic priorities surrounding market operations and expanding cooperation across the 'seam' (Organization of MISO States, 2020), there is no mechanism for MISO to formally acknowledge OMS comments. Having a formalized way of acknowledging OMS statements and suggestions would increase trust and a working relationship.

A combination of all outcomes would be best for aligning MISO, PUC, and generator incentives and incentivizing the integration of renewable energy as well as for the consumer. Implementing these aspects of the factor will work concurrently with increased communication to constituent stakeholders. Outcome 5 is imperative to breaking down barriers between MISO and the state bodies they work with. Communicating more freely and at a deeper level will reduce information asymmetries and build trust which is extremely valuable to the goal of increasing renewable generation.

iii. DER Factors

The final module of the investigation covers distributed energy resources. The factors assessed in this module are described in these sections.

The factors, ranked by importance, are as follows:

1. Financial Considerations relating to DERs
2. Cross-Institutional Information Exchange and Communication
3. Distributed Energy Resource Ownership Structure Availability
4. Compliance and Implementation of FERC Order 2222 by ISOs
5. Regulatory Framework of DERs in the Retail Market

These enumerated factors each have their own implementations. Figure 4 highlights the implementations of these factors by highlighting their estimated impact and likelihood of occurrence. Each implementation shown here is described in the sections that follow.

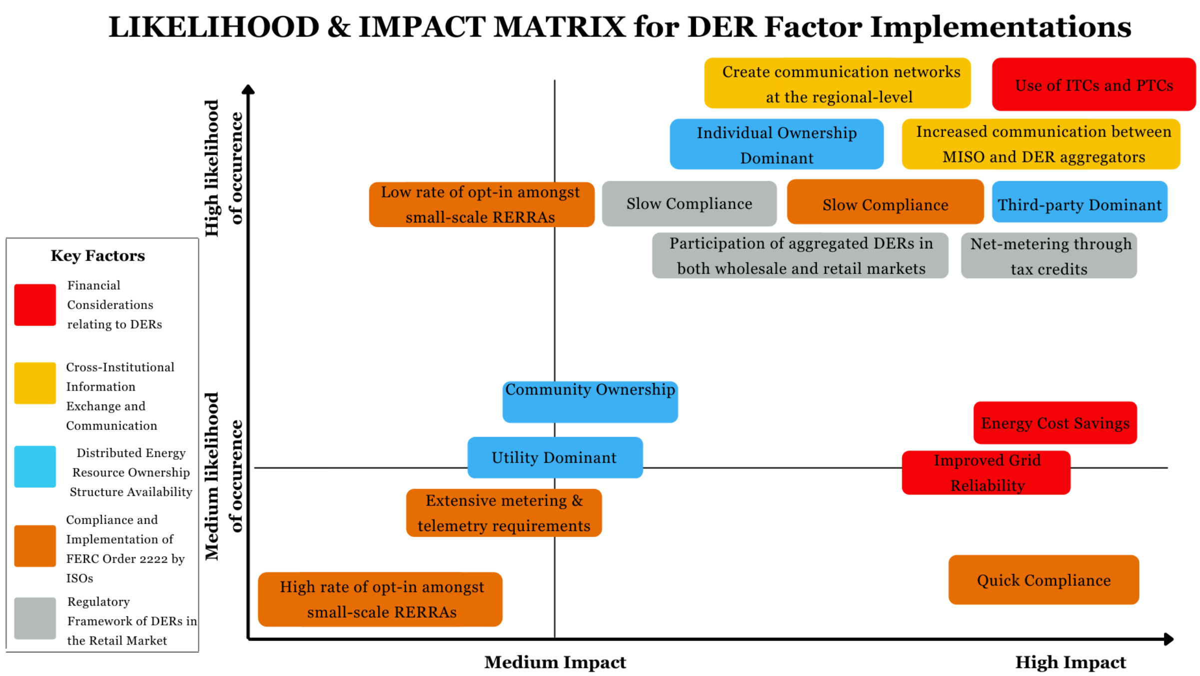

Fig. 4 *Estimation of the likelihood of occurrence and relative impact for the DER factor implementations.*

1. Financial Considerations relating to DERs

FERC Order 2222 has opened the door for the extensive integration of DERs into wholesale energy markets. The financial considerations related to DER integration are a central factor in determining the potential benefits of DER integration under different scenarios. Financial considerations related to DERs include the impacts of DERs on Energy Costs and grid reliability, as well as the use of Investment tax credits (ITCs) and Production tax credits (PTCs).

These issues influence a wide range of stakeholders. The most notable are RTOs, energy consumers, and current energy producers. RTOs are relevant because they manage the grid and will set the rules that will determine what DER's must do to access the wholesale market. Consumers are relevant because potential DER benefits, such as lower, more stable energy and improved grid resiliency, should directly benefit consumers. Current energy producers are relevant stakeholders to the extent that DER integration into the wholesale market could reduce the demand for new large-scale energy generation facilities and increase overall competition in the energy production market.

Perhaps the largest obstacle towards realizing the benefits of these considerations is related to how RTOs will decide to implement FERC Order 2222. RTOs decisions on issues like double counting, telemetry requirements, and pricing nodes will influence the ease with which DERs will be able to access the wholesale market (Dennis, 2020). If regulations in these areas are made unfavorable towards DERs, it is likely that they will still largely avoid official participation in the wholesale market.

Table 9. Financial Considerations Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Energy Cost Savings	Medium	High	Beneficial
Improved Grid Reliability	Medium	High	Beneficial
Use of ITCs and PTCs	High	High	Beneficial

The first financial considerations subfactor is "Energy Cost Savings". It is believed that integration of DERs into the wholesale market can lead to decreased energy costs by increasing competition among energy suppliers, decreasing the need for costly capital investments, and optimizing overall asset utilization (Advanced Energy Economy, 2019). This financial consideration was one of the primary motivations for FERC Order 2222. The extent to which these benefits are realized depends largely on the regulatory framework constructed by the RTOs.

The next subfactor is "Improved Grid Reliability". The installation of DERs often requires a new grid-connected energy storage system. The expansion of these grid-connected energy storage systems increases the overall capacity of the grid, improving reliability. DERs also **i**mprove grid resiliency by providing energy downstream from more vulnerable generation, transmission, and distribution systems. If a major event such as extreme weather or a terrorist attack negatively impacted the more vulnerable, upstream systems, DERs would be able to pick up some of the slack, improving overall grid resilience.

The use of ITCs and PTCs is also worth briefly noting as a financial consideration, although this subfactor is not as reliant on the implementation of FERC Order 2222. ITCs and PTCs are tools the federal government likes to use to encourage renewable energy generation. Because of these programs, installation of DERs, like solar panels, has been increasing, and is projected to continue increasing. These credits will continue to support DER installations, regardless of the extent to which DERs can access the wholesale market. The main point of this subfactor is to understand that DER use is projected to rise, and this will only increase the potential financial benefits they offer to the wholesale market, regardless of if those benefits are able to be realized

Under an ideal implementation scenario, RTO regulations put in place dictating how DERs may access the wholesale market would not be overly burdensome. These financial considerations rely largely on market forces to be realized. As long as regulations are not overly burdensome, the potential benefits of decreased energy costs and improved grid reliability should be able to manifest.

2. Cross-Institutional Information Exchange and Communication

There is a limited, and in some instances, no institutional relationship which has been established between ISOs and local distribution departments within IOUs. This operational separation has functioned in the status quo market, but as DER integration continues to increase this lack of information exchange will lead to problems including real-time monitoring issues (Geiger, 2019). In a scenario involving deep decarbonization of the power sector and rapid electrification of the transportation, industrial and buildings sectors, DERs could become especially significant. This would be manifested most likely through the proliferation of micro- and nano-grids integrated into the distribution system, further underlining the need for effective communication between the different institutional stakeholders. Through demand monitoring DERs usually reveal themselves as reductions in demand but increasing the visibility of DERs could lead to real benefits for the grid. Further, institutional relationships built between distribution departments of IOUs and MISO transmission can lead to increased cooperation between the two entities as DERs become more popular (Kristov, 2017). Theoretically, creating additional information exchanges and communications between entities can lead to enhanced grid monitoring, reduced operating costs, increased reliability and increased grid capacity (Gridworks, 2017).

The institutional exchange of information needs to be further unpacked, as the relationship between entities is not established nor is it typical. The type of information needing to be shared and the agency apparatuses to share that information need to be determined and established in order for the process to go forward. MISO's DERs Task Force is currently addressing this impending need as it engages stakeholders in its Order 2222 Compliance Planning process currently underway.

Table 10. Cross-Institutional Information Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Increased communication between MISO and DER aggregators	High	High	Beneficial
Create communication networks at the regional level	High	High	Beneficial

3. Distributed Energy Resource Ownership Structure Availability

There are four main structures of DER ownership: individual ownership, utility ownership, third-party ownership, and community ownership. For consumers that are able to purchase DERs, a purchase can be made through covering all costs or taking out a loan (potentially through a low-interest loan like HELOC - home equity line of credit). In this model, the purchaser typically must be a home or business owner. For consumers not wanting to outright purchase a DER system, the other option for home or business owners is third-party ownership which often takes the form of leasing or power purchase agreements (ILSR, 2021). This ownership structure helps to reduce upfront costs and other barriers to adopting rooftop solar (or other DERs) (ILSR, 2021). However, this third-party ownership option is not available in all states, but community solar initiatives have been gaining in popularity with LMI communities being of particular focus (ILSR, 2021).

For consumers who are not home, business or governmental or non-profit institution owners, the options for ownership become sparse. In the US, the discussion of distributed energy resource (DER) ownership for non-homeowner residential consumers mainly centers around two options: utility-centered ownership and nonutility-centered ownership (or third-party ownership) of a community solar project. The Department of Energy and AEE suggest that utility ownership of DERs can be appropriate in certain instances where there is not a current market for DERs. These are spaces for which utilities and another party could work together to create a small-scale solar project. This method is often thought of as the foundation for a future competitive market (Advanced Energy Economy, 2017). The drawback to this model is that the communities of low- and moderate income (LMI) consumers are not included/or are still unable to take advantage of these projects in the absence of governmental or charitable financial support.

There is an additional model for community-ownership. In this model, community members and local stakeholders own most of the project and act as decision-makers within the process. This model allows for many of the project's socio-economic benefits to be applied to the local community (IRENA, 2020). This model can mean full ownership by the community, but other ownership structures such as community owners combined utility owners are also possible.

Community ownership in DER projects has been highlighted as a way to increase DER deployment in communities of low- and moderate-income consumers (Baker, 2021). However, community/shared DER (solar) projects are not currently available in Indiana (ILSR, 2021).

Table 11. DER Ownership Structure Matrix

Factor: Ownership Structures	Likelihood of Occurrence	Level of Influence	Impact
Individual Ownership Dominant	High	High	Neutral
Utility Dominant	Med	Med	Beneficial
Third-party Dominant	High	High	Beneficial
Community Ownership	Med	Med	Beneficial

There are two possible implementations of additional ownership structures: expand DER deployment, a policy of co-ownership of DERs should be established for qualifying LMI households and communities in partnership or co-ownership with IOUs and allow middle/higher income households to utilize leased DER systems through third-party or utility ownership.

First, Indiana does not currently allow shared/community solar but co-ownership of DERs for community style projects should be included in policy initiatives for states that wish to increase DER deployment (ILSR, 2021). This co-ownership can be between LMI consumers/community stakeholders and utilities. This uses the principles discussed in AEE regarding the need for utility-centered projects in areas where there is not a current market. DERs are typically for higher income households and the related benefits, therefore, typically are unavailable to low-and moderate-income households.

This recommendation advances DER deployment for communities that may otherwise miss out on DERs due to high upfront costs and provides these communities with the socio-economic benefits of DERs. This method may also reduce the concern of utilities for cross-subsidization. IOUs argue the consumer most impacted by DERs are the LMI customers, because current rate structures "subsidize customers who can afford to implement renewable energy at the cost of those who cannot."(Peskoe, 2016) This structure would reduce this argument by placing benefits with LMI customers and customers who would not typically gain access to these benefits.

The second expansion of ownership for leasing will increase DER deployment. Half of all states allow leased DER systems for residential homes (Peskoe, 2016). Currently, neither solar leasing nor power purchase agreements are available in Indiana through a third-party (ILSR, 2021). IURC did approve a pilot program to lease solar through Duke Energy in 2019 which found limited success. This third-party ownership structure for middle-high income households decreases barriers to adoption. The counterfactual for Indiana is the current landscape for ownership- this is one in which the only way to have reduced upfront costs is to receive a loan.

4. Compliance and Implementation of FERC Order 2222 by ISOs

Order 2222 is the latest in a series of rules promulgated by the Federal Energy Regulatory Commission in order to facilitate the presence of small-scale Distributed Energy Resources on the grid (FERC, 2020). The Order mandates that RTOs and ISOs allow DER aggregators to participate in all regional organized markets, including wholesale capacity, energy, and ancillary services (Campbell 2020). Originally, all RTOs and ISOs must have a compliance plan for the order to be approved by FERC by July 19th, 2021 (ISO, 2020). However, many RTOs anticipate needing more time to develop their plans; MISO specifically requested to extend its compliance deadline to April 2022, which was accepted by FERC (Morehouse, 2021).

Implementation of Order 2222 will ultimately require adequate coordination, communication, and adequate sharing of information between numerous stakeholders, including RTOs, utilities, DERs, and RERRAs. This communication will ensure that RTOs and other regulatory authorities have adequate information about the energy resources present within their footprint; however, excessive metering requirements would prove prohibitively costly to some DERs. Therefore, while Order 2222 allows RTOs to implement metering requirements, it prohibits requirements that create significant barriers for DERs (MISO). The Order also provides leniency to smaller-scale regulatory authorities, which are not required to allow DER integration and may instead opt into Order 2222 at will (MISO).

Table 12. Compliance and Implementation Matrix

Factor Outcomes/Components	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Quick Compliance	Low	High	Neutral
Slow Compliance	High	High	Beneficial
Extensive metering requirements	Medium	Medium	Neutral
High rate of opt-in amongst small-scale RERRAs	Low	Low-Medium	Beneficial
Low rate of opt-in amongst small-scale RERRAs	High	Medium	Detrimental

Although Order 2222 is a mandate, it trades some of its regulatory strength for stakeholder flexibility. Due to provisions within the rule, DERs are shielded from excessive metering requirements, and small-scale RERRAs may choose to opt into the rule (MISO). Generally, it would be beneficial for stakeholders to forego this leeway: increased metering will provide more useful information to RTOs and RERRAs, and opt-in by small-scale RERRAs will allow for greater DER participation. Both of these factors will allow for a more uniform and consistent regulatory regime across MISO's footprint.

In order to achieve these goals, holistic communication between relevant parties is vital. Stakeholders, especially RTOs, DERs, and RERRAs, must make their needs known and understood, so as to find common ground between provision of information and the increased financial burden it may cause. The process of adequate stakeholder communication will likely be time-consuming, so taking a slower path to compliance with Order 2222 may be necessary. Although this slower compliance will delay the implementation of the Order, preventing DER aggregators from participating in energy markets as soon as they otherwise could, it will ensure that MISO formulates a robust and mutually beneficial compliance plan that accommodates all stakeholders within their regulatory footprint.

Nonetheless, maintaining steady progress towards compliance is necessary. Although a slower compliance timeline will allow for the creation of a more robust compliance plan, delays in compliance for the Order will allow current barriers to DERA participation in wholesale markets to persist for a longer period of time. As such, it is important to ensure that adverse interests, opposed to the increased presence of DERs on the electrical grid, do not have undue influence on the compliance process.

5. Regulatory Framework of DERs in Retail Markets

This factor considers the possibility of DER integration with the grid at the local or state levels through retail markets or microgrids, including issues of double-counting that may arise due to simultaneous participation in both wholesale and retail markets, which may undermine the cost-feasibility of DERs. If DER services are being overpaid for, state and local authorities may not be favorable towards them and would push for having an opt-out clause (Thomas & Dennis, 2019). While FERC Order 2222 addresses the integration of Distributed Energy Resources (DERs) into the wholesale electricity market, the regulatory framework at the distribution level remains weak. A retail framework that allows for DERs to provide multiple services at both the wholesale and retail market levels will allow for increased resiliency, lower costs, and energy independence for consumers. However, it is important to note that many utilities (both vertical and municipal agencies) own both transmission and distribution grids, and many DERs meeting qualifying thresholds will participate in both whole and retail markets through the same program or through different aggregators. This introduces some jurisdictional ambiguity as the power may not directly go through a retail market to an end-user but to an intermediary through a transmission system that is interstate. This potentially puts it under FERC jurisdiction, but is not very clear-cut as the distribution system interconnections may be state or locally regulated. Additionally, when retail suppliers purchase electricity from behind-the-meter DERs (mostly consumer-owned) they are reselling it and hence wholesale market rules which again fall under FERC regulations apply (Levitt et al., 2020).

Finally, provisions for net metering of behind-the-meter DERs need to be clearly established. Historically, net metering which is the purchase of power by utilities from behind-the-meter DRs owned by consumers has either been compensated through fixed retail rates or set purchase rates often leading to either under- or over-compensation of DERs. Developing a comprehensive body of law governing compensation of net metering through appropriate time-varying and locational marginal pricing and tax credits could encourage more consumers to install behind-the-meter renewable DERs (Lowder & Xu, 2020). It would also counter the problem of cross-subsidization - with non-DER owning consumers bearing the brunt of the costs incurred by subsidizing DERs through net metering schemes for DER owners. As Haider et al (2021) note, charging a grid maintenance fee to DER prosumers in addition to compensating them through time-varying and locational pricing would address the inequality in billing structures. The possibility of developing a time-of-use and locationally adjusted net metering mechanism for large clusters of prosumers is high at the distribution level. This factor may change how people view electricity supply in general, in addition to adding a degree of stability to grid operations. Simplified net metering has a direct impact on cost of energy and grid resilience and reliability by removing the cost obstacles to DER grid integration.

Consumers/prosumers and all DER owners play an important role in increasing the penetration of DERs in the energy market. Transmission and Distribution utilities, which include municipal utility agencies and regulated utilities, facilitate DER owners to participate in both wholesale and retail markets. Finally, by passing Order 2222, FERC has cemented its position as a catalyst stimulating increased DER participation in the energy market.

While the participation of aggregated DERs in both wholesale and retail markets may help increase the contribution of DERs in the energy mix and thereby increase resiliency, cost effectiveness and reduce carbon footprint, it may also give rise to the possibility of over-counting. This may lead to unsound investments and high expectations. Net metering through time-varying and spatially adjusted pricing mechanisms would encourage smaller consumers and larger industrial consumers to invest more in renewable DERs and it may also lead to an overwhelming volume of applications that may not be efficiently managed due to resource constraints.

Compensation mechanisms for end-users that own DERs supplying power to both wholesale and retail markets either through the same aggregator or through different programs need to be clearly defined to avoid double-counting the sale of one unit power produced by DERs in both wholesale and retail markets. A possible framework of looking at it is through the quantification of the avoided costs (such lower generation costs and transmissions costs) and social benefits of generating a unit of energy through a DER connected to a distribution grid as compared to a unit produced by traditional resources, e.g., coal. The value of the benefits should be added to the cost of production and owners should be compensated as such by a distribution level entity (DSO), the functions of which are detailed in Scenario 2 of DERs, in the 'Scenarios: How Factors Interact' section. To avoid the problem of double-counting, the DSO would maintain and update a list of DER sources and the different wholesale and retail programs they are included in. The benefits (e.g., GHG emissions reduced) and capacity of the DERs should only be counted as either a reduced load in a retail program (if DER is participating in both WEM and retail markets through the same aggregator) or for its generation output to a wholesale market (if participating through different aggregators). Close communication between DER owners and DSOs will ensure proper documentation is maintained for all transactions for proper compensation. Hence, while the DSO may facilitate the participation of DERs in both retail and wholesale markets, the contribution would only be counted once with the DSO. Double counting impacts the economic feasibility of DERs and is therefore directly related to the increased integration of DERs. Solving this issue will strengthen the argument for increases in DER deployment (AEE, 2017).

Recent court rulings have denied the request of states to opt-out of the process of DER integration with the wholesale market. Local or States authority can no longer limit the ability of DERs to participate in wholesale markets under FERC order 2222 (FERC, 2021). The charge of regulating the development of inter-connections for grid integration falls on state authorities. In areas where the cost of electricity is high as well as high grid congestion, it may serve/drive state authorities to introduce policies to sustain reliability and hosting capacity thresholds of the electricity generation from DERs. This may involve revision to management plans for quicker response to energy demands. Removal of barriers to entry in either type of market will increase the number of applications for grid integration, which will in turn increase visibility of DER resources for the relevant regulatory authorities, it will also increase DER presence in the energy mix. Participation in both types of markets speeds up the integration process by pushing innovation, creating economic opportunities and promising a more decentralized, energy-efficient power supply that is more resilient to weather changes.

Table 13. Regulatory Framework of DERs Matrix

Factor Outcomes	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Participation of aggregated DERs in both wholesale and retail markets	High	High	Beneficial
Prevent double-counting of DERs	High	High	Beneficial
Net metering through tax credits	High	High	Beneficial

All three outcomes can be successfully achieved if a decentralized entity for managing retail market transactions is established. This entity will be separate from MISO, possibly within the jurisdiction of a state utility commission but will still closely interface with MISO to coordinate parallel retail and wholesale transactions. Such an entity will also be able to closely monitor DER development and increase its visibility to include in the state's resource energy planning. It can address both outcomes addressed in section 5 as it will steward compensations for behind-the-meter generation (removing this responsibility from utility providers) and adjust it to time varying demands. It would also ensure that all retail transactions with DERs are documented properly and compared with DER transactions in wholesale markets for the same region (for more details, see Scenario 2 of DERs, in the 'Scenarios: How Factors Interact' section).

2.2. Scenarios: How Factors Interact

This project offers six scenarios depicting possible futures of the Midwest energy market. The purpose of these scenarios is to identify interactions between factors that will produce ideal outcomes for ISOs and PUCs to more easily facilitate the integration of renewable energy sources. These scenarios define areas in which change within the stakeholder environment could potentially enhance the interactions between ISOs and PUCs, thereby facilitating increased usage of renewable energy in resource portfolios.

Each scenario is given a basic description in which its framing is more clearly explained. Subsequently, factors were analyzed for their potential outcomes and implications; outcomes that serve as necessary events to produce a given scenario are listed, and their impacts are assessed. These impacts are determined by the changes produced by a factor outcome (What circumstance changed), the ways in which that factor impacts the circumstances surrounding it (How the circumstance changed), the importance of the factor's importance to the overall scenario (Why it is important), and the key stakeholders who are necessary for that outcome (Stakeholders). Actions or elements that may lead to the specified factor outcome are listed (Catalyst). Finally, all factor outcomes within a scenario are organized into a logical order to facilitate the scenario (Factor Sequence).

The six scenarios identified are:

1. Changes in the state policy to mandate increased data sharing between IOUs and PUCs, MISO and PUCs, or both
2. States or the federal government enact new policies in response to extreme weather events in February 2021
3. Reduced inefficient generation
4. Increased communication
5. Increased information exchange between DERAs and MISO/RERRAs
6. Creation of an efficient manager of DERs at the local distribution level (retail market) with a role in the aggregated wholesale market

Each sub-section of this section outlines key factors and outcomes relevant to the scenarios, but such outcomes are not inherently restricted to particular modules. Furthermore, these changes represent areas of focus for each module, but multiple changes may or may not occur simultaneously causing interactions among factor effects. One explicit integrated variable is the role of communication. While each module represents a scenario involving improved communication dynamics among stakeholders, this change may occur in different ways, using distinctive means, suited toward unique ends. Finally, it is also conceivable that factor outcomes in one scenario also take on significance in another scenario, but for concision and focus, this report organizes outcomes by significance for the reader.

Based on the possible outcomes of the scenario analyses, this section concludes with a description of unifying concepts and considerations across all modules. These considerations serve as conceptual guideposts for the conclusions and recommendations presented at the end of this report. As such, this section highlights the catalysts, drivers of change, and potential interactions across all scenarios, with the overall purpose of informing recommendations and conclusions.

i. Planning

The projected increased penetration of renewable energies in the midwestern grid requires a new planning strategy since the dispatch and availability of renewable energy is more variable than that of fossil fuels. The successful implementation of this planning approach is contingent upon stakeholders' ability to address a series of challenges synergically.

First, part of the complexity of efficiently planning an increased share of renewable energy resides in the multijurisdictional nature of planning. Indeed, state policies fall outside the purview of ISOs and utilities, which complicate policy uniformization at the regional level, increasing the regulatory burden on market actors. Second, even though an increasing number of midwestern states have adopted Renewable Portfolio Standards (RPS), the IRP process and the ISOs' "queue system" hamper the ability to attain RPS objectives and contribute to increased uncertainty and make establishing an efficient planning strategy more difficult.

Consequently, addressing these multijurisdictional challenges requires a high level of cooperation and coordination between local and state governments, utilities, and ISOs. This is particularly challenging given the recent overhauls to the Federal Power Act which give larger jurisdiction to federal regulators via the Commerce Clause of the US Constitution, rather than the prevailing statute itself. However, the current framework impedes and provides insufficient opportunities for formal communication and information/data sharing between stakeholders and threatens the system's reliability and efficiency.

Although problems inherent to planning result from the interconnection of different factors, the following section analyzes each factor individually. Factors deemed of immediate concern to establishing adequate planning strategy are: Regulatory Uncertainty, Transmission and Integrated Resource Planning, Generation Planning and Forecasting, and Communication. The next section also identifies potential outcomes resulting from these factors under various conditions.

Regulatory Uncertainty Outcomes

I. Changes in Federal/state policy resulting from weather events in February 2021. Disjointed policy may reduce efficiency.
II. Policy may change to require greater coordination between ISOs, require greater stakeholder engagement, or other actions.

Transmission and Integrated Resource Planning (IRP) Outcomes

I. Streamlining policies across MISO
II. Expanding long-range transmission planning
III. Reconciling and synergizing reliability with a larger share of renewable energy
IV. Accommodating for seasonal variability with less conventional generation technologies

Generation Planning and Forecasting Outcomes

I. ISOs are granted marginally greater input into generation retirement decisions

II. Changes to current forecasting and cost-benefit analysis methods

Communication Outcomes

I. Insufficient formalized communication & data sharing processes between stakeholders
II. Coordinating narrow interests to drive policy change in a way that is forward-looking, efficient, and reflects insight from all stakeholders
III. Too few iterative feedback loops across generation, transmission, and distribution processes
IV. Need for continuing, interactive, and multidisciplinary education for and between all stakeholders

These factors and associated outcomes allow for the crafting of scenarios that may be used as potential avenues of action to assist stakeholders in developing a new planning strategy that ensures reliability and cost-minimization and considers for the unique aspects and challenges of renewable energy sources. The first scenario addresses the lack of data sharing by advocating for *changes in state policy mandate to increase data sharing between IOUs and PUCs, MISO and PUCs, or both*. The second scenario pertains to reliability considerations by encouraging the *states or the federal government to enact new policies in response to extreme weather events.* These scenarios are described in further depth in the following paragraphs.

Scenario 1: Changes in state policy to mandate increased data sharing between IOUs and PUCs, MISO and PUCs, or both.

This possible policy change would likely resemble something like what is the intent of IN HB 1520, which mandates increased data sharing between IOUs and the IURC and grants the IURC authority to conduct an investigation and mandate resource changes if utilities are found to have acquired insufficient summer/winter capacity. This policy would increase mandated data sharing between IOUs and PUCs and could also foster additional communication between other stakeholders. This collaborative data sharing would improve forecasting models for MISO, IOUs, and PUCs. In addition to allowing the state to regulate more efficiently, changes to the forecasting process could drive improvements in generation and transmission planning processes and facilitate the integration of renewables into the grid.

Scenario 2: States or the federal government enact new policies in response to extreme weather events in February 2021.

In response to the ever-increasing concern about system reliability, states and the federal government have a number of policy options at their disposal, several which, if enacted, will generate outcomes that are not mutually exclusive, but interact. Additionally, multiple policies may be enacted by different state governments and the federal government. It may be the case that the policy response is disjointed across states or between states and the federal government. It is likely that utilities (and potentially ISOs) will face increased reporting requirements. Additionally, market actors may modify their cost-benefit analysis process in response to greater access to data or policy change. Improvements to the cost-benefit analysis will improve generation and transmission processes. Further, federal policy may mandate increased interconnectedness across ISOs. This would improve reliability of the grid by both enhancing disaster readiness and long-range transmission capacity, thus facilitating the integration of renewables into the grid. Finally, the federal government may take steps to create a regulatory framework that is less disjointed and more evenly spreads the benefits and burdens of regulatory policy across both regulators and market actors.

ii. Operations

The MISO energy market is intended to be competitive and dynamic. While MISO maintains ways and means to communicate price signals and asset management, the operator is neither accountable for nor maintains a vested interest in any particular asset, utility, or specific stakeholder. MISO's interest and purpose broadly speaking regards the geographic service territory and the overall operation of the energy market within it. But, notwithstanding its intended purpose, this market has been superimposed on a status quo driven by system reliability considerations and vertically integrated monopoly interests toward economic inefficiencies, creating losses for customers, utilities, and public funds. This sub-section outlines how the current status quo for market operations can be altered by several factors occurring under two distinctly different sets of conditions.

The factors at play within MISO market operations involve stakeholder capability, communication, and oversight policy initiatives. These three concerns converge on a fundamental challenge to efficient energy economics within the MISO service territory. This challenge is the role of data within the market footprint and its effect on stakeholder behaviors. Energy demand and supply signals are integrated by MISO personnel daily to provide energy to the market in a reliable and resource agnostic manner. Furthermore, MISO is required by its stakeholder frameworks and tariff to protect information provided by stakeholders in order to support a competitive energy market. Factors deemed of immediate concern to market operations are: Energy Storage and Self-Commitment of assets (Supply Signaling), Oversight Policy (Demand signaling), Improved Communication with Constituents (Communication), and Improved Inter-Agency Communication (Communication). The next section identifies potential outcomes resulting from these factors under various conditions.

Energy Storage and Self Commitment Outcomes

I. Implementation of a hybrid generation market participation model
II. Restrict self-commitment
III. Seasonal Operation

Oversight Policy Outcomes

I. Statutorily enforced market transparency
II. Increased Securitization Offers

Improved Communication with Constituents Outcomes

I. Coordinate and Schedule with Legislators
II. Create Specific Information/Data Portal for Members of State Legislatures

Inter-Agency Communication Outcomes

I. MISO shares data with PUCs

II. Market design incorporates Price Signals

These factors and their associated outcomes converge to create substantial changes to the status quo under two identified condition changes. These scenarios are not all-inclusive and represent two paths toward a more efficient energy market. The first scenario is a significant change in market rules resulting in *reduced inefficient generation.* The second scenario involves changes to stakeholder behavior as a result of *increased communication***.** These Scenarios are described in further depth in the following paragraphs.

Scenario 1: Reduced Inefficient Generation

Under the current system, some investor-owned utilities (IOUs) are inefficiently self-committing coal plants. Estimates of the resulting costs to ratepayers range from $250 million to $750 million in annual losses from uneconomic coal plant operation, with a small share of IOUs operating much less efficiently than their counterparts. Other causes of inefficient generation are inadequate demand signals and distortion of the market by reliability imperatives. Under the status quo, the energy sector can expect further losses from inefficient asset management, particularly from the worst actors. The table below outlines several potential reforms aimed at reducing inefficient generation. These include reforming market rules on self-commitment, making utility data more available to state regulators, seasonally operating plants, facilitating hybrid market models that include storage, and offering securitization to more quickly retire unnecessary and uneconomic coal plants. Catalysts of positive change include greater awareness and information sharing, legislative changes, and the falling prices of clean energy and storage technologies.

Catalysts for change regarding market inefficiency are generally assumed to reflect the predicted customer response to market costs passed to them by improper operations. The increasing capabilities of energy storage devices and public awareness are perceived to be primary motivators toward market change. One of the first signs this scenario is occurring is if self-commitment restrictions are enforced by regulators, operators, or by legislatures and local PUCs.

Scenario 2: Increased Communication

Communication between technical experts such as MISO and state PUCs and those less-experienced with energy policies such as legislators, has been nearly non-existent, leading to frustrations among all stakeholders and a lack of progress in better grid management. Better intercommunication between technical experts and synthesizing recommendations for legislators may ultimately facilitate behaviors among the general public that are the result of better communication between technical experts and lay people. Technical experts should first share data with one another to promote markets to incorporate changes through price signals. Once this data is shared, technical experts can work together with legislators to convey these signals in an easily understandable manner that can be communicated to the general public. The level of communicating this information can vary, leading to different results among the general public. Although these factors can be implemented at different intensities, the process of consolidating technical information between experts, synthesizing this information into understandable terms, and then conveying this understandable information to the general public can create a more well-informed audience that will better respond to changes in grid management.

The primary motivator toward change under this scenario regards the political impacts of improved communication between customers, stakeholders, regulators, and lawmakers. Under these conditions it is likely the status quo would change significantly as motivations would more strongly impact members with statutory or electoral authority who are also more closely responsible to the customers composing their respective electorates. The first sign this scenario might be occurring is if MISO shares technical data with PUCs.

iii. Distributed Energy Resources

Distributed energy resources (DERs) are challenging to marketplace managers for a variety of reasons. Reliability and cost certainty are major priorities among market managers, regulators, and consumers however DERs are not always guaranteed to meet these imperatives. Additional development of technology and software can contribute to DER shortcomings with regard to these stakeholder priorities, but regulation and policy also play major roles in the current marketplace. This subsection outlines the major outcomes and two potential scenarios relevant to the expanded role DERs play in today's marketplace.

The outcomes relevant to DERs are Regulatory Uncertainty Outcomes, Cross-Institutional Information Exchange and Communication Outcomes, Distributed Energy Resource Ownership Structure Availability Outcomes, Compliance and Implementation of FERC Order 2222 by ISOs Outcomes, and Regulatory Framework of DERs in Retail Markets Outcomes. These outcomes manifest in diverse consequences with the potential to fundamentally reshape the structure of the marketplace. To ensure this assertion is not an overstatement, the outcomes in this section suggest communal, individual, and third-party ownership.

These consequential shifts in market ownership are also intrinsically connected to technological and infrastructure investments. DER market presence represents how instances of simplicity cause complex and outsized impacts on the greater environment. For example, the increasingly available capability to self-generate electricity in the marketplace has second and third order effects across the greater service region. Explicit depictions of these outcomes are listed below.

Regulatory Uncertainty Outcomes

I. Energy Cost Savings
II. Improved Grid Reliability
III. Use of ITCs and PTCs

Cross-Institutional Information Exchange and Communication

I. Expanding long-range transmission planning
II. Create communication networks at the regional-level

Distributed Energy Resource Ownership Structure Availability Outcomes

I. Individual Ownership Dominant
II. Utility Dominant
III. Third-party Dominant
IV. Community Ownership

Compliance and Implementation of FERC Order 2222 by ISOs

I. Quick Compliance
II. Slow Compliance
III. Extensive metering & telemetry requirements
IV. High rate of opt-in amongst small-scale RERRAs

V. Low rate of opt-in amongst small-scale RERRAs

Regulatory Framework of DERs in Retail Markets

I. Participation of aggregated DERs
II. Prevent double-counting of DERs
III. Net metering through tax credits

Distributed Energy Resources present a unique challenge to the current marketplace and likely have a more volatile impact on the marketplace as a result. While communication of economic data and demand signals is still prominent, technological advancements and regulatory developments are also likely to play a major role in bringing about change to the status quo. These changes are represented in two scenarios: *Increased information exchange between DERAs and MISO/RERRAs* and the *creation of an efficient manager of DERs at the local distribution level (retail market) with a role in the aggregated wholesale market.* These Scenarios are described in further depth in the following paragraphs.

Scenario 1: Increased information exchange between DERAs and MISO/RERRAs

Under Order 2222, MISO and other RTOs may implement metering and telemetry requirements for DERs. Increased sharing of information will allow MISO and local regulatory authorities to create a more holistic picture of the distributed energy resources present within their footprints. However, more advanced metering imposes higher operating costs on DERs and aggregators, who lack the financial resources of large utility companies. As such, these requirements "must not pose an unnecessary and undue barrier to individual DERs." Mutualistic cooperation between DERAs and MISO are necessary to ensure that all necessary metering information is provided without creating excessive regulatory burdens that may not be manageable for smaller-scale DERs.

This scenario is inherently focused on communication within the market. However, unlike some of the other scenarios presented, it has more variable catalysts. For example, customer costs, regulations, and interaction among actors in the environment provide more opportunities for this scenario to be realized. While information exchange between aggregators and MISO is essential to a positive outcome, the scenario might generate momentum within the policy, stakeholder, or consumer communities independent of communication variable progress.

Scenario 2: Creation of an efficient manager of DERs at the local distribution level (retail market) with a role in the aggregated wholesale market

This scenario assesses how the creation of a distribution-level entity separate from but closely interfacing with MISO could serve to facilitate the coordination in parallel of both retail and wholesale transactions. The distribution system operator (DSO) is illustrated in Figure 5. The DSO would take over the distribution grid operations from distribution utilities and would have several offices serving distribution regions (or regions with T-D interfaces) within a reasonably defined radius at sub-regional level. In this particular case, the DSO would have regional offices that would span all sub-regions that fall under the larger MISO umbrella as it would make it easier to coordinate with transmission operators who are members of MISO. The establishment of the DSO can be achieved via a federal cooperative between FERC and the DSO (consisting of representatives from all stakeholders including municipal power agencies, distribution owned utilities, PUCs).

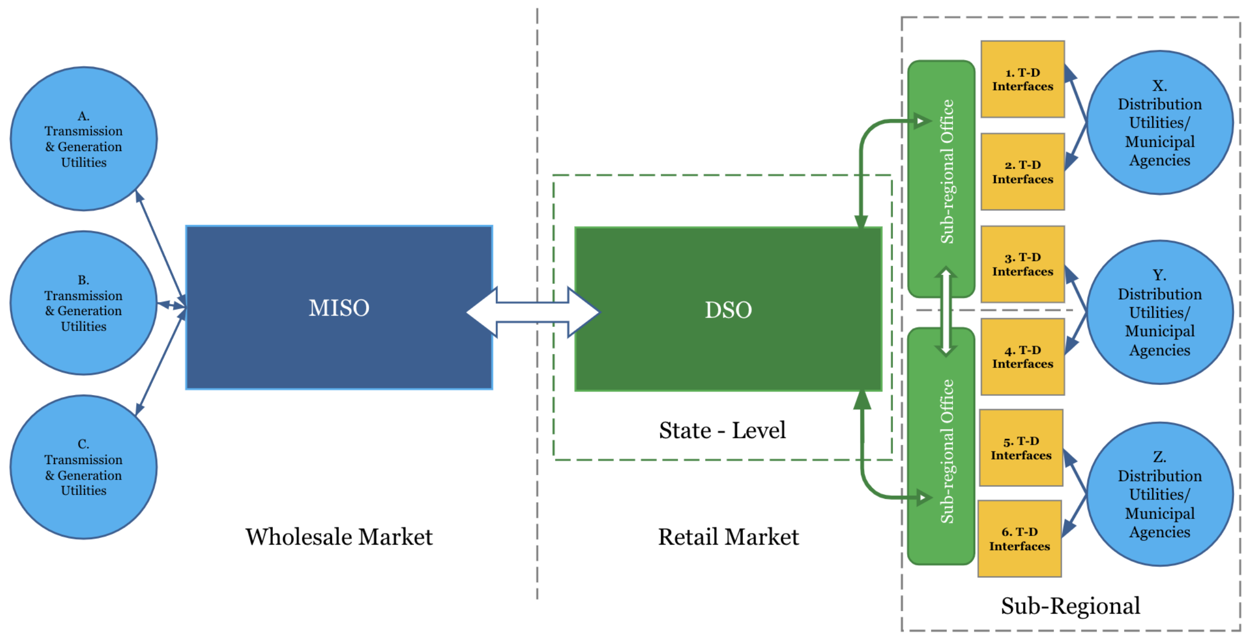

Fig. 5 *The structure of a DSO. The arrows indicate information exchange between actors. This conceptualized entity would require additional channels of communication at the sub-state level compared to the status quo.*

The functions of the DSO would include integration of distribution and transmission operations planning, computation of spatially- and temporally-adjusted net metering rates, facilitating participation of DERs with various ownership structures, determine a baseline capacity of the grid to accommodate DERs, keep track of all wholesale and retail programs that registered DERs are participating in and maintain optimal system performance at the distribution level by continually interacting with MISO to adjust wholesale demand in response to DER outputs.

The establishment of the DSO is likely to occur as a result of ineffective communication between stakeholders, between stakeholders and regulators, and as a result of non-existing means to access information from DER owners. These catalysts suggest a requirement for localized data collection and communications elements across the market. A major component of this outcome is that it involves a modernized signal network with decentralized data exchange points across the energy marketplace. If this outcome occurs as projected within this report, then it will have cascading effects across the other scenarios and outcomes as well.

3. Results

This section characterizes and describes the outcomes of each scenario previously outlined. The scenarios provide conceptual frameworks for interpreting consequences of implementation of the various factors and how the outcomes will potentially interact with each other across the energy market among key stakeholders. To begin this interpretation, each scenario is accompanied by a matrix (Tables 14 through 19) which illustrates the interaction of factors in the given scenario. The following information is itemized within each scenario matrix:

- *What Circumstance Changed* - the specific outcome of a factor
- *How Circumstance Changed* - the means by which the respective factor impacts the circumstances surrounding it
- *Why Circumstance Changed*- the factor's importance to the overall scenario
- *Which Stakeholders* - the key stakeholders who are necessary for the respective outcomes

Additionally, the questions of what facilitates changes were assessed with two characteristics:

- *Catalyst* - actions or elements that may lead to the specified factor outcome
- *Factor Sequence* - logical ranking of factors in order of facilitative impact

Assessing the impact of identified outcomes of a scenario led to the reasoning that several key factors can be leveraged in the stakeholder environment. The scenario results will be presented in three sections which pertain to the scenarios' original research area: "Planning," "Operations," and "DERs."

3.1. Planning

The following scenarios were developed through the aggregation of information from stakeholder interviews, research, and developing an understanding of market needs with stakeholders' interests and incentives. To be better prepared for extreme weather due to climate change, DER integration, and changing market conditions, the generation and long-range transmission planning process must be carefully considered and utilized as a useful mechanism to achieve advantageous results for the most stakeholders. The following scenarios focus primarily on information and data sharing, as well as the various planning processes that could benefit from a policy change or natural catalyst. To that end, the planning scenarios work towards achieving a higher visibility of DER integration, increased communication, and a maximization of stakeholder engagement.

These scenarios' factors include:

1. Regulatory uncertainty
2. Generation planning and forecasting
3. Transmission and IRP

Achieving the scenario's expected outcomes relies on:

1. Policy change
2. Increasing data sharing
3. Aligning information sharing processes
4. Improving power generation & transmission planning methods
5. Improving generation planning
6. Changing cost-benefit analysis methods

i. Scenario 1 Outcomes

Changes in state policy which mandate increased data sharing between IOUs and PUCs, MISO and PUCs will have a domino effect on planning-related issues, especially surrounding renewable energy market penetration. The outcomes of Planning Scenario 1 are:

1. Increased data sharing
2. Improved forecasting models
3. Improved generation planning
4. Improved transmission and long-range transmission planning

Similar policy changes and initiatives are prevalent in state legislatures (e.g., see Indiana HB 1520 and HB 1220). These outcomes are anticipated to occur for the following reasons:

1. Data sharing improves transparency and modelling and fosters collaboration among stakeholders
2. Improved models support collaboration and promote efficient regulation and generation/transmission planning
3. Effective generation planning enhances system efficiency, flexibility , and resiliency
4. Improved transmission planning promotes dispersed renewables and minimizes clustering.

This scenario was selected because of the significant ability of one factor to facilitate the implementation of other factors to better integrate renewables. Information disparities and the need for communication were echoed in multiple stakeholder meetings with representatives from ISOs, regulatory bodies, utility representatives, and others. These subjects are also common in the extensive research done for this paper. As such, this scenario was constructed around the design of efficient multi-party data sharing and communication processes. Analysts explored the numerous benefits unlocked through efficient communication, including improving load forecasting models, generation planning processes, transmission planning processes, and long-range transmission planning (LRTP) capabilities. While some of these factors could be partially implemented without data sharing, improving communication is a necessary, albeit insufficient, condition.

Table 14. Outcomes of Planning Scenario 1: Changes in the state policy mandating increased data sharing between IOUs and PUCs, MISO and PUCs, or both.

Planning Scenario 1 Outcomes				
Factor Sequence	**1.**	**2.**	**3.**	**4.**
Factor Outcome	**Increase data sharing**	**Improve forecasting models**	**Improve generation planning**	**Improve transmission planning and LRTP processes**
Stakeholders	MISO, IOUs, and PUCs	PUCs, IOUs, MISO	IOUs, MISO, PUCs	MISO
Circumstance Changed	Transmission, generation, and distribution data transparency	Greater access to data improves forecast models	Improve operation in periods of seasonal instability	Facilitate better incentives/investments for transmission capacity
How Circumstance Changed	PUCs create a plan for timely information sharing with possible input from stakeholders	Greater volume of data shows areas for model improvement	Driven by changes in forecast models	Use forecasting models and state policy tools to increase transmission capacity
Why Circumstance Changed	Data sharing improves transparency & forecasting models, fosters collaboration	Improves system transparency, fosters collaboration, allows for more efficient regulation by PUCs	Improved planning increases system efficiency, preparedness for extreme events	Facilitate dispersed renewables (i.e. to discourage clustering)

Catalyst	Policy change, such as IN H.B. 1520	Increased data sharing	Improved forecasting models and collaboration	Improved forecasting models and collaboration

ii. Scenario 2 Outcomes

Texas's recent energy crisis exposed the power sector's vulnerability to extreme weather, due in large part to a lack of preparedness and little investment in weatherization. While Texas is unique in its autonomous operation from the FERC, the 2021 Texas Electricity crisis raises concerns over other regions' electric grid preparedness and reliability. Furthermore, the projected growth of renewable energies into the generation mix brings forth additional concerns and challenges that system operators must consider to ensure the power system's reliability in extreme weather conditions. Increasing the MISO footprint's grid preparedness and reliability while increasing the share of renewable energies will require significant coordination among diverse policymakers. This scenario explores the interaction of a suite of factors which offer a potential pathway to increase system reliability and weather preparedness. The resulting effects arise through improved communication and interaction opportunities between stakeholders, enhanced policy alignments, and changed cost-benefit analysis practices.

This scenario's outcomes are:

1. Enhanced interconnectedness between ISOs
2. Increased data sharing and reporting for utilities
3. Coordinated processes and information flows across institutions (i.e., NERC, FERC)
4. Reformed cost benefit analysis methods
5. Improved methods of power generation and transmission planning

Enhancing interconnectedness between ISOs, increased data sharing and reporting for utilities, and aligning processes and information flows across institutions will foster synergistic interaction, leading to improved transparency and coordination within and between levels of stakeholders. These combined factors will also improve and inform the reformation of cost benefit analysis (CBA) methods. Reforming CBA methods will serve as a catalyst to improve power generation and transmission planning methods. However, implementing the results of the CBA relies on enhancing ISO interconnectedness, increasing utilities' data sharing and reporting, and aligning institutions' processes and information flows.

Research indicates no apparent mechanism by which these factors would inhibit one another. Rather, the factors are part of a sequence of changes that amplify one another. The only potential barrier is if changes do not occur in the early stages of the scenario, it will inhibit CBA reformation and subsequent improvements to generation and transmission planning. If the factors fail to occur, then increased renewable energy market penetration is jeopardized.

Table 15. Outcomes of Planning Scenario 2: New state or federal policies in response to extreme weather events in February 2021

Planning Scenario 2 Outcomes					
Factor Sequence	**1.**	**2.**	**3.**	**4.**	**5.**
Factor Outcome	**Increased connections between ISOs**	**Increased data sharing and reporting for utilities**	**Aligning processes and information flows across institutions (FERC, NERC, etc.)**	**Changes to cost-benefit analysis methods**	**Improve power generation and transmission planning methods**
Stakeholders	ISOs, Federal Agencies	IOUs, PUCs, MISO	Federal Agencies	MISO, IOUs	MISO, ISOs
Circumstance Changed	Improve communication, data sharing, and long-range transmission	Requirements to share data, certify that requirements are met	Align goals, costs and benefits of policy across federal agencies, state and federal levels	Must incorporate resiliency into BCAs	Change generation and transmission planning based on changes and BCA conclusions
How Circumstance Changed	Iterated feedback loops, joint councils or operations	Reports to PUCs or other parties as mandated	Sharing information and data across agencies, coordinating policy efforts	Incorporate uncertainty in extreme weather to determine costs and benefits	Make preparation changes in resiliency to recognize benefits and avoid costs
Why Circumstance Changed	Mandated by policy, improve disaster preparedness	Mandated by policy	Create unified regulatory framework and policy responses	In response to recent events, policy recommendation by NARUC-NASEO task force	Improve generation and transmission efficiency, weather preparedness, increase capacity for renewable integration
Catalyst	Extreme weather unpreparedness, policy change	Policy change	Federal policy change	FERC or internal (MISO/IOU) policy change	Changes to benefit-cost analysis

3.2. Operations

The interaction between ratepayers, policy makers, and electricity markets affects the operations of utilities' electricity generation and related functions. The development of the following scenarios was heavily influenced by ongoing challenges among Indiana Energy Market stakeholders. Examples of scenarios include: the adaptation of practices to recent FERC regulatory guidance occurring in Indiana and with the FERC or recent declarations and commitments by regulators, legislators, and communities making commitments to resource diversity in energy portfolios. The methodology for developing the following scenarios depends heavily on topical events occurring in Indiana and with the FERC. These events as well as stated priorities from stakeholders, such as MISO and the Indiana Public Utilities Commission, guided the choice of factors, which subsequently influenced the choice of scenarios. The geographic characteristics for these scenarios' potential outcomes encompass the entirety of the MISO footprint, which presents interstate jurisdictional conflicts. Ultimately the outcomes of these potential scenarios focus on how the projected increase of renewable generation changes the grid's operation and how to improve the function of the grid as a result of the increase.

Under the current system, some investor-owned utilities (IOUs) are inefficiently self-committing to generation, particularly among coal-powered plants. Estimates of the resulting costs to ratepayers range from $250 million to $750 million in annual losses from uneconomic coal plant operation, with a small share of IOUs operating more inefficiently than their counterparts. If current conditions persist, it can be expected that further losses from inefficient asset management, particularly from the worst actors, will continue to affect the electricity market. This scenario outlines several potential reforms aimed at reducing inefficient generation demonstrated by these IOUs. Catalysts of positive change include greater awareness and information sharing, legislative changes, and the falling prices of clean energy and storage technologies.

These scenarios' factors include:

1. Restriction of self-commitment
2. Market data sharing
3. Market participation from hybrid generation
4. Increased securitization
5. Seasonal operation of coal plants

Achieving the scenarios' expected outcomes relies on:

1. Placing more regulatory power in the hands of the states
2. Streamlining coordination between state regulators and ISOs
3. Strengthening market share for renewable generation
4. Determining the fastest and easiest method of removing coal generation from the grid
5. Providing an economical steppingstone to retirement for coal plants

i. Scenario 1 Outcomes

If successfully implemented, the combination of policy tools utilized in this scenario would:

1. Increase market functionality through better pricing signals
2. Facilitate the efficient retirement of uneconomic plants
3. Reduce market asymmetries between renewable and conventional generators

Ratepayers and generators gain the most from this scenario, as these measures lower rates and give IOU/IPPs a means by which to economically retire plants and save unnecessary costs by minimizing the self-commitment of generation resources.

This scenario would support the implementation of other scenarios, because (1) minimizing inefficient self-commitment and (2) formalizing hybrid generation market participation, easing the introduction of DERs into the grid. Specifically, Operations Scenario 1 supports Planning Scenario 1, discussed above, by providing better tools to map the distribution of assets and renewable generation growth. Operations Scenario 1 would both further facilitate and benefit from DER Scenario 2, discussed below. Operations Scenario 1 would enhance DER Scenario 2 by giving consolidated DERs a greater market share and a fair chance at competing against conventional generation. Conversely DER Scenario 2 supports Operations Scenario 1 by implementing safeguards against abuse of the market by arbitrageurs and DER aggregators. Additionally, hybrid generation will rapidly extend outside the purview of IPPs and IOUs through DER Scenario 2. A market structure must be implemented in order to support the growth of DER hybrid electricity production. While the authors recommend the sequence of implementation given in the table below, all changes could be implemented independently, with the exception of formalizing hybrid generation market participation, which would first require market data sharing to be effective. For instance, securitization legislation may face less political barriers as it is a potential win-win for IOUs, ratepayers, and renewable energy advocates, and thus could be implemented more quickly than other changes.

Unless rules are changed and market oversight improves, IOUs are likely to conduct business as usual, with certain coal plants regularly operating at a loss. State and federal regulators should restrict the conditions under which generators are permitted to self-commit, for instance when plants are conducting mandatory output testing. PUCs should ensure they have access to the necessary IOU data when conducting prudency reviews and should disallow imprudent costs. Such data could come from MISO or directly from the regulated utilities. This is a relatively straightforward method of incentivizing more prudent generation asset management.

As coal plants become less economic compared to other generation resources, more utilities have begun to operate these plants seasonally rather than as base load power sources. State PUCs can continue to encourage this, either through financial incentives or by mandate. Additionally, as both natural gas and renewable generation grows, not all currently operating coal plants may be needed.

Securitization is a financial tool that can be used to more quickly retire uneconomic plants altogether. Several states have already passed legislation enabling utilities to issue "securitized" bonds that would allow them to close these plants early, recover the invested capital, and invest in renewable generation. Because securitization interest rates are much lower than the allowed rates of return on these assets, ratepayers' bills do not need to increase; in fact, the financial savings can lower rates and/or be invested in easing transitions from coal to renewables. Experts representing ratepayers and communities affected by coal plant closures should be included in the policymaking process.

Table 16. Outcomes of Operations Scenario 1: Reduced Inefficient Generation

Operations Scenario 1 Outcomes					
Factor Sequence	**1.**	**2.**	**3. ***	**4.**	**5.***
Factor Outcome	**Restrict self-commitment**	**Market data sharing**	**Seasonal operation of coal plants**	**Hybrid generation market participation model**	**Increase securitization offers**
Stakeholders	State Regulators, IOUs	MISO, IOUs, PUCs, Arbitrageurs, Ratepayers	IOUs, PUCs	IOUs, MISO, Arbitrageurs	IOUs, Ratepayers, State Legislators
Circumstance Changed	Only allow self-commitment under strict conditions e.g., mandatory output testing	Policy to implement private data sharing behind/in front of meter	State PUCs incentivizing or mandating seasonal operation	Institute a hybrid generation participation model, giving equal access for hybrid generators to participate in day-ahead and ancillary markets	Securitized bonds issued to recover stranded assets and invest in renewable generation
How Circumstance Changed	State regulation on self-commitment	Increased access and investment in self-supplier meter reading, protected dissemination of real-time market data among stakeholders	Ability to reject IRP, and disallow IOU costs	MISO creating new tariff to set rules for hybrid generation, similar to Order 841	Legislation to permit IOU use of securitization

Why Circumstance Changed	Prevent unnecessary inefficiencies of coal plants	Limit information asymmetries between IPPs, MISO, and IOUs	Coal plants are more efficient and profitable in certain months	MISO will be prepared for influx of hybrid generation, as well as giving RE greater market power against fossil fuels	Economically efficient and rapid method of taking coal-fired power plants off the grid
Catalyst	Multiple reports of uneconomic power generation, policy change (i.e. on self-commitment)	Uneconomic generation, self-supplied energy reaches critical threshold, shift toward DER energy portfolios by legislators (restricting self-commitment)	Increased data sharing: growing number of IOUs deciding to seasonally operate plants	High integration rate of storage in California, decreasing battery prices (occurs after seasonal operation is implemented)	IOUs pushing for support with this method (occurs after hybrid generation participation)
* Indicates that factor can occur independently (i.e. factor is not dependent on previous factors).					

ii. Scenario 2 Outcomes

The outcomes of implementing this scenario would result in the following benefits to multiple stakeholder groups:

1. Enhanced cooperation and trust between federal and state regulators
2. Increased efficiency of wholesale electricity markets
3. Improved legislative experience and knowledge of energy issues
4. Updated goals for stakeholders.

The benefit from Operations Scenario 2 will be expressed in qualitative terms, as consumers/taxpayers will enjoy greater transparency with IOUs and representatives in the state governments. For legislators and state agency administrators, communication, education, and transparency will support efficient lawmaking, policy development, and support the coordination of interests across sectors and organizations. The costs incurred for many of these solutions to be implemented would weigh on either MISO or the state governments, since the time and technology deployment required to exchange information could be significant. For instance, increased communication or price signals would add tasks for MISO and the PUCs to complete, thus imposing an additional cost on these two entities.

Much of Operations Scenario 1 was influenced by the spoken and unspoken views learned from various stakeholders. Specifically, the views many stakeholders expressed on the relationships between organizations within the MISO jurisdiction were utilized. Analysis suggests that minimal communication exists between stakeholders, particularly between legislators and regulating bodies (i.e., MISO and PUCs). The lack of communication exacerbates jurisdictional and informational barriers that prevent higher degrees of coordination and efficiency.

The outcomes of this scenario include:

1. Increased technical data sharing between MISO and the PUCs
2. Integrated price signals into market designs
3. Enhanced coordination and policy strategizing between legislators and MISO
4. An established information portal available to state political leaders
5. An obligation for MISO to respond, adopt, or reject suggestions from the Organization of MISO States
6. An obligation for MISO to redefine 'reliability' to incorporate the limitations and advantages of renewable energy

The results of this scenario echo the findings prevalent throughout the scenarios explored in other modules: increasing communication is a foundational policy on which all other outcomes rest. Expanding communication will allow states to better implement transmission projects, weatherize the grid, hold generators accountable, and support a regional manager for DER participation in markets.

Table 17. Outcomes of Operations Scenario 2: Increased Communication

Operations Scenario 2 Outcomes				
Factor Sequence	**1.**	**2.**	**3.**	**4.**
Factor Outcome	**MISO shares technical data with PUCs**	**Market design incorporates price signals**	**Coordinate /schedule with legislators and MISO**	**Create specific info portal for state MOCs**
Stakeholders	MISO, IOUs, PUCs	MISO, IOUs	State Legislators, MISO, PUCs	State Legislators, Consumers, IOUs
Circumstance Changed	Technical data gathered from MISO and its independent observer on IOU fuel purchasing and dispatch	MISO shares price signal information from generators to ratepayers /regulators	Technical information from MISO synthesized for less technical audiences	Synthesized communications from MISO

How Circumstance Changed	Create a specific database which updates monthly on IOU operations; section dedicated to fuel contract renewal timing	MISO creates market design where price signals are shared to ratepayers and regulators	Regular meetings to convey information and answer clarifying questions by legislators	Range of information delivery, from simply making information available to consistent messaging
Why Circumstance Changed	Giving PUCs independent but controlled access to data will ease tensions and allow MISO to relinquish responsibility for what they do with the information	Setting price signals will allow ratepayers and regulators to make more informed decisions of how and from whom they consume energy, pressuring generators to improve performance and reliability	Legislators are important conduits to delivering information to the public; they must understand info being delivered	Behaviors ultimately change via the public, and they can only do so if information is provided to them
Catalyst	Multiple reports on uneconomic coal power generation	Increased data sharing	Frustrations derived from lack of communication between legislators and PUC/MISO	Repeated confusion of new members of state congresses

3.3. Distributed Energy Resources

As Indiana advances its energy portfolio with additional decarbonization targets, Distributed Energy Resources (DERs) will continue to become an increasingly important factor in reaching these decarbonization goals. DERs play various roles for customers to be able to store, shift, and produce energy on a grid that in the future can be further transformed to benefit the whole region. The following DER scenarios allow for transparent and beneficial increased information exchange between DERAs and MISO/RERRAs and advocate for an efficient manager creation for DERs at the local distribution level with a role in the aggregated wholesale market. Proposed scenarios outline possible positive and negative implications and current challenges in place for the scenarios while discussing proposed policy complexities and their degrees of certainty for regulators and regulated parties.

These scenario factors are:

1. Deliberately increased communication and engagement between these two parties facilitated through planning meetings
2. An extended compliance timeline for FERC Order 2222 ("the Order")
3. A reduction in energy costs and enhanced grid resiliency

Achieving the scenarios' expected outcomes relies on:

1. Simplifying regional and local DER operations
2. Preventing double-counting of DER benefits
3. Creating a regional-level communication network
4. Promulgating additional grid efficient ownership structures.
5. States expanding control over DER aggregation and system operation
6. Increased transparency between all stakeholders, particularly from ISOs and ratepayers
7. Expenditures in time and money from IOUs for metering upgrades

i. Scenario 1 Outcomes

The benefits of the scenario for facilitating increased information exchange between DER aggregators and ISOs include:

1. More efficient aggregation and community-owned DERs
2. A comprehensive and effective regulatory structure for aggregation and payment for DERs
3. Less inequality in energy and electricity access, for both DERs and conventional generation

In order to properly understand and manage energy generation, storage, and transmission resources within a footprint, ISOs require metering data from DERs and DER aggregators. Presently, this information is sparse, such that ISOs lack comprehensive information regarding the number and size of DERs and DER aggregators within their footprint, making it difficult to assess the energy that these resources can contribute to the grid. The Order permits ISOs to impose metering and telemetry requirements for DERs, but only so long as they do not create undue financial burdens on individual DERs. Due to a deficit in communication between ISOs and DER aggregators, ISOs lack information about the financial and technological resources that DERs have at their disposal, and it is currently unclear what level of metering requirements would constitute an undue financial burden. This lack of information creates a self-perpetuating problem: without clearer information about DERs, ISOs will not be able to determine an appropriate level of stringency for metering requirements. Without more stringent metering requirements, ISOs will not be able to gather substantial information about the DERs on their footprint. Therefore, direct communication and engagement between DER aggregators and ISO is critical, both to clarify the breadth of information necessary to better manage DERs alongside other energy generation and storage assets, and for DERs to describe their own metering capabilities and financial limitations.

Recurring communication between MISO and DERs will establish better mutual understanding between regulators and regulated parties. The deliberate increased communication and engagement between these two parties will be created through institutional relationship building. Relationship building between these institutions can begin to take shape through planning meetings. This can set the foundations for a strong and trusting working relationship between the two entities. The process of establishing trust and lines of communication between these two, not to mention conducting sustained stakeholder engagement, will be time-consuming. This has been demonstrated through the recent approval by FERC of a motion to extend MISO and other ISOs' deadline to comply with Order 2222 from July 19th, 2021 to April 18th, 2022. During this period of increased delay, effective implementation of the Order will not occur, potentially exacerbating the obstacles preventing DERs from participating in energy markets. Although this will result in increased short-term barriers to DER implementation, it will ultimately lead to a more robust and mutually beneficial compliance regime with the Order in the long term.

DER Scenario 1 has financial implications for numerous stakeholders, although its ultimate economic impact remains somewhat unclear. Provision of data to MISO and other ISOs will require DERs to enhance their metering functions and capabilities, the necessary technology and equipment for which may prove costly. Although increased communication will ensure that agreed-upon levels of metering are not prohibitively expensive to individual DERs, they may still create a financial disincentive for DER owners, which are often individual private citizens with significantly fewer financial resources than aggregators, IPPs, and IOUs. Ideally, a solution could be reached wherein the financial burden of metering is shifted or redistributed, either through subsidies, tax incentives, or investment by solar collectives. Achievement of these policy mechanisms is highly uncertain and would require the involvement of other stakeholders such as state legislators or private investors into residential solar markets. However, across the board, ratepayers will see economic marginal benefits: as communication between ISOs and DER aggregators eventually results in mutually-agreed-upon metering and telemetry requirements, it will be easier to incorporate DERs into the energy grid, improving grid resiliency and decreasing energy costs.

Table 18. Outcomes of DER Scenario 1: Increased Information Exchange Between DERAs and MISO/RERRAs

DER Scenario 1 Outcomes			
Factor Sequence	**1.**	**2.**	**3.**
Factor Outcome	**Increased communication between MISO and DER aggregators**	**Extended compliance timeline for Order 2222**	**Reduced energy costs & improved grid resiliency**
Stakeholders	MISO, DERAs	FERC, MISO, DER Owners and Aggregators	MISO, DERAs, Energy Consumers, Current Energy Generators
Circumstance Changed	Few to no channels of communication between ISOs and DER aggregators	No current metering or telemetry requirements for DERs for wholesale market	DERs can now access wholesale and capacity markets
How Circumstance Changed	Increased collaboration between MISO, DERAs and ISOs	Minimal increase in requirements for telemetry and metering	Integration of DERs in wholesale market should marginally decrease energy costs and improve grid resiliency
Why Circumstance Changed	Necessity of better understanding of ISOs' information needs and DERs' technical limitations	Giving stakeholders adequate time to determine mutually beneficial regulatory regime	Lower telemetry and metering costs would reduce capital and operation costs for DER aggregators
Catalyst	Need for better information exchange between regulators and regulated bodies	Need to reduce barriers to compliance with Order 2222 and barriers to DER aggregation	High current electricity prices

ii. Scenario 2 Outcomes

This scenario's benefits include:

1. Simplifying regional and local DER operations
2. Preventing double-counting of DER benefits
3. Creating a regional-level communication network
4. Promulgating additional grid efficient ownership structures

Understanding these factors' interactions and influence is critical for increased deployment of DERs and the sustained efficient and effective management of aggregated DERs. Key stakeholders benefiting from the implementation of the factors would include the PUCs, ISOs, and utilities involved in managing the transmission system. Additionally, the lack of an efficient management institution has impeded DER aggregation in the wholesale market. A DSO would act as an efficient manager of DERs at the distribution level and facilitate participation of aggregated DERs in the wholesale market.

There is no current channel for peer-to-peer communication in the distribution and transmission of electricity, highlighting the absence of an important conduit for regional and sub-regional data sharing. DERs represent a new challenge for both local distribution operators and regional transmission operators since the systems in which they operate were designed for traditional power plants. DERs cannot use this centralized model of operation due to the distributed nature of the technology. The very nature of the technology requires the resource to be capable of transmitting information from various locations, therefore a decentralized system for DER data interconnections and communication will better serve the efficient integration of this emerging resource. ISOs and local IOU distribution operators will benefit from increased communication.

Regulatory ambiguity currently hampers the regional and local operations of DERs. This lack of clarity (1) creates difficulties for smaller energy producers and DERs to participate in either the wholesale or retail markets and (2) stems from ambiguity in the jurisdictional boundaries between ISOs and PUCs. DER owners would benefit from being able to sell their power in either market and from having clearer rules and opportunities for DER aggregation.

Allowing DERs to operate in both the wholesale and retail markets presents concerns of double-counting the resource. This concern has resulted in a limited participation of DERs in both markets. The projected cost-effectiveness of DERs increases by reducing the possibility of double counting, thus strengthening the case for increasing DER integration. The DSO, or similar entities, would ensure that all retail transactions with DERs are properly documented and compared with DER transactions -- in wholesale markets across the same region -- to monitor double-counting instances.

Currently, limited DER ownership structures are available in Indiana and other midwestern states. This lack of DER ownership structures limits the number and type of DER owners on the market. The current DER ownership landscape in the Midwest is dominated by individual ownership and siting of these resources often requires home ownership. Other ownership structures such as utility-owned, community-owned, or a combination of these two ownership types can result in higher-capacity DER projects than those owned by a single homeowner. Expanding ownership structures to include utility- and community-owned DERs could also result in better coordinated DER projects with benefits extending to more members of the communities in which they are located. The DSO could prioritize DER installation by size and ownership so that the benefits of DER ownership could be available to a wider range of consumers. This scenario will lead to greater deployment of DERs.

Table 19. Outcomes of DER Scenario 2: Creation of an efficient manager of DERs at the local distribution level (retail market) with a role in the aggregated wholesale market

DER Scenario 2 Outcomes				
Factor Sequence	**1.**	**2.**	**3.**	**4.**
Factor Outcome	**Creating communication networks at the regional level**	**Simplifying regional/local DER operations**	**Preventing double-counting that would reduce cost-effectiveness of DERs**	**Increased promulgation of grid efficient ownership type**
Stakeholders	IOU Distribution Departments, DER Owners, PUCs	MISO, PUCs, Legislators, DER Owners	MISO, Energy Consumers, Current Energy Producers	DER Owners, IOUs, PUCs
Circumstance Changed	Lack of a conduit for regional DER data sharing	Ambiguity in jurisdictional boundaries between MISO and PUCs	Limited participation in wholesale or retail market	Lack of alternate DER ownership structures
How Circumstance Changed	Higher degree of DER data inter-connections	Increased local regulator involvement	Increased percentage of renewable DERs in the energy mix	Prioritize DER installations by size and ownership
Why Circumstance Changed	Centralized module for DER integration is currently inefficient, hence moving to a decentralized system for better communication management	Regulatory ambiguity hinders smaller entities and DERs participating in either wholesale or retail markets from participating in both	Projected cost-effectiveness could be higher, as current DERs are not being used optimally	Current ownership structure equates individual ownership with larger DER projects
Catalyst	Lack of peer-to-peer communication channels	Lack of regulatory clarity	Concerns of double-counting	Limited ownership structures available

4. Discussion

This section discusses the expected outcomes of these scenarios, interactions between scenarios and their related factors, and the influence that these interactions will have on stakeholders. The discussion follows an evaluation of requisite actions from regulators regarding the planning processes and operations for grid reliability and the grid integration of DERs. This section also addresses the implementation and interactions of factors that would lead to desirable outcomes. Finally, the section examines the implications of scenario outcomes for stakeholders. To this end, several key synergies, both existing and proposed, are highlighted: (1) increased data sharing for stakeholders and improvements in transmission demand forecasting, (2) weather preparedness of the power grid and long-term energy reliability, (3) market rule and regulation reformation to facilitate hybrid renewable and DER market participation, and (4) increased cooperation between DERs and RTOs in providing metering data. The objective of the section is to explore the implications to policymakers and other stakeholders via interpretations of scenario outcomes that will enable these stakeholders to make informed decisions to reform and improve the efficiency and reliability of the energy market served by MISO.

As noted in Figures 7, 8 and 9, the burdens and benefits to each stakeholder group vary considerably as different factors were implemented in the scenario analyses. While these impacts resulting from policy dynamics are centered on the principal actors, two other stakeholder groups--retail ratepayers and large industrial and commercial consumers--will also bear costs and enjoy benefits corresponding to each scenario. While the consequences of the various policy decisions to these stakeholder groups will be important, their influence in the policy-making realm is more indirect than those of the primary stakeholders evaluated in this research. Therefore, their roles in this policy assessment were not directly evaluated.

4.1. Planning

i. Scenario 1 Implications

One of the most important and overarching implications of the study's results is the need for increased data sharing and more effective communication. An increase in data sharing across all stakeholders would facilitate the integration of renewables onto the grid. The need for greater transparency between MISO, utilities, and PUCs requires developing effective data collection techniques and fostering consistent communication. This free flow of information across boundaries and stakeholders will improve efficiency and collaboration to improve regulatory efficiency. It will also help stakeholders increase the accuracy and precision of forecasting models to meet renewable energy goals. Creating a revolutionary change in stakeholder engagement and information transparency will greatly improve long-term planning.

A state-level policy change - enacted by state legislatures - catalyzes this scenario, which would require increased data sharing from utilities concerning their facilities and LRTP. The preferred order of implementation of this scenario is presented in Figure 6. Once more significant generation and distribution data become available to PUCs and utilities, they will have the capability to improve forecasting models and generation planning models. Then, with those improvements, MISO can regionally improve transmission planning and LRTP processes. Collectively, this linear sequence of events can enhance renewable energy penetration. Consequently, if the implementation of one factor is suboptimal, enhanced renewable penetration may become compromised because the latter relies on the former. However, the benefit of this scenario is that a single catalyst – the policy change – creates a domino effect of beneficial change, spanning several planning issues.

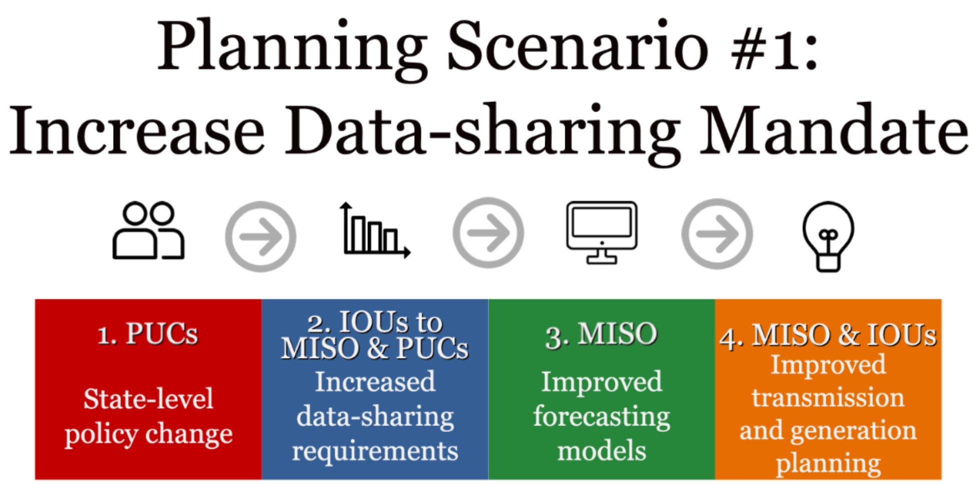

Fig. 6 *Flowchart depicting the ideal linear pathway to implementation of Planning Scenario 1.*

Under optimal circumstances, each factor that influences this scenario facilitates the implementation of other factors. The supposed effects on each stakeholder due to this scenario is illustrated in Figure 7. Ideally, efficient data sharing processes improve load forecasting and generation planning models. From here, MISO can improve transmission planning and LRTP processes, enabling greater integration of renewables into the grid. Establishing efficient data sharing processes is key to unlocking optimal outcomes in this scenario. Optimal outcomes are the availability of generation and distribution data to be used to strengthen MISO's transmission planning and a willingness to cooperate from utilities and MISO. Data sharing could benefit regulators, who would gain access to better data for more informed decision-making. For instance, state regulators would be able to monitor integrated utilities' asset management more effectively and make more informed decisions in prudency reviews such as fuel adjustment clauses ("trackers") and rate cases. Utilities, MISO, and ratepayers could also benefit if data sharing promotes efficient regulation and increases the efficiency or reliability of energy systems.

Optimal scenario outcomes also face several barriers. As utilities would be subject to additional reporting requirements after the policy change, these parties would likely bear some costs, both financially and in terms of human resources, and may be hesitant to share data with regulators. Utilities may resist increased data sharing if they suspect their data may be inadequately protected and thus subject to misuse. They may also be hesitant to share more data if there is a concern about incurring regulatory penalties. Further, ratepayers will be harmed if sensitive information (e.g., credit cards, bank account numbers, addresses) shared with regulators is compromised by a cyberattack. Regulators should ensure that information sharing policies are not arbitrarily burdensome, that policies facilitate improvements to the energy system, and that sensitive information is stored and shared securely.

While data sharing would create optimal outcomes, even without this policy change, the development of software and artificial intelligence technologies will lead to the natural advancement of forecasting, modeling, and planning processes. However, if state regulators lack sufficient information about how the market is operating (due to inadequate forecasting and modeling capacity), regulation will be inefficient. In that case, utilities or MISO may facilitate more efficient regulation by sharing information with regulators.

ii. Scenario 2 Implications

Increasing preparedness for extreme weather events and ensuring the power grid's reliability will incur short-term costs and result in long-term benefits. The anticipated stakeholder benefits of this scenario are presented in Figure 7. In Scenario 1: "Changes in state policy mandate increased data sharing between IOUs and PUCs, MISO and PUCs, or both," the scenario calls for improved data sharing and increased communication, the stakeholders—primarily IOUs, MISO, and PUCs—will prioritize data collection efforts to have adequate information to share. With a catalyst such as extreme weather, it may replace the need for a policy change taking place voluntarily and instead instigated by a breaking point for both consumers and administrators.

In addition to data collection and communication efforts, another cost to stakeholders is the coordination and alignment of processes and information flows. Following policy alignment efforts, MISO and IOUs will change their cost-benefit analysis (CBA) practices by incorporating redundancies of bulk power systems into their CBAs. While this scenario requires a drastic change in the stakeholders' approaches to communication and coordination, this scenario's implementation may yield long-term benefits that exceed costs. Aligning and coordinating policy efforts, increasing data sharing and communication, and incorporating resiliency into CBA practices would improve the system's reliability and preparedness against extreme weather events.

Following the extreme weather events of 2011 in Texas, NERC and FERC developed reliability guidelines and industry best practices but did not institute a reliability standard. This failure contributed to inaction and reliability issues in Texas a decade later, in a 2021 winter storm. A federal policy mandate by FERC would require more data sharing of MISO and consequently IOUs. Without guidelines or a policy change on either the state or federal level, there are currently ineffective incentives to encourage information sharing. Weather preparedness and weatherization increase grid reliability in general and reassure stakeholders and ratepayers of the feasibility of transitioning to majority renewable generation, as is the stated goal of many states and the present administration.

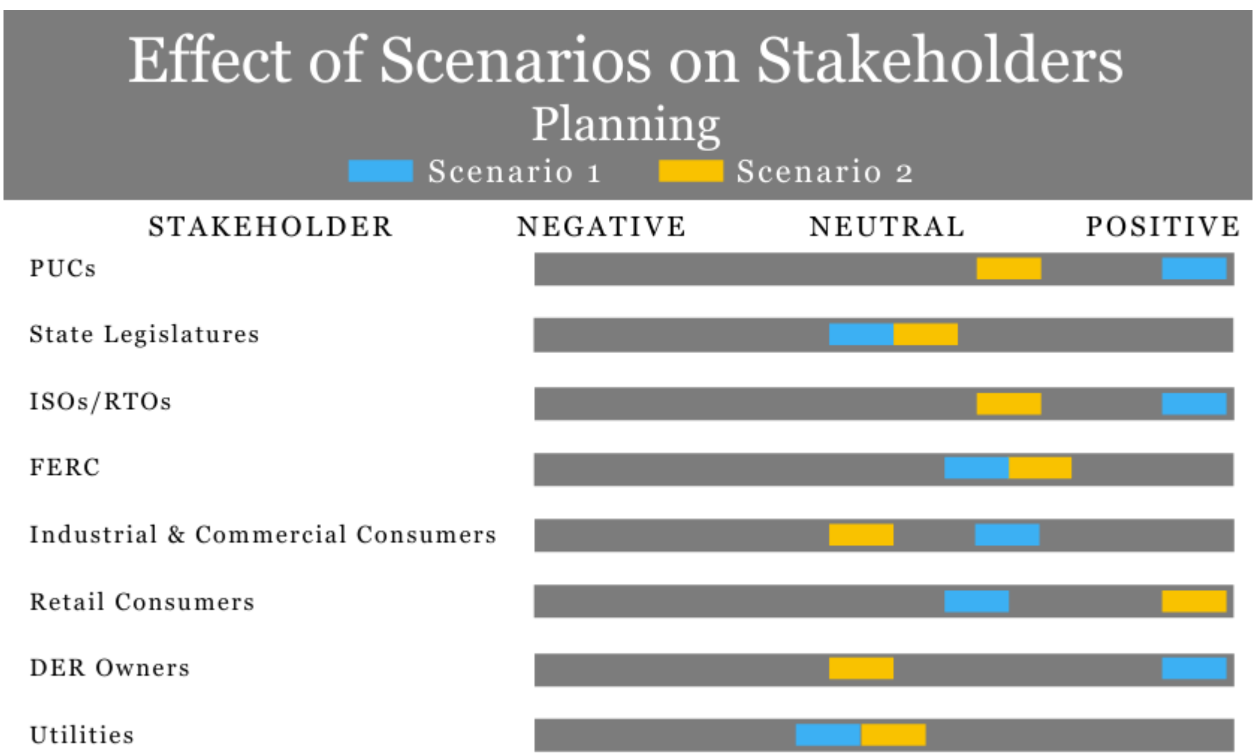

Fig. 7 *The anticipated benefits and detriments of the Planning module's scenario outcomes.*

4.2. Operations

i. Scenario 1 Implications

Policies addressing inefficient asset management and hybrid generation will be more effective when supported by mutual agreements among stakeholders while providing a path toward increased investment in renewable energy. This scenario represents a sequence of events intended to bring policies and stakeholders into closer alignment. The optimal outcomes of this scenario are (1) restricting the conditions under which coal plants can self-commit, (2) incentivizing the early retirement of uneconomic plants, (3) seasonally operating more coal plants, and (4) facilitating hybrid market models that include storage. These outcomes will create synergistic benefits for both market participants and ratepayers. The effects of this scenario on each stakeholder are shown in Figure 8.

With buy-in from states, IOUs, and community advocates, these outcomes will make the grid more efficient, help reduce electricity rates, and create a path for integrated utilities to recover stranded asset costs and invest in more renewable sources. However, optimal outcomes will require substantive coordination and negotiations that include representatives from each stakeholder group to ensure that reformed market rules, securitization terms, and competing priorities among MISO customers are addressed in a mutually beneficial manner. Otherwise, such changes may face significant pushback. For instance, IOUs will likely only favor securitization if they can at least recover the capital invested in coal plants and envision a feasible path forward for investment in renewable generation. State legislatures and consumer advocates are more likely to favor securitization if they are assured that rates will not increase and that portions of the proceeds will be invested in affected communities and achieving renewable energy goals.

MISO modifying the existing framework of the wholesale market to better support hybrid market participation would ease the integration of hybrid generation throughout the MISO footprint. This modification will help MISO prepare for the influx of renewables and give renewable energy greater market power against fossil fuel generators. This result, in turn, will make hybrid generation more attractive to investment and development. Ancillary markets will also function more smoothly and in concert with the rest of the grid. Creating a strengthened wholesale market will ultimately benefit many stakeholders; however, there will be considerable volatility and instability if the transition is mismanaged. Even if the transition goes as smoothly as possible, markets will still experience upheaval over some time until storage and generation have found an equilibrium point. These risks also carry over into the Planning Scenarios, as transmission planning and operation rely heavily on established generation incorporation procedures and types of generation.

ii. Scenario 2 Implications

Better communication between all actors in the energy grid system would (1) improve system efficiency, (2) ensure generators are held accountable for imprudent asset management, and (3) increase integration of hybrid generation systems. The effects of this scenario on stakeholders are presented in Figure 8. Better and more efficient communication in the legislative system will have the long-term effect of improving policy that incorporates the technical aspects of the energy system. Also, legislators can make more informed decisions with all stakeholders in mind. Increasing the communication between legislators and ISO/PUCs will align policy windows and present more opportunities to bring the total weight of federal or state endorsement behind legislation and policies which will promote renewable generation integration. This communication improvement also builds trust and cooperation between state and federal jurisdictions for further collaboration for transmission and generation planning. A long-term effect for data sharing between agencies, including OMS, will facilitate informed decision-making and alignment of stakeholder incentives that promote efficient policy. However, one concern of IOUs is that if MISO chooses to create an information-sharing portal, having a secure network and portal will be essential for protecting information. Additionally, a short-term consequence would be that employees would need training to utilize the portal to avoid data protection issues adequately.

The integration of price signaling and subsequent switch to a wholly competitive market structure has the long-term ability to lower consumer prices and improve communication and transparency among PUCs. In addition, it can align incentives between generators and PUCs where all actors look at prices for efficiency. Aligning IOUs with the PUC goal of price efficiency by introducing a price mechanism will prioritize economic efficiency. This result can incentivize efficiency, renewable power generation, and technology innovation in the system by allowing ratepayers to send signals to IOUs regarding their level of interest or willingness to pay for renewable generation. IOUs will likely resist these measures, as they have a vested interest in upholding the status quo. Once (1) IOUs are forced to compete more fully with renewable energy and (2) prudency reviews reject inefficient operations, then coal and natural gas plants will retire rapidly. The promise of renewable generation for customers will incentivize them to build renewable generation and create profits. However, doing so can also reduce the net income of the IOUs who have a vested interest in increasing profits by using prudency reviews and building more generation. Improving legislative efficiency for communicating with stakeholders and timeliness of policy implementation before other factors may ease policy changes regarding data sharing. Well-coordinated policy from increased communication can create a chain of events that holds generators accountable and enables MISO to incorporate price signals more fully into the wholesale market. As renewable generation becomes a more significant part of the wholesale market and generation mix, what is deemed reliable and unreliable will change to match the generation, just as hybrid generation changes renewables into more reliable sources. Having a more competitive market will help transition to renewable generation and support novel reliability-conceptualization. This scenario was chosen because increasing communication between all actors and stakeholders in the energy grid system improves long-term system efficiency and eases the integration of renewable energy projects.

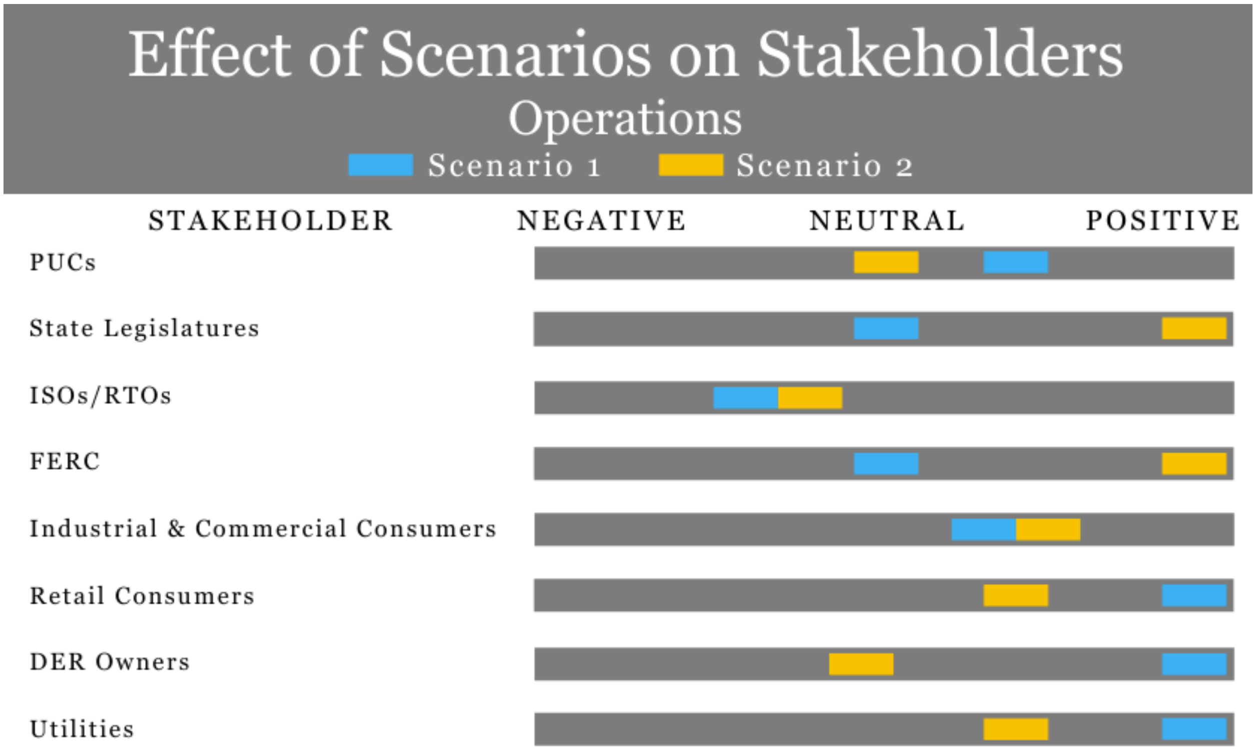

Fig. 8 *The anticipated benefits and detriments of Operation scenario outcomes.*

4.3. Distributed Energy Resources

i. Scenario 1 Implications

In much the same way as increased data sharing between MISO/IOUs and PUCs will enhance the transmission planning process and allow for greater penetration of renewables on the grid, increased information exchange between DER aggregators (DERAs) and MISO/electric retail regulatory authorities will allow for smoother implementation of DERs and would be beneficial on the whole. Although increased communication will prolong the decision-making process for Order 2222 compliance and potentially delay DER integration in the short term, it will allow ISOs and DERs to reach a resolution amongst themselves regarding metering requirements, helping ISOs to get the data they need without the necessity of regulation by PUCs. The stakeholder effects from this scenario are presented in Figure 9.

While MISO and other ISOs benefit from this scenario, the benefits are much more ambiguous for DERs and depend on the metering requirements agreed upon through increased communication. Even if metering requirements do not create an undue or prohibitive burden, they will likely still create additional costs for DER owners. Although these costs may be offset through several means, including subsidies, tax incentives, and partnerships with investors such as solar collectives, these offsets are much less certain and require additional stakeholders. Although, without offsets, the higher cost of metering may create an additional barrier to entry for new DERs. Furthermore, the longer compliance with Order 2222 is delayed, the longer current barriers to DER integration into the grid will remain. In summary, although long-term benefits are positive, short-term benefits may not be.

Once DERs are more fully integrated into the grid, industrial, commercial, and residential ratepayers will benefit from a more diverse and resilient energy grid and potentially reduced electricity costs. As DERs integrate, though, utilities may see some loss in revenue, in that their customers will get more of their electricity from outside sources. As such, an Order 2222 compliance regime may experience opposition from utilities if it (1) involves lower metering requirements and (2) eases the financial burden on DERs.

An increase in information sharing between DERs and ISOs gives rise to the potential for numerous synergies between factors. Increased cross-institutional information exchange, especially between these two parties, will allow for a better mutual understanding of the financial considerations about DERs, especially from the perspective of DERs themselves, though not as much from the perspective of utilities, for example. Additionally, the exchange of information between parties may simplify the regulatory framework surrounding DERs. MISO and other ISOs are empowered by Order 2222 to create metering standards for DERs; increasing the voluntary provision of information by DERs to ISOs will negate the need for such policy, expediting the decision-making process. Preemptively determining appropriate levels of data provision by DERs and developing universally-recognized standards will ultimately reduce the bureaucratic "red tape" around DER integration.

ii. Scenario 2 Implications

The outcomes presented in this scenario should follow this sequence: (1) create a sub-regional level communication network, (2) simplify regional and local DER operations, (3) prevent double counting of DERs by clearly tracking the services they provide and programs they participate in, and (4) increase the promulgation of grid efficient ownership types. This scenario impacts many all stakeholders and the effects on each are presented in Figure 9. The regional-level communication network would be administered by a Distribution System Operator (DSO). It would create communication channels between the actors involved in DER energy generation -- precisely DER owners, ISO transmission operators, Municipal agencies, regulated utilities, and local distribution operators. These communication channels are virtually nonexistent; once created, they will create information-sharing pathways that will allow for more efficient operation of DERs. The establishment of a DSO will result in clear jurisdictional boundaries between ISO operators and distributional operators. This data sharing pathway and jurisdictional clarification lay the foundation for the entity to track both wholesale and retail transactions of specified DERs. This tracking will allow the entity to explore the issue, prevalence, and available mitigation strategies for double-counting DER capacities. Finally, by alleviating communication blocks, information asymmetry, and operational ambiguity and by mitigating double-counting, additional ownership structures can be promulgated and prioritized in their construction. Alternative ownership structures, past single-homeowner ownership of DERs, can provide larger project sizes and more opportunities to receive ownership benefits.

The formation of a DSO would greatly benefit end-users with DER installations, as it would provide faster communication and response times. The decentralized structure would allow greater clarity in jurisdictional boundaries between wholesale and retail markets, giving retail distributors greater autonomy and allowing for faster response times in reliability events. This result would lead to greater efficiency for end-users. Due to the development of communication channels between ISOs and DSOs, ISOs would have a clearer picture of resources in the network, contributing to efficient planning and LRTP, forecasting, and better weather preparedness. Each of these aspects positively impacts the consumer by providing a more reliable grid. The consumer additionally benefits from increased opportunities to participate in energy markets through alternatively structured DER ownership models. By expanding ownership models, the pathways toward financial opportunities which can be accessed through the deployment of DERs can be utilized by more consumers and, therefore, increase deployment of the technology.

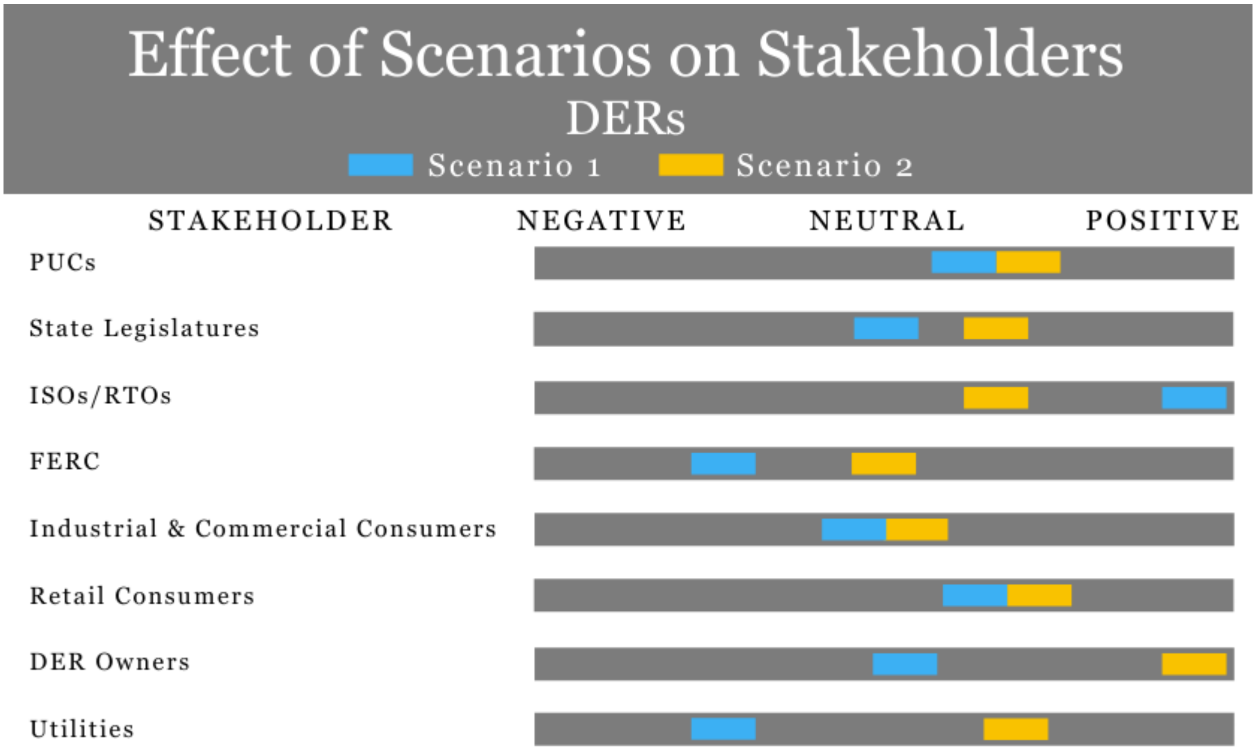

Fig. 9 *The anticipated benefits and detriments of DER scenario outcomes.*

4.4. Common Themes

Certain key themes are present in all three of the research modules and are explored in the scenario analysis; if embraced, these themes could create the conditions for the successful implementation of many of the factors assessed. This section examines these commonalities to determine overarching themes between them and their implications. The critical overarching aspects include (1) communication, (2) access, and (3) prevalence. This section discusses primary drivers of change and explores synergies across these three themes. Additionally, an ideal chronological sequence is proposed for the modification of these three aspects, which would enhance grid integration of utility-scale renewable energy and DERs.

i. Implications for Communication

In all six scenarios, the primary driver of change within the environment involved improved communication between various entities and stakeholders. The analysis suggests the key to change and improving MISO footprint practices is establishing enhanced communication networks and information protections to encourage desired behaviors among all market participants. Enhancement to communication is pursuable in three domains: organizational, technical, and market.

Since enhancing communication is a generic goal, various types of information exchange occur between different stakeholders in unique arenas and details regarding improvements to communication vary by domain based on the nature of relevant information exchange. Within each of the three research domains, unique yet specific and appropriate improvements in the content and manner in which information exchange occurs may add value to many aspects of the overall system.

The organizational domain encompasses aspects of the environment, such as the statutory relationships between regulators and stakeholders. Technical communication includes the material and physical capacity to measure generation outputs by aggregators, individual producers, and mainstream generators. The market domain reflects the type of communication relating to market signals and cost/benefit among stakeholders. The proposed lines of communication are conceptualized in Figure 10.

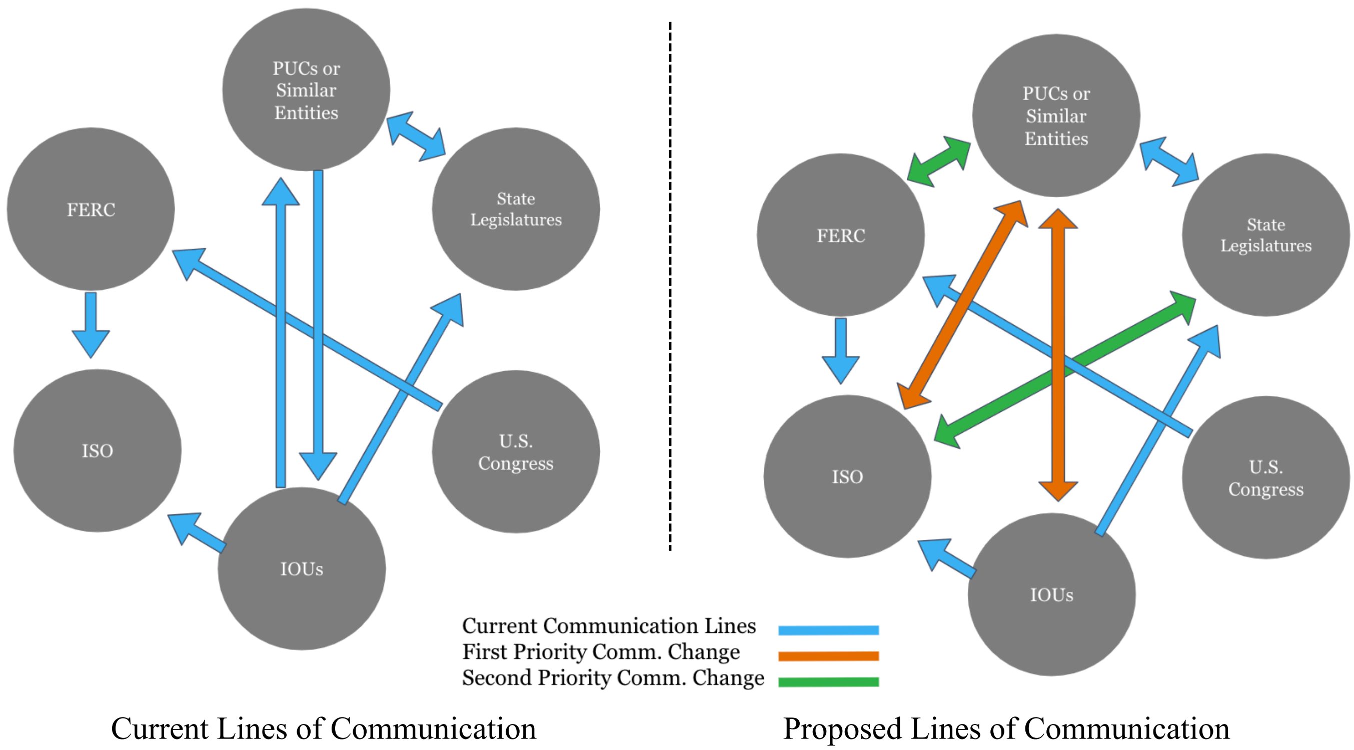

Fig. 10 *A visual comparison of current and idealized communication regimes. The left figure represents current perceived methods of communication. The right figure represents communication methods proposed by the implementation of enhanced communication mechanisms. Double-head arrows represent the same method of communication or same content of information being exchanged.*

While communication is a significant aspect of the overall integration challenge, additional challenges relating to technology, barriers to entry in the marketplace, and outdated regulatory frameworks prevent efficient market behavior from occurring and, in some cases, encourage poor business practices for lack of a better alternative.

Finally, longstanding and established relationships and methods of communication have increasingly constrained the energy industry from actualizing the potential of the regulated competitive market from integrating renewable energy faster. Particularly in the current political climate and change in administration, federal action to correct the issues discussed in this paper will supersede any chances that states, ISOs, and IOUs must work on their terms to resolve communication asymmetries and deficits. However, not all issues can be solved with communication enhancement due to various limitations (e.g., proprietary information exchange barriers). Thus, additional methods to address the issues identified in this report follow below.

ii. Implications for Access

A secondary driver of change in the marketplace is access. Here, access to technology and information emerge as notable themes. If communication does not exist to create an effective market that supports innovation and choice, a possible motivator will be individual access to DER power generation. As individual access and implementation of DERs grows, (1) IOUs will be motivated to engage in better communication to retain power in the marketplace, and (2) MISO will be motivated to support access through improved long-range transmission planning. Consequently, it is imperative to protect the accessibility and collectivist options for consumers and DERs, not only in creating equity and a just transition for the coming decades but as a powerful tool to recreate a market that functions efficiently and promotes MISO's reliability imperative.

One theoretical example of how future technology can incentivize access is by providing modular aggregation options, allowing the eventual employment of communal power sharing methods. This plausible example of access does not alter the marketplace using a new company entering the space, but rather by reducing the required loads from generators and providing property upgrades and physical retrofits. If DER technology becomes more widely available and affordable at the property owner and real estate manager level, then it is plausible that "behind the meter" data spurs power generators into a more favorable position toward communication.

In terms of operations, access to tools, such as securitization, exposes ratepayers and others to industry decisions in novel ways and creates implications for reducing information asymmetry. As society becomes increasingly technology-centric, the responsibility of those in power to provide access to information and education for the public is essential. Access to information, including planning practices and decisions, and the agencies/committees which make choices that affect ratepayers, must be made more accessible.

iii. Implications for Prevalence

A third driver of change is the pervasiveness or prevalence of renewable energy integration. As renewables become more pervasive in the generation field, embracing their presence will motivate centralized entities to reduce investment in inefficient generation facilities to avoid losses. While this interaction between integration and investment is somewhat cyclical, the government's investment of time and policymaking can both interrupt integration with regulatory burdens or enhance integration with necessary incentives and accommodative policy.

A similar circuitous issue is evolving for renewables, and hybrid renewable generation, as the growing popularity of storage will increase the pressure to allow for broader participation in the wholesale market. However, for storage to become even more widespread and used, market rules must be made official to invest in storage worthwhile to IOUs and IPPs. Again, policy implementation along the lines of FERC Orders 2222 and 841 are already working to establish wholesale market rules for hybrid generation, making storage a better investment. Legislatures within ISOs should pass complementary legislation providing storage subsidies for renewable generation only.

iv. Characteristics and Significance of Sequencing Cross-Module Themes

Based on these common aspects, the chronological order of a desirable factor implementation from the scenario analyses is as such:

A Unified, Proactive Scenario:

1. Enhancing communications framework on organizational, technical, and market levels to reduce information asymmetry.
2. Increasing individual access to alter market factors that subsequently motivate stakeholders to adopt/update improved planning and operational frameworks for renewables and DERs.
3. Embracing pervasive deployment to facilitate naturally adjusting policies can enhance free market behaviors so that generators will assume rational costs based on reliable signals in the market.

Failing to establish better market practices will increase social welfare costs to consumers, governments, and utilities. The benefits of divesting from non-renewables will manifest with a suitable transition. However, making the transition sooner will reap more social welfare benefits, whereas delays may be irreversible. Therefore, the transition must generally improve upon communication, access, and regularity.

5. Conclusions

This section synthesizes the key themes and interactions that became apparent during the investigation of ways to increase renewable energy integration and facilitate DER deployment. As discussed in the preceding section, the key themes that arose from this analysis are enhanced communication, market signals, the role of non-renewable resources, and the regulatory framework of energy resources. In this section, these themes are discussed and their implications considered in the context of centers of influence.

In general, when weighing the benefits of implementation of the individual factors and their overarching themes, it is apparent that some actions, when considered collectively, may promote favorable conditions for numerous factors to be implemented. While it is overly optimistic to envision that a specific threshold exists beyond which implementation of many of the recommended actions will be much easier, there may be several factors that, if implemented, will create overall conditions that strongly favor and facilitate the implementation of many more of the needed factors.

When key themes shared by policy factors and centers of influence are synthesized to find synergies and areas of overlap within the Midwest energy market and policy environment, identifying policy and goal alignment between centers of influence and policy increases efficiency for policy reform. While factors implemented though various scenarios offer insight regarding the ways and means of change, institutions represent entities capable of shaping the environment and/or responding to change. Some centers of influence may not yet exist; however, those that do not yet exist are worth establishing based on their potential to improve renewable integration. For example, while MISO constitutes a major existing center of influence, one that does not yet exist is a “distribution system operator” (DSO), which could facilitate market signals and manage output among aggregated DERs in the marketplace.

Communication plays a major role across all scenarios, yet manifests differently within each scenario. Data sharing is necessary for various modules and scenarios, but a variety of disincentives currently impede it. These disincentives need to be offset with proportionate and appropriate incentives. However, certain stakeholders, especially IOUs and ISOs, may perceive excess transparency as a vulnerability that may put them at a disadvantage. Therefore, it is critically important to include these stakeholders in the decision-making process and find an ideal balance of transparency and privacy, especially in the case of sensitive data. Addressing this and other various communication challenges requires better “working relationships” between IOUs, MISO, third-party DERs, and PUCs. In the end, increased communication could also enhance LRTP processes. This is important for integrating renewables, since increasing renewable penetration requires increased transmission infrastructure.

Another important theme that is closely related to communication is the importance of wholesale/retail market signaling and functionality. It is clear that regulating stakeholders, namely ISOs and PUCs, need to have more information about the parties they are tasked with regulating. This is especially true when considering DER integration into the grid and into markets, as it has been established that transmission operators have little to no visibility of DERs. It is difficult for ISOs to incorporate DERs into energy markets without reliable information concerning the DERs within their footprint. There is a clear need for better provisioning of metering data from DERs to ISOs. However, the best way to meet this need is not entirely clear, as this type of provisioning could prove to be overly burdensome for individual DERs. An additional aspect hampering market efficiency and renewable integration is the invisibility and lack of power that hybrid renewable generation currently has in the market. Allowing hybrid generation into the wholesale and ancillary markets will give them a larger market share and draw more investment, particularly if ISOs only allow renewable hybrid generation, incentivizing IOUs to broaden their renewables assets in order to capitalize on emerging markets. This is crucial especially as hybrid generation and storage becomes more widespread and affordable: without ISO policies specifically favoring renewables, generators will attempt to pair storage with natural gas, prolonging the lifetime of natural gas-fired units and taking valuable market power away from renewable hybrid generators.

PUCs also require improved monitoring capabilities of generation assets to track economic efficiency and judge the prudency of cost-recovery measures. This is especially important with respect to fossil fuel-powered generators, which often engage in economically inefficient fuel purchasing and operating practices. Unlike PUCs, MISO has access to private/confidential economic and operational data showing the extent of a facility's efficiency and capacity. PUC monitoring of utilities is hampered by their lack of access to this information. Currently, MISO does not share this information due to concerns over security, distribution of costs to create sharing capabilities, and industry resistance to regulation. This last concern is particularly relevant, given the essential nature of the relationship between MISO and IOUs. The creation of an information-sharing portal between ISOs and PUCs has the potential to remediate this information asymmetry.

Until the wholesale market transitions to a fully competitive model, prudency reviews will ensure efficiency from fossil fuel generators. Without information such as fuel trackers, states cannot hold IOUs accountable for the costs passed on to consumers, or if they are truly in need of building more generation units. Incorporating data from ISOs will overall create more economically and technologically efficient generation.

An additional key theme that has been addressed throughout this analysis is the role of fossil fuels. It has already been determined that increased monitoring is necessary to reduce inefficient management of fossil fuel-based generation. Beyond this, moving away from coal will be made easier over time as natural gas becomes cheaper and energy storage costs decrease. In the long run, securing long-term investment from non-renewable stakeholders may require investing in fossil fuels. This type of investment incentivizes utility company investment into renewables by reducing risk. Reduced risk allows utilities to shift their funds away from fossil fuels and focus on renewables. While this has the potential to increase barriers for new generators, the effect of those barriers may be offset by DER localization. Overall, it will be easier to reduce fossil fuel use and facilitate the generation and development of renewable energy through securitization of coal plants. Political and economic barriers to retiring fossil fuel powered plants will also be lowered by using securitization funds to reinvest in communities and provide support for transitioning to renewable energy.

The final key consideration that should be addressed involves changes in the regulatory framework. Policy reform targeting current regulations will be necessary to drive the sharing of data, increase transparency between stakeholders, and facilitate the integration of renewables. This is especially relevant for the regulation of DERs, where current regulatory frameworks do not facilitate wholesale market participation. DERs are a more decentralized form of energy generation than traditional utilities, and so require a new method of management that is not provided by the current regulatory framework. The framework needs to be updated in a way that management and monitoring of DERs can account for their contributions in both wholesale and retail markets to ensure the prevention of double-counting. An "oversight body at the distribution level" would potentially allow for better management of renewable DERs and could remedy some of the current issues in the DER regulatory framework. Community and utility ownership structures lead to higher capacity projects and make DER ownership benefits available to more consumers (i.e., not just upper/middle class homeowners). Regulatory and market structures also need to be made more robust and reliable against system shocks that occur during extreme weather events (like Texas Snowstorm in 2021). In the end, it should be seen that the current regulatory framework has issues that will need to be addressed to better encourage the integration of renewables.

6. Recommendations

Analysis thus far has discussed factors and scenarios in the context of three research modules: planning, operations, and DERs. This section will synthesize module research and scenario outcomes to provide recommendations to stakeholders. Recommendations are organized by stakeholder and prioritized within each stakeholder, as each stakeholder has the authority to implement the recommendation or make the suggested policy change. It is often the case that relatively minor policy changes are prioritized over larger reforms, since smaller reforms, such as increasing communication, will facilitate the implementation of larger market reforms.

The stakeholders receiving recommendations include PUCs, ISOs, IOUs, FERC, state legislatures, and the U.S. Congress. These stakeholder recommendations were selected because of the potential for the policy changes to impact energy system efficiency and/or the integration of renewables. The omission of stakeholders from this section does not imply that they have no role in the future of the energy system, and this list should not be viewed as an exhaustive collection of recommendations. Rather, the recommendations included are those with the greatest potential to achieve desirable outcomes.

The recommendations fall into five main categories: changes in the regulatory regime, institutional structural changes, economic incentives, improved communication, and technological or infrastructure changes. For instance, many of the stakeholders (PUCs, ISOs, IOUs, and FERC) recommendations move toward improved communication. This highlights areas for cross-institutional collaboration. The communication category and remaining recommendation categorizations are presented in Figure 11.

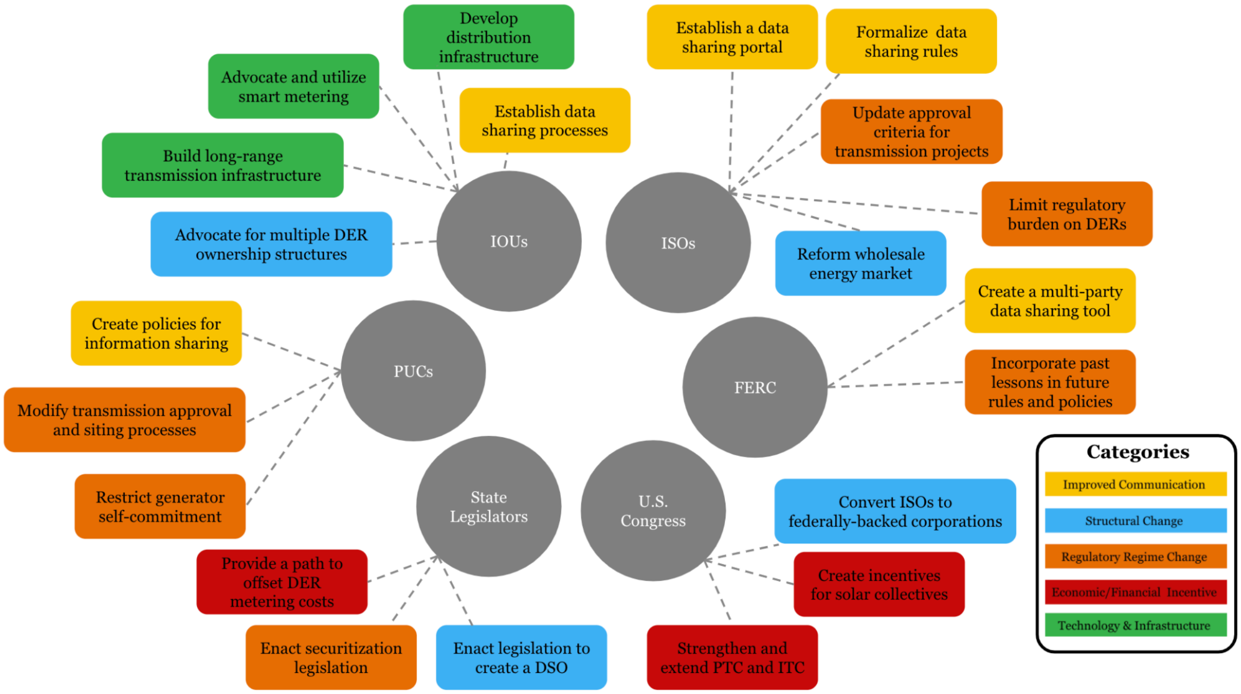

Fig. 11 *Recommendations for stakeholders fall into five categories. These are a change in regulatory regime, technological changes, improved communication, structural change and economic incentives. Here, each stakeholder is shown with the categories of recommendations proposed.*

6.1. PUCs

- **Restrict the conditions under which generators are allowed to self-commit.** Generators should allow for the market and ISO to dictate dispatch operations. PUCs could continue to allow IOUs to self-commit coal and natural gas plants for clearly justifiable reasons, such as mandatory testing. This is crucial especially as hybrid generation and storage becomes more widespread and affordable, allowing inefficient self-commitment to continue will aid natural gas generators in cornering the wholesale and ancillary markets away from renewable hybrid generators.
    - **Restructure prudency reviews/rate recovery.** Those PUCs which do not already, should hold prudency reviews to hold IOUs accountable for their operation practices and prevent consumers from paying for inefficient decisions. Those PUCs which already hold prudency reviews should obtain and integrate generator data into reviews.
- **Create institutional information sharing processes**. PUCs should create formal data sharing processes to reduce knowledge gaps between policymakers and regulators. Institutional knowledge gaps created by policy maker turnover impair decision making and acclimatization to new positions.
    - **Coordinate regularly through reports and schedule periodic virtual or in-person meetings with Legislators.** PUCs should continue to coordinate with

legislators, who may not have in-depth knowledge of or experience in energy policy. PUCs should foster positive relationships with state legislatures, ensuring that accurate and appropriate information is exchanged in order to avoid redundancies like IN HB 1520.

  - **Create a multi-stakeholder informational portal.** A comprehensive informational portal would disseminate knowledge and data to policymakers, legislators, regulated parties like IOUs, and the general public. Information sharing processes facilitated by PUCs should give stakeholders, including IOUs, the tools they need to navigate the rapidly changing energy landscape.

- **Change transmission approval and siting processes.** Legislators must equip PUCs and energy agencies with a greater capacity to collect data and information. Subsequently, cost benefit analyses should place greater emphasis on limiting transmission congestion and integrating renewable generation. Collaborating across states is also necessary to prevent the clustering of renewables and to account for the varying climates and types of extreme weather across the MISO footprint.

6.2. ISOs

- **Formalize processes of sharing data**. State policymakers should create formal procedures by which information flows between all entities within the state jurisdiction.

  Coordinate regularly through reports and schedule periodic virtual or in-person meetings with Legislators. Extensive coordination will provide opportunities to align state goals and leverage incentives to better plan multi-value projects, as well as alert ISOs to important votes or policies for which they can provide support or endorsement.

- **Establish a portal or venue for data sharing.** ISOs can voluntarily begin a process to share information and data with PUCs in the appropriate states, especially with respect to DER mapping, IOU fuel trackers, and other data intended to promote transparency and efficiency. Due to the non-profit status of ISOs, it can understandably be difficult to allocate resources to implement expensive software. Expensive software investments are dependent on rates of recovery and modifying these rates would require support from multiple stakeholders. Therefore, it is important that ISOs develop simpler methods of sharing pertinent data in a timely manner, either in concert with or instead of a new distribution software.

  Create a protected real-time update data hub. Data access would be exclusive to PUC members or those members of a prudency or IRP review panel.

  Coordinate up-to-date data transfers for prudency reviews. Due to the many obstacles facing ISOs and the varying needs and framework of states within their jurisdiction, a less expensive measure of sharing data may simply be transferring encrypted data in preparation for a prudency review.

Investigate federated learning software. This brand-new technology is designed to use data to find patterns in performance without exposing the data to outside users. The software would aid in improving the collective efficiency of generators in the MISO footprint while also protecting proprietary information. Presenting this opportunity to IOUs as a high-profile way of becoming leaders in innovation will encourage participation and show ratepayers that IOUs are not hanging on to the past.

- **Reform the wholesale energy market.** Creating a competitive, strong wholesale market will require internalizing externalities in order to give renewable or renewable hybrid generators market power. By enabling renewable generation to have a foot in the door, they will garner more market power and become self-sustainable. This recommendation also has important ramifications for DER equity and transmission planning.

  Convert to free market functionality with real-time price signals. With an increase in information flow between entities, a more actualized free market can replace the lingering monopolization of utilities. This monopolization has prolonged the use of fossil fuels, as IPPs and renewables have not been able to compete with fossil fuels and push them out of the market. ISOs must invest in software and technology which provides real-time market activities, available to any stakeholder to access and utilize.

  Create a hybrid generation market model. Creating a hybrid generation model ensures renewable generation competitiveness by allowing hybrid renewable generation to compete in the wholesale markets alongside conventional generation. Once hybrid renewables are in the same market as fossil fuels, they will easily outcompete in terms of cost and flexibility. Electricity storage is the most important breakthrough in renewable energy as it breaks the instantaneous nature of electricity demand and supply structure.

  Limit battery/electricity storage use to renewable generation. Until renewables are fully integrated and are on a level playing field with remaining fossil fuel generators, natural gas generators having electricity storage would extend their prospective lifetimes and resist retirement and transition to full renewable energy.

- **Modify approval criteria for new transmission projects.** Reducing the 25% efficiency gains requirement for new transmission projects would facilitate the construction of additional transmission capacity. Increased transmission capacity could reduce costs by increasing efficiency, facilitate the integration of renewables, and increase grid security and interconnectedness.

  Reduce efficiency gains requirements to be closer in line with opportunity costs. Historically, the opportunity cost of capital has ranged between 5-7%.

Because the MISO's 25% efficiency gains requirement drastically exceeds opportunity costs, the rule prevents efficient transmission projects from being constructed.

Adopt a more holistic approach to assessing transmission projects. The benefits from economic efficiency transmission projects extend beyond efficiency. Factors like resource security, sustainability, ability to aid renewable integration, and the effect on future transmission network development should also be considered.

- **Limit the regulatory burden on DER integration from Order 2222 compliance.** Coordination, communication, and information sharing will be key to limiting the regulatory burden resulting from Order 2222. However, excessive metering requirements could prove to be prohibitively costly for some DER owners. ISOs should capitalize on the stakeholder flexibility provided in Order 2222, as it may be key to avoiding significant burdens on DER integration. Although the process of stakeholder engagement may substantially prolong MISO's compliance timeline, FERC has already extended certain compliance deadlines for ISOs, in part because of time-consuming software upgrades.

6.3. IOUs

- **Establish data sharing processes.** While larger stakeholders such as utilities are reluctant to share data, increased data sharing will be mutually beneficial and will significantly enhance planning efforts, as described in Planning Scenario 1. If IOUs are hesitant or unwilling to establish data sharing processes, state or federal regulators may need to mandate their creation.
- **Advocate for and utilize smart metering technology.** Data from smart meters provided to PUCs and ISOs, after trade secrets and confidential information are properly protected, will streamline the process of aggregating DERs. Sharing this data would allow ISO planners and state regulators to better understand the state's current energy production, usage, and needs. This will reduce the long-term costs for IOUs investing in new transmission and generation infrastructure.
    - **Establish customer data portals.** Shared through customer portals, smart meter data can help make prosumers partners in the planning, operation and further expansion and improvement of the "smart grid".
- **Advocate for community- plus utility-owned DER potentials** in the states in which they operate. Although IOUs are incentivized to over capitalize investments to boost regulated returns, IOU ownership of DERs could create opportunities for DER ownership where there are currently gaps in the market. This would allow for more consumers to gain benefits from DER. Utilities would benefit from owning additional capital in the form of DERs, but they could also provide co-ownership (and benefits) to communities in which

they are sited. Additionally, these programs should make a concerted effort to include LMI consumers.

- **Build long range transmission infrastructure**. In cases where IOUs own transmission infrastructure, building out long range transmission will facilitate the increased integration of renewables in addition to increasing interconnectedness between ISOs. This could allow grid operators to move power across ISO lines in times of emergency.
    - **Increase the time horizon for transmission planning.** The life of transmission and generation investments is long and currently exceeds planning horizons. Extending the time horizon will allow for better planning concerning generation retirement, construction of renewable generation, and the construction of new transmission projects.
- **Develop distribution infrastructure.** In cases where IOUs own distribution infrastructure, building out near-term to facilitate the aggregation and integration of DERs through such mechanisms as micro- and nano-grids to develop more of a "mesh" and less of a "radial" grid configuration should be actively considered and formally evaluated in the planning process.

6.4. FERC

- **Create a multi-party information sharing portal.** Creating an information sharing portal for ISOs, PUCs, and IOUs to access shared data will supply a multitude of benefits, including improved prudency reviews, efficient transmission/generation planning, improved net metering, efficient DER aggregation, equitable access to DERs, and more. Developing synergistic relationships to maximize the value of shared data would require the implementation of coordinated reforms, especially between FERC and PUCs. While it is possible that the states, in coordination with individual ISOs, could develop their own data sharing systems and software, a federal information portal would provide important cyber and legal protections for sensitive and proprietary information needed to create benefits. The cost and maintenance of such a system would also be borne more easily by the FERC.
    - **Real-time information portal fed directly by independent market monitors (IMM).** Independent market monitors are impartial data collectors experienced in protecting proprietary information. IMMs feeding data directly to a FERC database would ensure no other competitors would see this data and IOUs would not interfere with which data or how much is actually shared. Accessibility to this portion would be limited to PUCs.
    - **Require states to upload IOU IRPs to the portal.** Communication between state energy regulation and the FERC could stand to be upgraded and improved, in order

to avoid redundancies and coordinate transmission planning, as well as inform trajectories for renewable energy goals.

- **Apply lessons learned from Order 2222 implementation reflected in future rules and policies.** FERC must be attentive to the potential lessons learned from the implementation of Order 2222. Although further delays in the compliance process may be necessary due to the complexity of integrating DERs into wholesale markets, there may also be cases in which unnecessary delays occur due to lack of cooperation between stakeholders, up to and including intentional obstruction. FERC should use the rollout of the Order as a case study to better understand the extent to which various stakeholders will support or oppose DERs and contextually analyze the relative merit of cooperation-based and regulation-based policy.
- **Reexamine FERC Order 1000.** Promoting efficient and cost-effective transmission development by facilitating greater competition between companies and technologies in transmission planning.

6.5. State Legislatures

- **Enact securitization legislation.** Securitization can help utilities retire coal plants earlier than planned and allow them to invest in renewable generation while still earning a fair return on investment and maintaining or even lowering rates for consumers. State legislatures should pass statutes allowing securitization as a first step to non-renewable energy generation retirement. Legislatures should direct agencies and PUCs to analyze generators for securitization candidates, and convene experts representing ratepayers and affected communities in addition to other stakeholders like IOUs, MISO, and regulators for plant closure negotiations.
- **Enact legislation to create state-level DSO entity**
  While many have recommended the establishment of a distribution system operator by assigning those duties to a distribution utility, it is more effective to have an independent nonprofit body similar to ISOs/RTOs carry out the function of planning at the distribution level. This independent nonprofit body to conduct planning at the distribution level would eliminate the possibility of energy access inequity and fraud while also partially resolving the problem of double-counting. State-level DSO legislation would enhance communication between consumers/prosumers, distribution utilities and the wholesale market (RTOs/ISOs) by increasing DER visibility and easier data sharing that would allow for better planning and forecasting.
- **Implement a system to offset up-front costs of metering technology.** State legislatures must give more consideration to the economic incidence of installing metering equipment. Individual DERs are often single households with solar or storage installations and lack the financial resources of other stakeholders in the energy sector, such as IOUs.

Creating a system in which up-front costs of metering technology are offset by another party in exchange for some percentage of the revenues from their energy generation has shown promise in reducing the economic burden of metering. In many states, solar leasing companies have been successful in incentivizing residential and commercial solar installation--especially for nonprofits, which may not be eligible for the same tax incentives as for-profit entities--by investing funds to construct solar installations in exchange for a cut of revenues from energy generation or for partial ownership of DER resources. Alternatively, states may intervene to incentivize DER creation by offering low-interest loans to parties who commit to building solar resources or to investors interested in establishing solar collectives. A particular incentive for investors to offset costs is metering technology which automatically transmits information for reimbursement.

- **Promote DER access equity.** Providing equitable DER access to all citizens is a central and pressing **environmental justice issue**. State legislatures should expand DER ownership opportunities to community, utility, and third-party ownership structures. Expanding the allowable ownership structures will expand the type of consumers who can access DERs and therefore expand deployment of the technology.

6.6. United States Congress

- **Replace ISOs with federally backed corporations.** A major, but logical step up from the legally less powerful ISOs would be to create functionally equivalent government-backed corporations. The replacement organization would have the power to distribute funds for securitization, issue grants for DER support, and contractually bind IOUs to provide more efficient energy generation and transmission. It is important to note, though, that the process of converting ISOs for this purpose may run aground of FERC Order 2000, which mandates that ISOs must remain financially independent from market participants. In order to circumvent this restriction and allow these successors of ISOs to financially support DERs and other parties, an amendment to Order 2000 or subsequent federal rule may be necessary.
- **Extend the Production Tax Credit and Investment Tax Credit.** Extending the Production Tax Credit (PTC) and Investment Tax Credit (ITC) to give additional economic incentives to DER owners will also increase DER ownership. The 2006 ITC, offering a 26% income tax credit to residential solar owners, is currently slated to be phased out by 2024, insinuating that some ISOs may still be formulating their Order 2222 compliance plans when the ITC is fully phased out. Although economic analysis has shown investment tax credits to be costly, they may be useful in the short term to offset the up-front costs of metering for DER owners while technology improves, and costs gradually decrease. This policy recommendation can be viewed as "low-hanging fruit" since these credits are

already established and extending the credits does not depend on the implementation of another factor.

- **Provide incentives to solar collectives and investors.** Front-end capital requirements are a significant disincentive to DER ownership and providing cost support to reduce barriers to adoption could increase DER ownership rates. The U.S. Congress may be in a superior position relative to state governments to alleviate the burdensome capital requirements associated with DER ownership. The federal government can finance incentive programs with relative ease and while also driving DER policy forward in a uniform manner.

7. Further Research

While this study attempts to offer the most comprehensive overview of the critical governance and policy issues that will facilitate the integration of renewable generation, additional questions emerge regarding how to implement solutions or change policies. The following list includes areas for future research:

- The increase in DERs introduces the potential need for state-level DSOs. Further research should focus on characterizing DSOs' institutional processes, organizational structures, and jurisdictional boundaries to (1) determine necessary resources, (2) explore opportunities for capacity building, and (3) recommend effective implementation. Subsequent research may focus on the outcomes of organizations similar to DSOs in other countries or U.S. states. Finally, further research should ascertain what jurisdiction or combination of jurisdictions have the capacity to establish and regulate DSOs.

- Improving long-range transmission is essential to increase the rate of renewable energy integration and ensure equitable and widespread integration. Future research should identify economic, policy, and technological factors to bridge remote but resource-rich areas with intensely populated urban areas, which are currently unsuited for renewable energy infrastructure development.

- The complexity of the U.S energy industry requires intricate and combined policy, legal, and economic maneuvering to bring about change. Further research should concentrate on streamlining stakeholders' procedures to accelerate transmission planning, market reforms, and accessibility for consumers. Specifically, research should look into transforming ISOs into federally-backed corporations.

- Since increasing access to DERs remains a crucial economic consideration for a just transition, future research should identify possible economic incentives for DER, such as offsetting installation costs or providing opportunities for solar collectives.

- Increasing the availability and transparency of information between stakeholders will foster efficiency and accountability. However, information sharing often remains a contentious aspect due to the proprietary nature of said information. Further research should look into which software would be the most efficient in hosting and securing that information and data. Similarly, jurisdictional factors and responsibilities should be evaluated to determine stakeholders' security considerations in accessing and sharing data.

- Aligning incentives across jurisdictions to implement new transmission planning rules and statutes remains highly uncertain. Hence, future research should identify crossjurisdictional incentives to mitigate NIMBY-ism, reduce clustering, and increase the pace of renewable integration, among other issues.

- The intermittent nature of renewable energies poses a reliability challenge to the power grid since the share of renewables is projected to increase. However, MISO, utilities, and state agencies have the responsibility to ensure reliability to their customers. Future research should identify policy, technical, and economic opportunities to enhance renewable integration without compromising reliability.

To conclude, assessing these research questions will draw a more comprehensive picture and thus facilitate the integration of renewable energies into the Midwestern grid.

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10. Appendices

Appendix A: Project Factor Outlines

Appendix A goes into full detail on the research done for determining the factors considered and why those factors were chosen.

Planning Module Factors

The Planning module is responsible for exploring the potential synergies between state utilities' integrated resource planning (IRP), generation/transmission processes, procurement processes, and MISO's regional future outlook, with the goal of balancing reliability and cost minimization. To achieve this goal the module has outlined four factors most relevant to optimizing processes, resources, and synergies. The factors are ranked by importance as follows:

1. Regulatory Uncertainty
2. Transmission and Integrated Resource Planning (IRP)
3. Generation Planning and Forecasting
4. Communication

1. Regulatory Uncertainty

Analyst: Sara Boukdad

Section 1: Background/Composition

Even before the extreme weather events in February 2021, states legislators and regulators have been increasingly concerned about and involved in regional electricity market regulation. Changes in state policy are, in large part, out of the direct control of utilities and ISOs. Because investor-owned utilities and RTO/ISOs may stretch across multiple state jurisdictions, differences in state policies may increase the regulatory burden on market actors.

Section 2: Stakeholder Overview

I. Legislature (State, Federal): Legislative body in Indiana is the Indiana Utility Regulatory Commission (IURC) and at the federal level is the Federal Energy Regulatory Commission (FERC).
   A. Most important: (HB 1520) (FERC 2222)
   B. Coming down the pike: Federal action related to weatherization

II. Investor-owned utilities (IOUs): IOUs are a **key** stakeholder (Read: most influential). Regulated by legislators but dependent on MISO for coordination.
   A. RTO/ISOs: Midcontinent Independent System Operator, the air-traffic controller.

Section 3: Factor uncertainty, challenges, and interdependencies with other related factors

- Uncertainty: There is still that remains to be determined related to federal action on weatherization. It is still in the initial stages of planning and not a lot of guidance or detail has been released from

FERC. For the HB1520, this is a yearly bill. This year, it includes greater data sharing between IURC and IOUs/MISO.

- Interdependency: Connects to long range planning of both transmission and generation to improve data sharing and integrated resource planning
- Interdependency: Connects to operations and information sharing across institutions

Section 4: Matrix Characterization

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Changes in Federal/state policy resulting from weather events in February 2021. Disjointed policy may reduce efficiency.	**Medium**: FERC has issued a proceeding to look into reliability in face of climate change	**Medium/High:** It depends on what is included such as investment req., coordination, and standards.	**Beneficial:** The current state of weatherization is left to the discretion of the IOUs with regulation from PUCs. Yet, federal action could create a more uniform approach.
Policy may change to require greater coordination between ISOs, require greater stakeholder engagement, or other actions.	**Medium**: Some legislatures argue that HB 1520 is redundant, and the level of data sharing is already in place and IURC already has the power to investigate an IOU. (link)	**Medium**: Depends on how much data sharing gaps exist and ways IURC has utilized its existing power to look into inadequate reporting currently.	**Beneficial**: By increasing coordination, this would open up greater efficacy on IRP, transmission, generation, and more optimized strategic planning. It may even lead to cost sharing and make more economic sense.

Section 5: Remaining Questions

- What would it look like if FERC utilized its authority under the Federal Power Act (FPA) to order a standard of conduct on weatherization and reliability, like they did in 2014 on supply chain, geomagnetic disturbance, and physical security standards? A similar standard was initiated in 2011 but never happened.

Section 6: References

- House Bill 1520 (link)
- R Street Webinar (March 1st: *Extreme Cold and the Power System: Framing Next Steps*) (link)
- FERC to Examine Electric Reliability in Face of Climate Change (link)
- Indiana Chamber of Commerce Legislative Agenda (link)
- NARUC Task Force Road Map: W/in ISO and IOUs own generation (Amber + Coral)

2. Transmission and Integrated Resource Planning (IRP)

Analysts: Pierre Chesnais and Kolt Vaughn

Section 1: Background/Composition

This factor primarily pertains to the spatial/geographic distribution of renewable energy resources that constrains transmission and resource planning as well as project siting. The basic problem concerns the uneven distribution of generation resources coupled with transmission constraints and resource planning considerations. When coupled together, these three factors significantly limit the penetration of renewable energy systems into the grid's energy mix.

Section 2: Stakeholder Overview

Utility (IOUs): the most influential player in state electric legislation in the Midwest

FERC: The FERC regulates the transmission and wholesale sales of electricity in interstate commerce, and thus plays a considerable role in alleviating the aforementioned constraints. The FERC also reviews the siting application for electric transmission projects

- FERC has exclusive jurisdiction over the "transmission of electric energy in interstate commerce," and over the "sale of electric energy at wholesale in interstate commerce," and over "all facilities for such transmission or sale of electric energy." FPA 201(b) (16 USC 824(b))
  - Guiding statute: 16 U.S. Code CHAPTER 12 - FEDERAL REGULATION AND DEVELOPMENT OF POWER

MISO: the most influential player in regional transmission planning

Consumers and Ratepayers: participate in the review of those process and certainly have a lot at stake

PUCs: granting approval for facilities falls under the purview of PUCs (certainly generation & maybe transmission) (approval relies on IRP simulations)

Section 3: Factor challenges and interdependencies with other related factors

1. First, within the planning module, there is a deep connection with generation planning since transmission is subsequent to generation and resource planning. In other words, transmission planning considerations are dependent on resource and generation planning constraints (e.g., LRTP is bound by generation siting realities).
2. Second, the efficacy of operations is constrained by the planning process as the latter precedes operation considerations.

Section 4: Matrix Characterization

1. Policies at different jurisdictional levels (local, state, and ISO) constrain new transmission projects' siting processes.[1]

Likelihood of Occurrence: Low-Med

Reasoning: There is a low likelihood that policies will be implemented across MISO states and municipalities that streamlines regulations/incentives to mitigate clustered sighting or siting NIMBYism. Such a policy intervention seems unlikely because coordinating various jurisdictions' policies is never easy. Notably, the only entity with the capacity to enforce regulations or offer incentives across the MISO region is MISO itself (e.g., changing the CBA

[1] ***Uncertainty:*** *High.* ***Reasoning:*** *There remains high levels of uncertainty about transmission policy because it relies on people to make decisions with imperfect information. This reality incorporates political, legal, and infrastructure constraints.*

ration from 1.25 to a lower value will increase the number and the viability of transmission projects).

Level of Influence: High.
Reasoning: Low or no policy intervention will limit LRTP's ability to support more renewables Similarly, comprehensive and uniform transmission policy can influence high levels of renewable integration.

Impact: Beneficial.

2. Limited transmission capacity in areas with renewable resources complicates RE's integration into the grid. Clustering backlogs the regional transmission system.[2]

Likelihood of Occurrence: High
Reasoning: The misalignment of current policies at the local and state levels leads to a high likelihood that clustering would occur. The rationale is largely based upon two maps that MISO presented to us, which showed disparities in clean energy goals throughout MISO's region and zones with transmission constraints.

Level of Influence: High.
Reasoning: Solving the clustering problem would allow for a better LRTP and distribution of renewable energy across and not limit REs to small geographic areas within MISO's region.

Impact: Beneficial.

3. An improper balance of renewable energy sources could threaten system reliability, especially in the case of extreme weather events or other system shocks.[3]

Likelihood of Occurrence: High
Reasoning: The intermittent nature of renewable energy resources and the lack of storage technology increase the vulnerability of the system. Hence, as the share of renewable energy is growing, so is the system's vulnerability, unless issues of intermittency and storage are successfully addressed (e.g., adding spatial consideration to the IRP process mitigates vulnerability).

Level of Influence: High.
Reasoning: As reliability is the key concern of stakeholders when it comes to electricity distribution, any event that could negatively impact the system's reliability will likely be disregarded since reliability will always take priority over RE penetration.

Impact: Beneficial.

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[2] ***Uncertainty:*** *Medium.* ***Reasoning:*** *Although stakeholders seem to have a good grasp of the issue, uncertainty mostly stems from the difficulty of aligning policies, and if such policy alignment were to happen, when will it happen?*

[3] ***Uncertainty:*** *High.* ***Reasoning:*** *This is a classic example of uncertainty in the future of extreme weather events driving the uncertainty in future reliability that those systems rely on and are subject to.*

4. Conventional units are being retired as renewable energy penetration increases. Renewables may be unable to accommodate seasonal variability and peak demand load.[4]

Likelihood of Occurrence: High
Reasoning: As states implement increasingly ambitious clean energy goals, an increasing number of conventional units will be retiring, which poses reliability issues due to the intermittency of renewable energy and the lack of storage.

Level of Influence: High.
Reasoning: In states with ambitious clean energy goals, the retirement of conventional units coupled with the rise of renewable energy drastically changes the balance and constitutes a paradigm shift in the generation and distribution of electricity. However, the level of influence could be lower in states with a lesser focus on energy transition, as these states do not necessarily have an incentive to replace "old" conventional units with renewable energy units.

Impact: Beneficial.

Matrix:

Factor Outcomes/Components	Likelihood of Occurrence	Level of Influence	Impact
(1) Streamlining policies across MISO[5]	Low-Med	High	Beneficial
(2) Expanding long-range transmission planning[6]	High	High	Beneficial
(3) Reconciling and synergizing reliability with a larger share of renewable energy[7]	High	High	Beneficial
(4) Accommodating for seasonal variability with less conventional generation technologies[8]	High	High	Beneficial

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

1. Factor: Streamlining policies across MISO
    Pros:

[4] ***Uncertainty:*** *Low.* ***Reasoning:*** *As states and localities engage in an energy transition to achieve environmental goals, all levels of government and consumers are driving the demand to retire the most polluting generators (i.e., coal plants). However, uncertainty may reach higher levels when it comes to the ability to address the intermittency and storage issues.*

[5] Policies at different jurisdictional levels (local and state) constrain new transmission projects' siting processes.

[6] Limited transmission capacity in areas with renewable resources complicates RE's integration into the grid. Clustering backlogs the regional transmission system.

[7] An improper balance of renewable energy sources could threaten system reliability, especially in the case of extreme weather events or other system shocks.

[8] Conventional units are being retired as renewable energy penetration increases. Renewables may be unable to accommodate seasonal variability and peak demand load.

- Uniform incentives to minimize clustering
- Consistent regulations to drive equal dispersion of renewable generation

Cons:

- IOUs and PUCs lose some independence
- Decreases policy innovation for governments with more ambitious goals

2. Factor: Expanding long-range transmission planning

Pros:

- Increased RE penetration in a more spatially uniform manner
- Increases regional reliability when local RE reaches a specific threshold

Cons:

- Difficulty of overcoming NIMBY-ism
- Consolidates power in MISO while decreasing all other stakeholders' power

3. Factor: Reconciling and synergizing reliability with a larger share of renewable energy

Pros:

- Would alleviate main concerns regarding a grid that largely relies on RE since most concerns about RE relate to reliability issues.

Cons:

- Perhaps impossible
- Stakeholders (e.g., MISO) are unlikely to experiment with this factor, so there is limited opportunity for taking risks.

4. Factor: Accommodating for seasonal variability with less conventional generation technologies

Pros:

- Increases RE penetration.

Cons:

- (Could be a con if the answer to the following question is "no") Would conventional units become uneconomical if they are run as back-up generating plants?

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

The factors one through four above are further divided and can exist on their own and become useful to other scenarios. However, when combined sequentially, the factors also exist in a continuum to support transmission and resource planning holistically.

Section 7: Remaining Questions

- (same as above [section 5, bullet point 4, section "Cons"])
  - Would conventional units become uneconomical if they are run as back-up generating plants?
- What comes first between resource planning, generation planning, and transmission planning or do they happen simultaneously?

Section 8: References

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3. Generation Planning and Forecasting

Analyst: Blake Steiner

Section 1: Background/Composition

State regulators utilize the "used and useful" test to make decisions regarding generation retirement. Increasingly, state policy is changing to give regulators authority to approve utility resource plans and certificates of need (Indiana HB 1520, for example). ISOs are responsible for operating capacity markets and must evaluate generator retirements regarding must-run reliability.

Section 2: Stakeholder Overview

State legislators and regulators – more authority to permit building/retiring generation
MISO – can now impose resource reliability requirements on utilities
Utilities – could be required to acquire additional operating capacity
Generators (including DERs) – increased efficiency in generation retirement
Consumers/ratepayers – participate in review of these processes, pay rates

Section 3: Factor challenges and interdependencies with other related factors

A) Generation retirement is currently a process that involves multiple parties with narrow interests. System efficiency may be increased if ISOs are granted marginally greater input into generation retirement decisions.

B) Changes to current forecasting and cost-benefit analysis methods may increase system efficiency and mitigate threats to reliability in the event of system shocks. Extreme weather events in February 2021, combined with the expectation that extreme weather events will become increasingly common due to climate change, necessitates a re-examination of forecasting scenarios and cost-benefit criteria.

Section 4: Matrix Characterization

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
ISOs are granted marginally greater input into generation retirement decisions	**Level:** High **Reasoning**: HB1520 is a Republican-sponsored bill in a red state.	**Level:** Med-High **Reasoning**: Identified by the NARUC-NASEO task force blueprint as highly important.	*Beneficial* **Reasoning**: Helps ensure that changes in generation make sense at the macro level.
Changes to current forecasting and cost-benefit analysis methods	**Level:** High **Reasoning**: NASUC-NAREO Task Force document focuses heavily on these in the appendix. Also, attention to this matter from events in Texas.	**Level:** High **Reasoning**: In the long term, these processes help institutions to identify goals and set their course.	*Beneficial* **Reasoning**: More data analysis, especially as a result of increased data sharing, should generate more accurate and impactful insights.

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

A. Should be largely positive, barring an excessive increase in administrative costs and use of time to the point where it is burdensome/results in a loss of efficiency.
B. Again, should be largely positive unless it is resource intensive.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)
A. Should plan on HB 1520 passing and should consider whether it will realistically present a challenge in regard to administrative burden.
B. Should consider not whether these changes will occur, but to what extent they are likely to be impactful (perhaps highly likely, as per Devin's comment, 'FERC just opened up a new proceeding on extreme weather/climate change affecting grid planning and operations').

Section 7: Remaining Questions

- Will HB 1520 passing severely affect administrative procedures and reduce efficiency?
- Will changes to forecasting and cost-benefit analysis (particularly data sharing) be an even larger factor in grid planning and operations going forward? To what extent have the findings of these processes been ignored/overlooked in the past, and why?

Section 8: References

HB 1520
What the Chamber of Commerce Thinks about HB 1520

[*Hoosier Environmental Council Opposes HB 1520*]
[*HB 1520 Sponsored by Only Republicans*]
[*Naruc-NASEO Task Force Document*]

4. Communication

Analysts: Tyler Wenande & Adam Baker

Section 1: Background/Composition

Communication is a driving factor that contributes to the success in working with a variety of public and private entities. The free flow of information across all parties creates trust through transparent communication. Many entities in the energy industry have similar alignment of goals and objectives for future plans including the integration of renewable energy, infrastructure upgrades to transmission grids, and the decommissioning of old power plants in order to provide stable and reliable electricity for its customers.

Section 2: Stakeholder Overview

PUC and Legislators: Under state law, PUCs have an obligation to the establishment and maintenance of utility services and to ensure that those services are provided at rates and conditions that are fair and reasonable. Although some legislators may not have specialized policy backgrounds on certain topics, their actions are driven by interpretation of state statute and must follow administrative procedures to make decisions. State legislators have to be open to receiving education and training on certain topics related to energy. Effective collaboration between state legislators and PUCs starts with education on energy systems, transparency in the consistent reporting of future plans and goals, and open dialogue about policy reform. This includes requests for statutory changes to the legislature and highlighting areas of existing laws that are unclear or could cause conflict with aligned plans.

Utility (IOUs): IOUs play a crucial role in telecommunications across territories. They are a part of the communication network that provides critical information and management of assets for a wide range of parties. Situational awareness in transmission backlogs, safety functions for the maintenance and restoration of electricity, and coordination of assets for efficient distribution is the backbone for reliability.

Ratepayers/Consumers: Communication between ratepayers and the utility provider molds a relationship where incentives are created, and motivation is given to customers. Providing education and incentivizing behavioral change could help utilities and even state legislators be more efficient in meeting targets and incorporating planning structures.

Ex: Smart meters allow for the utility to personalize their customers energy experience and tailor to their energy dependent needs. The more educated and aware consumers are PUCs and IOUs are relieved of stress and can plan more efficiently based on customer trends.

Section 3: Factor challenges and interdependencies with other related factors

Challenges:

- Difficulties arise when coordinating narrow interests to drive policy change. Although every party may have similar goals, not every utility involved will be able to voice their opinion when it comes to policy reform. There are always ulterior motives that must be considered when aligning goals.
- There is a disconnect in communication between generation, transmission, and distribution processes. Addition of iterative feedback loops brings situational awareness through cross-

dimensional data sharing. Because these components of a successful utility company are so concentrated, there is a potential internal communication barrier regarding everyday generation, transmission, and distributional planning and organization.

- Increased need for transparency in data sharing processes between stakeholders and sufficient formalized communication could be challenged by confidentiality laws in the public and private sector.
- Continuous communication through interactive and multidisciplinary education for all stakeholders is crucial to understanding the underlying processes and the different ways to improve the utility operating system. Education and training are only successful through engagement and repetition. Without constant refresher training and education, parties involved in renewable energy systems planning may make the wrong decisions or spread misinformation.

Interdependencies:

-Communication in long range transmission planning is especially crucial when dealing across multiple jurisdictions.

-Regulatory reform is done through dialogue between PUCs and state commissioners when identifying problems in the current legislature for the planning of renewable energy integration to meet future expectations.

-Coordinating narrow interests between State Energy Portfolio Requirements and Integrated Resource Plans (IRPs) creates efficient and effective planning based on aligned goals

-Data sharing and establishment of iterative feedback loops across generation, transmission, and distribution processes allows for the identification of trends to help in generation planning as well as forecasting models.

Section 4: Matrix Characterization

1. ***Data sharing and formalize communication:***
   Likelihood of Occurrence: High
   Reasoning: Formalizing communication between stakeholders through data sharing is a likely procedure to occur. Regular communication and data sharing influences planning strategies.
   Uncertainty: Medium
   Reasoning: There are no constraints with data sharing, however, there is also no policy enforcing the flow of data. Currently, it is up to the parties involved to co-exist.
   Level of Influence: High
   Reasoning: Increased data sharing is the catalyst for all planning factors and has the highest potential for a beneficial impact.

2. **Coordinating narrow interests to drive policy change:**
   Likelihood of Occurrence: Medium
   Reasoning: Many goals and future outlooks are aligned. Planning to meet target objectives and aligning narrow interests across all stakeholders is a plausible opportunity.

Uncertainty: Medium

Reasoning: There is a need for communication between stakeholders through consistent forms of coordination: meetings, progress updates, future plans.

Level of Influence: High

Reasoning: Aligning goals and objectives across all stakeholders will drive policy change in accordance with the narrow interests of parties involved.

3. **Iterative feedback loops across administrative entities (generation, transmission, distribution):**

   Likelihood of Occurrence: Medium

   Reasoning: Addition of feedback loops increases internal communication through cross-dimensional data sharing. Coordinating generation, transmission, and distribution processes starts with cooperation and proper communication to increase situational awareness under certain scenarios.

   Uncertainty: High

   Reasoning: Because these components of a successful utility company are so concentrated, there is a potential internal communication barrier regarding everyday generation, transmission, and distributional planning and organization.

   Level of Influence: Medium

   Reasoning: Improving internal communication through feedback loops allows for coordination between generation, transmission, and distribution in order to problem solve. Communication of data and proper guidance will level the playing field in order to be more efficient on the internal operations.

4. **Continuous, interactive, and multidisciplinary education for all stakeholders:**

   Likelihood of Occurrence: Low

   Reasoning: Consistent refresher training and education for political entities is unlikely. Encouragement and engagement in education is normally not a priority.

   Uncertainty: Low

   Reasoning: There are many highly educated and influential people in the energy sector who completely understand the underlying processes and ways to improve the utility operating systems.

   Level of Influence: Medium

   Reasoning: It is difficult to rate the influence of education for stakeholders and the impact it will have on overall planning scenarios. However, continuous communication through interactive and multidisciplinary education for all stakeholders is crucial to understanding the underlying processes and the different ways to improve the utility operating system.

Factor Outcomes/Components	Likelihood of Occurrence	Uncertainty	Level of Influence	Impact
Insufficient formalized communication & data sharing processes between stakeholders	High	Med	High	Beneficial

Coordinating narrow interests to drive policy change in a way that is forward-looking, efficient, and reflects insight from all stakeholders	Med	Med	High	Beneficial
Too few iterative feedback loops across generation, transmission, and distribution processes	Med	High	Med	Beneficial
Need for continuing, interactive, and multidisciplinary education for and between all stakeholders	Low	Low	Med	Neutral

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

-Coordinating narrow interests between all stakeholders is beneficial to the planning process. Future goals that are aligned across all entities enforces positive outcomes and incentivizes coordination between parties to meet projected targets.

-Integration of iterative feedback loops across generation, transmission, and distribution processes are beneficial for internal communication for problem solving and anticipating future trends.

-Formalized communication and data sharing between stakeholders has the potential to influence planning processes, however, this factor holds a low likelihood of occurrence based on possible confidentiality barriers.

-Proper education for all stakeholders drives innovative thinking and ensures an understanding of system processes.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

The combination of outcomes from communication factors formulates scenarios based on interdependencies and impact potential. Increased data sharing and the transparency of data influences future decisions or changes to processes or infrastructure. In turn, a projected improvement in current forecasting models will allow entities, such as IURC, to follow trends and report to utilities to influence increased generation capacity and to ensure reliability for consumers. Improved forecasting from data sharing will directly affect long-range transmission planning and generation to facilitate better incentives/investments for transmission capacity. Barring any confidentiality agreements, data sharing as a form of communication is one of our recommended scenarios.

Section 7: Remaining Questions

- (Communication question) What infrastructure (software or otherwise) is needed to provide real-time information regarding DERs and power availability for MISO?
- What current type of information sharing system is available and who has access to it? (MISO, PUCs, utility owners, etc.)
- How often are regulators meeting with leadership committees and commissioners from states, as well as MISO? (Interstate legislative communication)

Section 8: References

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https://www.utilitydive.com/news/utilities-communications-needs-are-diverse-and-growing-utc-survey-finds/553286/
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Operations Module

The operations module has focused on evaluating how the client interacts with generators and developing a framework to reduce inefficient generation. In order to achieve this goal, the module identified four factors which targeted all aspects of operations for the client:

1. Market rules
2. Oversight Policy
3. Improved communication with constituents
4. Improved communication between agencies

1. Market Rules: Increase Storage and Minimize Self-Commitment

Analysts: Kerry Korpela and Nate Young

Section 1: Background/Composition

Market Rules establish how utilities can participate in the wholesale energy markets. State and federal regulators provide oversight and monitoring, ostensibly to ensure that market rules are not impeding fair competition or safety/reliability. Two issues have been identified as being the most important influences on changing market rules to improve renewable generation integration, both to promote its onboarding and to balance its usefulness within the grid. These are reducing inefficient self-commitment and restructuring hybrid generation market participation.

Rather than allowing MISO to determine generation needs for reliability purposes or allowing MISO to schedule generation based on the day-ahead market, IOUs have instead been allowed to self-commit, with certain plants operating at significant losses. MISO's independent market monitor, Potomac Economics, puts forward a much more conservative estimate of $50 million in inefficient and unprofitable losses. Potomac Economics also points out that a small share of integrated utilities is responsible for a lion's share of total losses, operating much less efficiently than other IOUs.

An important long term and market paradigm-shifting technology is energy storage, specifically paired with renewable energy generation. In order to optimize the integration of renewable energy onto the grid and improve ramping capabilities, the implementation of formalized hybrid generation market rules to incentivize storage capabilities is crucial. Implementing a hybrid energy source market participation model will allow hybrid generators to fully integrate into the day-ahead markets and make them dispatchable. Currently the rapid influx of non-dispatchable generators is creating greater ramping capacity within the

MISO footprint, therefore incentivizing battery investment with a new participation model will reduce grid and generator stressors.

Section 2: Stakeholder Overview

Generators: giving renewable energy generators more power to interact with the market via storage integration is a long-term gain for both generators and the grid in general. Generators will possess more power in the energy market and capture valuable profits through ancillary markets which will then make renewable energy sources more valuable.

Utility (IOUs): IOUs are self-committing coal plants uneconomically; rules to prevent the inefficiency of self-commitment will force full market participation and market analysis from the utilities. IOUs with renewable generation will gain market incentives to invest in more storage.

Arbitrageurs: arbitrageurs operate DER and storage electricity output onto the grid. Creating a hybrid generation source market participation may cut arbitrageurs out of some of the market, as greater market power would rest with producers who both generate and store electricity. This would reduce some complexity that MISO is dealing with but would also limit competition potential and may run into legal issues based on FERC initiatives around storage.

PUCs and Legislators: PUCs are responsible for determining the prudency of utility asset management and approving utility cost recovery. Legislators control important budget aspects that can be used to incentivize the removal of coal generators from the grid.

Ratepayers/Consumers: Ratepayers are ultimately paying for uneconomic utility operation through higher than necessary prices. Citizens in general are also bearing the environmental costs of cleaner energy sources being "crowded out" by these coal plants.

Section 3: Factor challenges and interdependencies with other related factors

Issues may arise in MISO alone attempting to curb self-commitment by removing the market mechanism by which facilities are authorized to self-commit. State governments can also encourage generators to internalize their fuel costs. This would be achieved by the internalizing of fuel costs for generators, mandated by state PUCs or legislated by state governments. This would be achieved by MISO sharing private operation data, monitored by MISO and their independent economic monitor Potomac Economics. This factor overlaps with the communication factor; ideally, both factors would be implemented simultaneously.

While inefficient asset management and market rules related to this problem affect operations, they also directly relate to planning. In planning the energy markets of the future, policymakers and IOUs must investigate how to reduce inefficiencies, align incentives, and retire coal plants where prudent.

A hybrid market participation model will require delicate implementation in order to allow the market forces to equalize the value of stored electricity versus the value of the storage modules themselves. Subsidies for storage could potentially vary from state to state, which may also extend the amount of time for market equalization. If a federal subsidy were to be implemented, it may smooth the implementation process.

Section 4: Matrix Characterization

1. Minimize Self-Commitment

    Likelihood of Occurrence: High

Reasoning: Unless rules are changed and market oversight improves, IOUs are likely to conduct business as usual, with certain coal plants regularly operating at a loss. State and federal regulators should restrict the conditions under which generators are permitted to self-commit. PUCs should ensure they have access to the necessary IOU data when conducting prudency reviews and should disallow imprudent costs. This is a relatively straightforward method of ending uneconomic operation at its source.

Level of Influence: Medium

Reasoning: According to the UoCS report, uneconomic self-commitment crowds out cleaner energy resources, including renewables, by taking their "spot" in the daily markets. Allowing prices to determine generation would mean that these uneconomic plants would be operating less, and cleaner plants would be operating more.

Inferred Efficacy (Impact): Beneficial

Reasoning: More efficient asset management would mean less coal and more clean energy in the grid.

2. Implement Hybrid Generation Market Participation Model

Likelihood of Occurrence: Medium

Reasoning: high costs of battery and electricity storage methods have limited their rollout in the MISO footprint, meaning not many participants will initially enter the hybrid market. However, the creation of the hybrid market will incentivize battery/storage investment and lower the costs of the technology and bolster the market model.

Level of Influence: High

Reasoning: changing the rules of the electricity market, the fundamental network which supplies electricity to the MISO footprint, will have geographically and economically widespread effect at all levels of government and with all different types of operators.

Impact: High

Reasoning: recreating market operation around increased storage and rewarding current storage operators will incentivize further storage investment. This will allow renewable generation to become dispatchable sources, rather than intermittent, and fully participate in the day-ahead markets.

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Implementation of a hybrid generation market participation model	Medium	High	Beneficial
Restrict self-commitment	High	Medium	Beneficial

Seasonal Operation	High	Medium	Neutral

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

1. ***Status Quo**:* Generators continue to self-commit resources, despite inefficiencies and unprofitability. Barring an increase in inefficient asset management, this is the worst-case scenario. If market rules remain the same and IOUs are not held accountable for inefficient asset management, ratepayers will continue to pay millions in unnecessary energy costs and coal will continue to "cut in line" and crowd out cleaner power sources.
   If the markets remain as they have, without enhanced openings for storage, technology and prices of electricity storage and batteries will decrease at a much slower rate. Fossil fuel generators will also continue to take full advantage of day-ahead markets with little opportunity for renewable generators. The ancillary markets will also struggle to meet the demand for ramping services, which will also operate inefficiently to match renewable generators' uncertainty.
2. **Hybrid Generation Market Model:** generators and utilities will be incorporated into day-ahead markets and become more competitive with traditionally dispatchable generators. This in turn will make them more attractive to investment and development. Ancillary markets will also function more smoothly and in concert with the rest of the grid.
   Conversely, the hybrid generation model may take longer to see the benefits of changes, as the battery and electricity storage market in the MISO footprint is still in early stages, as compared to California. Balancing the market value of electricity with greater storage capacity will also take time to rebalance, making prices somewhat more prone to rapid shifts.
3. **Seasonal Operation**: IOUs could take seasonal outages, i.e., not run coal plants when resources are less needed or economic. The impact is deemed as neutral due to the fact that operators will still be incurring losses by shuttering plants for some of the year.
4. **Restrict self-commitment**: Legislators and state regulators could change market rules so that IOUs are either not allowed to self-commit or self-commitment is much more restricted. MISO can still direct plants to operate to meet reliability standards, but otherwise IOUs would offer their resources economically by allowing the day-ahead market to guide startup/shutdown decisions.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

Based on the comparisons of Section 5, the preferable outcome is one wherein the hybrid generation market participation is created and rolled out in stages. In the interest of MISO's preference for reliability and enhancement of important ancillary markets, refocusing on storage and hybrid generation must occur within the next five years in order to handle the load of renewable generators on the grid. A scenario in which DERs become more concrete and commonplace, they will benefit from a strong ramping market and a day-ahead market which has levelized the hybrid electricity generation costs.

Outcomes 3- 5 are all preferable to the status quo and can be enacted conjointly.
Coal plants that are consistently unprofitable can be operated seasonally and shut down when not needed. Self-commitment should be restricted so that the wholesale energy markets can work as intended. MISO

can and should be sharing data with the PUCs to help them provide adequate oversight and hold IOUs accountable for imprudent asset management.

Section 7: Remaining Questions

- What ancillary market rules should be modified?
- What mechanisms of self-commitment abilities need to be removed?
- How can MISO's technical system be shared with state regulators?

Section 8: References

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A Review of the Commitment and Dispatch of Coal Generators in Miso, Potomac Economics, September 2020.

2. Oversight Policy

Analysts: Randy Miller and Kerry Korpela

Section 1: Background/Composition

This factor investigates causes and impacts of uneconomic generation incentives. It explores policy means to incentivize more economically efficient generation. Effective oversight and policy targeting information asymmetries provides an opportunity for states to address rate making, resource portfolio composition, and effects on the market occurring based on self-suppliers.

Sharing utility operations data and behind the meter data with state regulators (while protecting proprietary information) would reduce the current information asymmetry inhibiting adequate market oversight. Additional considerations relevant to this example include cost-recovery for capital assets and asset management permissions among generators in the MISO service territory.

Securitization is an important component of getting fossil fuel generators off the grid. Giving communities the tools to equitably reorganize their energy generation and economic solvency is crucial. MISO currently offers securitization granted through money from the FERC, and such funding will undoubtedly need to increase in order to achieve more renewable energy generation.

Section 2: Stakeholder Overview

PUC and Legislators: In January 2021 former PUC commissioners called for "states and FERC to take steps to work in concert to manage their complex and sometimes varied regulatory roles, looking beyond their respective retail and wholesale jurisdictions, and working cooperatively in a coordinated manner." PUCs and state legislators may lack the capabilities or will to enact proper financial incentives on investor-owned utilities in their markets. Increased coordination between MISO and PUC policy-makers would yield more information regarding uneconomic operation. An example of coordinated policies could be statutory requirements for ISOs to share masked market data points within markets in order to provide operational transparency. In some states they are also required to approve IRPs and the closing of generating facilities. Legislators also have an interest to pursue diversified energy resources. They will likely be more motivated to modify the portfolio with accurate real-time estimates of the market demand.

Utilities and IOUs: PUCs should ensure they have access to the necessary generator data when conducting prudency reviews and should disallow imprudent costs. Generators operate at the direction of MISO but incur increased fixed costs on capital assets if underutilized. Power generators are responsible for being ready to respond to MISO dispatch needs, but do not retain authority over when to dispatch their power. This dynamic might contribute to uneconomic activity and utilization as well as contribute to distrust among stakeholders. More funds for securitization will allow IOUs to save resources, finances, and support their communities through transitions. Additionally, the increased access to information regarding self-suppliers on the market will help generators reduce wear or unneeded use of their capital assets. Trends regarding increased self-supply could also motivate more cost-effective capital investments for future projects.

Federal Regulators: The FERC plays a major role in energy affairs by law, with order 2222 being a major policy challenge for MISO stakeholders currently. Stakeholder discussions reveal the expectation for ISOs to submit compliance extensions in order to refine ISO plans to meet FERC requirements. Focus on recent FERC requirements might narrow focus among stakeholders promoting coordination regarding FERC 2222 but reducing focus and coordination on other issues.

MISO: MISO has a unique and critical position within the stakeholder environment because they manage the market in real time. For example, the ISOs "refresh" market prices in five-minute intervals in some cases. MISO is resource agnostic but manages the operation of an energy market with shared interests by generators, rate-payers, regulators, and legislators who are not resource agnostic.

Section 3: Factor challenges and interdependencies with other related factors

Major challenges to this factor include:

1. Unwillingness by utilities to share their market dispatch information and capabilities
2. MISO capability to comply with market transparency measures in a formal/statutory context. For example: their data may not be a perfect fit for statutory requirements but enable transparency in less formal coordination forms.
3. Transparency measures might create dispatch equity requirements making reliability and response to demand more difficult.
4. Cost recovery for capital assets is unlikely to be popular and may be perceived as "bailing out" certain energy providers.
5. Transparency might erode the impact of MISO Resource Agnosticism. Such erosion could reduce diversity in the MISO portfolio. For example, producers might exit the market gradually if certain

fuels were more economic or more streamlined for stakeholders to meet formal/statutory requirements.

6. Securitization is also a difficult recourse for IOUs and ratepayers, as the sunk cost fallacy often interferes with sound business and economic decisions.

Section 4: Matrix Characterization

Implement participation policy based on rate making and behind meter transparency

Likelihood of Occurrence:

A Reasoning: Medium, it is possible the inclusion of DERs in future IRPs could drive stakeholder interest in increased transparency measures

B Reasoning: High, if a change to the environment led to public known capital asset degradation, the reliability imperative framework makes cost recovery a very likely outcome.

Level of Influence:

A Reasoning: High, market transparency would cause a ripple effect across all stakeholders. This could lead to changed behaviors by generators, grid managers, and reorder policy priorities by regulators and legislators.

B Reasoning: Medium, Other than public offsetting asset losses, the market is not affected by cost recovery. However, if cost recovery incentivized poor upkeep practices, then market inefficiencies could develop based on poorly maintained generation assets.

Inferred Efficacy (Impact)

A Reasoning: High market transparency significantly alters the market environment as it could become a motivator for DER onboarding and erode "resource agnosticism" among regulators, grid operators, and shift public interest toward specific sources.

B Reasoning: Medium, Cost recovery policies would likely create unanticipated inefficiencies elsewhere or incentivize other uneconomic behaviors either offsetting gains or making situation worse

Increase securitization offers

Likelihood of Occurrence: High

Reasoning: paying operators to remove coal fired plants from the grid is the fastest and most efficient way of removing competition for renewable generators. The FERC will seize the opportunity to give money and oversight to MISO.

Level of Influence: Medium-High

Reasoning: this solution to removing coal fired plants will be highly influential with IOUs and ratepayers, however other stakeholders such as state lawmakers and PUCs will not be as influenced by the potential for federal interference.

Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): High

Reasoning: Paying IOUs to remove their inefficiently run and costly coal generation plants will free market space for more renewable generators to come online, particularly if energy storage becomes cheaper and more sought-after within the MISO footprint. It will also help struggling communities make the transition from fossil fuels to renewable generation.

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Statutorily enforced market transparency	Medium	High	High
Uneconomic use of capital asset cost recovery rejected	High	Medium	Medium
Increased Securitization Offers	High	High	High

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

1. ***Status Quo****:* Generators continue to self-commit resources, despite inefficiencies and unprofitability. Barring an increase in inefficient asset management, this is the worst-case scenario. If market rules remain the same and IOUs are not held accountable for inefficient asset management, ratepayers will continue to pay millions in unnecessary energy costs and coal will continue to "cut in line" and crowd out cleaner power sources.
2. ***MISO Implements transparency policy****:* MISO could share data that is currently not public with the PUCs so that they can provide more effective oversight. The entire point of cost for service regulation is to provide market-like incentives that ensure IOUs are managing assets efficiently and ratepayers are not "stuck" paying higher prices than necessary. Regulators cannot do their job without sufficient information that will allow them to determine the extent to which a utility is prudently (or imprudently) managing its assets. With more information, regulators can disallow imprudent costs, setting important precedents that make it clear to utilities that bad management is unacceptable, or as UoCS put it: "[such actions are] unacceptable and that the costs associated with that action cannot be recovered on the backs of captive ratepayers."
3. **MISO increases the securitization budget and planning:** securitization is an attractive offer to IOUs and will incentivize them to more quickly retire coal plants. However, if securitization is done in an unstructured manner or before other plants are capable of handling the load, the grid may experience more instability.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

Based on the comparisons in Section 5, it is recommended that MISO begin legal, and policy moves to make operation and efficiency data available for sharing with other stakeholders. In addition, request a larger securitization budget from FERC and begin planning IOU-based phase outs of coal-fired power plants.

Section 7: Remaining Questions

- What policy issues does MISO face in using sensitive industry information?
- How can securitization money be used effectively for communities at large?

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3. Improved Communication With Constituents

Analyst: Zach Siegert

Section 1: Background/Composition

Although state legislators make many of the long-lasting statutes that guide energy policy within a state under MISO's jurisdiction, they are often balancing these energy needs with several other competing interests in politics. Legislators are also not experts on these matters as regulators from PUCs and managers from MISO are in planning energy deployment. The problem arises in how legislators are able to communicate the complicated technical policy recommendations produced from PUCs and MISO managers to the general public in an understandable manner.

To best measure this factor, analysts will observe the themes of a proposed policy, the politics of the region in which these policies will be implemented, and the timing of the policy implementation. Upon describing these aspects, situations may be categorized into general groups that highlight certain policies that are appropriate for these different categorizations. Once appropriate timing of implementing these policies is identified, improved formatting of messaging delivered to legislators' constituents in a manner that maximizes the support and compliance with the joint efforts of the legislature, PUC, and MISO. For reference, when referring to "constituents," this is an umbrella term that refers to all stakeholders receiving communication from an entity.

Section 2: Stakeholder Overview

PUCs: PUCs are responsible for synthesizing the themes of technical information presented to legislators so that the most important points are communicated in ways that are not unnecessarily complicated. However, synthesizing the technical information should not go so far as eliminating key aspects of the policy recommendation. PUCs must be prepared to revise their explanations to legislators to facilitate wider understanding of what is being discussed. This in turn will allow legislators to have a stronger understanding of what information must be communicated to the general public. PUCs must also use their expertise to assist in the identification of time periods where specific policies will be more objectively salient. For example, weatherization of generator components has become a very salient topic after the extreme weather events in Texas. PUCs are more familiar with what is required of a utility system and must express the importance of policies that facilitate these measures to the individuals that decide on statutes relating to energy.

Legislators: Legislators must be prepared to ask questions to ensure they are fully aware of the technical information prepared by MISO and PUCs. The specific experience with areas represented will be invaluable to how themes from a PUC and MISO recommendations are to be presented. Legislators are highly attuned to respective constituents' needs and issues, therefore should be prepared to communicate with the PUC and MISO about how specific recommendations address the issues if at all. Finally, legislators capitalize on the political saliency of given proposals to maximize the effective timing a policy is introduced.

Utility (IOUs): Utilities must be aware not to interfere with communication between constituents and legislators. Some of the information disseminated by PUCs and legislators may be dispersed most efficiently through IOU communication with their consumers. They must be aware not to alter the messaging enough to the point that it completely changes the theme of the information, and instead only explains how the individual utility's participation would work so constituents have specific examples to look to.

Ratepayers/Consumers: Consumers are the end of much of this communication. Their role is far more passive than active in comparison to the other stakeholders. However, they should be engaged in educating themselves using the information provided by legislators and other sources. When this information is not communicated in an understandable manner, this issue should be communicated to legislators. Additionally, if there is an issue within MISO or the PUC's purview that is currently unaddressed, consumers must formulate this issue and the basis behind it to legislators so that they can work with PUCs and MISO to formulate solutions and explain how the solution will affect consumers' daily lives.

Section 3: Factor challenges and interdependencies with other related factors

Discuss any foreseen challenges arising within or from this factor. Note any connections with other factors within or outside of your module.

Politicization: Some communication may fall victim to political opportunism rather than objective benefit to constituents. State legislators may be wary to implement policies recommended from entities managing more than an individual state. While the political variable is perceived as far more important than is actually the case, analysts must still be cautious not to let politics in messaging become a "blame game."

Section 4: Matrix Characterization

Coordinate and Schedule with Legislators and MISO

Likelihood of Occurrence: Medium

Reasoning: Advocacy for states' rights is at an all-time high, and state relationships with MISO are becoming strained as a result. However, legislators nonetheless see the value in maintaining consistent meetings with regulators to better understand the issues they are voting on after gaining further insights from MISO.

Level of Influence: High

Reasoning: Becoming more involved with the state and local legislative process will signal MISO's willingness to work closely with state legislators and achieve solutions that mutually benefit both entities rather than impose unilateral regulations on them.

Impact: Beneficial

Reasoning: Coordinating and scheduling with legislators may not directly aid increasing renewable integration into the grid, but it may smooth the process of navigating the political hurdles of doing so using objective information from MISO and PUCs. The increased communication between these entities will mitigate any information asymmetry that leads either entity to feel disadvantaged and more likely to reject proposals from the other.

Creating Specific Information/Data Portal for Members of State Congress

Likelihood of Occurrence: High.

Reasoning: Communication is constant, particularly in political fields. Many constituents receive their information from legislators and media outlets rather than from institutions like MISO or PUCs. Even when constituents are not listening to their legislators and are instead choosing to do the opposite, communication between legislators and constituents is still occurring, making the likelihood of this factor occurring high.

Level of Influence: Med-High.

Reasoning: Depending on the constituency, communication between constituents and legislators has a varying influence. Some constituents value the words of their legislators highly, while others prefer to ignore anything from their legislators. However, if information is disseminated in ways that will be understandable to constituents, whether constituents agree or disagree with their legislator, they will have opinions on the information itself

Impact: (How effective is this strategy for increasing renewables into the grid's energy mix?): Neutral?

Reasoning: While communication is likely to occur on a regular basis, its ability to actually influence integration of renewables is limited by the influence constituents have in electing legislators. Additionally, constituents changing their behavior may change some things such as increased DERs in constituents' homes, but most changes in policies will require enforcement mechanisms to ensure their successful implementation.

Use the table below if needed.

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Coordinate and Schedule with Legislators	Medium	High	Beneficial
Create Specific Information/Data Portal for Members of State Congress	Medium	Medium-High	Neutral

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

Compare each outcome of your factor. Discuss the benefits and drawbacks.

1. **Status Quo**: As it stands right now, constituents are not very aware of the role MISO and PUCs even play in their daily lives. This does not incentivize any changes in constituents' behavior, nor is it a proactive way to address problems that may arise from poor grid management. Instead, this results in situations that are primarily reactionary and do not solve the causes of problems. Additionally, this prevents PUCs, MISO, and legislators from forming better relationships that foster future communication. Often, this can lead to situations where blame is shifted around after the fact when communication may better explain what is happening. This situation does offer the pro of giving more freedom for legislators to focus on other issues. Additionally, constituents may

not necessarily do much with the information provided to them, even if it is understandable. This would mean that not implementing this factor would likely allocate some resources that would have been used to facilitate communication to other objectives.

2. **Slight Improvement - Information Available as Needed**: With some communication from legislators to constituents, the public may become more aware of the roles of MISO and PUCs in managing the grid and ensuring electricity is delivered in a timely manner. This may be specifically pertinent when around time periods that raise the likelihood of a major issue in the grid such as extreme weather. During times preceding these events, constituents may look to be more informed about what steps institutions are taking to mitigate the negative effects of these disasters and if there are certain steps that they can take to mitigate any negative effects. Additionally, this information would be useful to constituents looking for ways to be more energy efficient and potentially implement renewables into their daily lives. However, this type of communication is limited in that it will only be accessed by constituents that have high enthusiasm and initiative to take steps to find this type of information. This limitation means that it will likely not be disseminated as widely as it should be amongst the general public. However, it would provide a strong base from which future communications can grow.
3. **Strong Improvement; Consistent Communication Directly to Constituents**: By communicating directly with constituents on a regular basis about the roles of MISO and PUCs as well as the behaviors constituents can change in order to facilitate the technical objectives that MISO and PUCs strive to achieve, a much wider base of constituents would be receiving information that is relevant to their daily lives. This provides constituents with information they may need during an emergency situation or if they decide to take initiative on a regular basis. This also disseminates the information to a wider audience as those without much initiative to look for the information that has been provided are now exposed to this messaging. The one drawback of this approach is that it requires a much larger devotion of time and resources for all parties involved (with the exception of constituents who will receive the information whether they searched for it or not). This increased time spent on formatting communications could be seen as unnecessary, particularly given the multitude of tasks PUCs, MISO, and legislators already contend with on a regular basis. However, the increased communication will likely yield a much greater resulting participation by constituents in the energy efficiency market and create a better understanding of the grid's operation in general.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

Based on section 5 comparison, which outcome is preferred, or which combination of outcomes is preferred? This can be the basis of a recommendation when this factor is applied to a scenario.

The implementation of this factor is relatively simple in comparison to other more technical factors as communication primarily requires time and cooperation, even if the ultimate impact is less than others. The preferred outcome would be outcome 3 as it is the most all-encompassing and ensures the largest audience possible is exposed. However, given that it is a large change from the current status quo and requires the most resources, it is understandable to initially reach outcome 2 where information is made available rather than actively disseminated and then gradually implementing more active communication over time.

Section 7: Remaining Questions

- (Communication question) What infrastructure (software or otherwise) is needed to provide real-time information regarding communication between constituents and legislators?
- (Communication question) How often is information disseminated to the public effectively reaching the widest audience possible?
- (Communication question) What groups of constituents are most likely to take initiative if information is disseminated as in outcome 2?
- (Communication question) What groups of constituents will be the most difficult to reach if information is disseminated widely as in outcome 3?
- What commonalities consistently occur among different PUCs that may be assisted by MISO-wide guidance?
- What categorizations of scenarios are most likely to occur, thus being the most pertinent for communicating to constituents?

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4. Improved Inter-Agency Communication

Analyst: Olivia Leos and Alyssa Shipman

Section 1: Background/Composition

Consistent interaction between PUCs, generators, utilities, and MISO are generally nonexistent in the present regulatory structure. This is generally due to the different incentives each of these players have, and the roles they are willing to fulfill to meet said incentives. Aligning and finding overlap in incentives will improve market function, help avoid redundancies, and accelerate renewable energy technology integration.

The exchange of technical information between MISO and PUCs or state oversight bodies is non-existent, which makes PUCs' decisions on generator operation asymmetrical and incomplete. In order to correct this asymmetry and give PUCs the ability to limit uneconomic self-commitment and dispatch, MISO must design a policy platform which legally transfers industry information to PUCs while continuing to protect generators' trade information.

Section 2: Stakeholder Overview

<u>PUC and Legislators:</u> States which have PUCs review utilities' rates for consumers and can approve and reject a utility's rate structure or reimbursement for operation based. PUCs also approve IRPs. Legislative bodies have considerable power to incentivize IOUs, communicate with ratepayers, and allow for generating facilities to be shuttered. Legislators may also use the information to decide whether or not statutes allowing fuel costs to pass directly to customers should be removed.

<u>Utility (IOUs):</u> Utilities need to have an incentive to operate economically and function outside of the incentive of maximizing their rate base. MISO has the information and ability to share their utility's fuel cost and rate information.

Ratepayers/Consumers: Once information about fuel costs is passed on to public and state knowledge, ratepayers may make more informed decisions about utilities and express opinions to legislators and the PUCs. By aligning MISO and PUC incentives, consumers will benefit by having better transparency of price signals and with better information pressure utilities into open market competition.

Section 3: Factor challenges and interdependencies with other related factors

Issues with communication between MISO and PUCs: People do not like change. It may be difficult to convince all PUCs and MISO to get on board with one way to share information. Chat websites also do not offer ways to archive the information. Meetings and Zoom are often dreaded by employees and may not be effective ways of communicating.

With difficulties in balancing the power and rights of various organizations, it will be important to ensure consistent and equitable information rollouts for all stakeholders involved.

Section 4: Matrix Characterization

MISO shares technical data with PUCs

Likelihood of Occurrence: Medium.

Reasoning: Devin stated that there is beginning to be pressure from FERC, for better collaboration. Much of the data gathered by IOUs is considered proprietary secrets and will require further legal research.

Level of Influence: High.

Reasoning: Better technical information will allow PUCs to plan better for integrating renewables into the grid.

Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): Beneficial

Reasoning: Better collaboration would decrease inefficiencies in the system and carve a path for better integration of DERs into the grid.

MISO market design incorporates Price Signals

Likelihood of Occurrence: High.

Reasoning: Devin stated that there is beginning to be pressure from FERC, for better collaboration. In addition, in a paper published by MISO, *MISO's response to the Reliability Imperative*, MISO wrote that as the "As the generation mix changes, it is important for MISO to provide signals about what will be needed to ensure reliability, and to give the right price incentives when the system is in need. Markets can provide useful signals across multiple time frames." MISO is already considering this action.

Level of Influence: High.

Reasoning: Signaling to IOUs that both the states and MISO are using prices as market indicators will hasten IOUs into reducing fuel spending.

Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): Beneficial

Reasoning: Allowing the markets to better function as markets and internalize all costs will keep IOUs accountable and create space for renewables to integrate into the grid.

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact

MISO shares data with PUCs	Medium	high	beneficial
Market design incorporates Price Signals	High	medium	beneficial

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

1. ***Status Quo****:* The different actors continue acting on their primary incentives, with little to no interaction or sharing of information, leading to redundancies and less informed rate structure actions by the PUCs. Continual over pricing of rates for the consumers and little incentive for renewable integration by utilities. Current incentives: Utilities continue operating by maximizing their rate base. PUCs continue to prioritize turf protection and cost prudency; and MISO continues ensuring reliability and satisfying transmission owners.
2. ***MISO shares data with PUCs****:* MISO could share fuel cost and operational efficiency data with the PUCs so that they can provide more effective oversight and rate structures. With more information, regulators can disallow imprudent costs to the consumer and better information for rate structures and oversight of PUCs on utilities. In addition, in order for the regulatory process to work the PUC has to be sufficiently informed about utility information, including best management practices and best plan practices. This information can be delivered by MISO to the PUCs to increase regulatory frameworks. A con of increasing communication between State and MISO is the fear of the state losing autonomy to FERC.

   The current known solutions are:
   - Information sharing on a website where PUCs and MISO upload (maybe monthly?)
   - Chat websites (Jabber) to share information instantly
   - Face to face meetings (Zoom for now)

   Efficiency: It will not increase renewables, but it will increase efficiency among the PUCs and MISO.
3. ***Market design incorporates Price Signals:*** MISO must design a market which legally transfers industry information to PUCs while continuing to protect generators' trade information. In order to do this, there must be an alignment of PUC, utility, and MISO incentives. One method of aligning incentives would be by incorporating price signals to drive reliable behavior of market participation. Utilities are mostly concerned with maximizing their rate base, which leads to uneconomic running of plants and a lack of incentive to integrate renewables. With price signals, utilities will have to think about economic efficiency, increasing pressure on MISO to also improve economic efficiency in order to not irritate utility stakeholders. This drives communication of fuel cost and redundancies between PUC and MISO. This will increase market collaboration and a market design can be incorporated that increases market participation. Con: Price signals may show renewable energy integration to be more expensive.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

Outcomes 2 and 3 are ultimately preferred over the status quo. A combination of both outcomes would be best for aligning MISO, PUC, and generator incentives and incentivizing the integration of renewable energy. Implementing these aspects of the factor will work concurrently with increased communication to constituent stakeholders.

Section 7: Remaining Questions

- (Communication) What analysis is MISO lacking to inform policy design?
- (Communication) What analysis are state PUCs lacking to inform policy design?
- (Regulatory) Can a pilot program including price signals or performance-based ratemaking be incorporated into the Midwest?
- (Regulatory) Has MISO looked into market designs to align incentive with PUCs?

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DER Module Factors

The DER module is responsible for evaluating the economic potential of Distributed Energy Resources (DERs), researching the best methods for RTO compliance with FERC Order 2222, identifying the institutional and policy framework that can assist in the increased deployment and integration of this technology. To achieve this goal the module has outlined five factors most relevant to DER integration and deployment. The factors are ranked by importance as follows:

1. Financial Considerations relating to DERs
2. Cross-Institutional Information Exchange and Communication

3. Distributed Energy Resource Ownership Structure Availability
4. Compliance and Implementation of FERC Order 2222 by ISOs
5. Regulatory Framework of DERs in the Retail Market

Each of these factors has been described below in detail.

1. Financial Considerations relating to DERs

Analysts: Jacob Selgestad and Vasiliy Sinelnyy

Section 1: Background/Composition

- FERC Order 2222 has opened the door for the extensive integration of DERs into wholesale energy markets.
- The financial considerations related to DER integration are a central factor in determining the potential benefits of DER integration under different scenarios.
    - Financial considerations related to DERs include the impacts of DER integration on Energy Costs, improved grid reliability, the use of ITCs and PTCs, and the use of rate-based or performance-based accounting methods.

Section 2: Stakeholder Overview

- RTOs
    - Manage the grid and will set the rules that will determine what DER's must do to access the wholesale market. Financial benefits related to DER integration will be largely determined by the rules RTOs will implement pursuant to FERC Order 2222.
    - RTOs are also relevant stakeholders to the extent that DERs improve grid resilience, and RTOs are responsible for operating the grid.
- Consumers
    - Consumers experience many of the benefits of DER integration. DERs have the potential to lower and stabilize energy costs while also improving grid resiliency. These are all good things for energy consumers.
- Current Generators
    - DER integration into the wholesale market will reduce the demand for new large-scale energy generation facilities.
    - DER integration has the potential to increase competition among wholesale energy sellers, which could lower energy prices (which reduce the returns current generators earn selling energy).

Section 3: Factor challenges and interdependencies with other related factors

- ***Regulatory Obstacles***: There are a number of potential regulatory obstacles that could limit the ability of DERs to enter the wholesale market and access these potential financial benefits.
    - NOTE: (will be discussed in regulations more but the decisions from this article are what I am referencing) https://blog.aee.net/ferc-opens-the-door-for-ders-in-wholesale-markets.-now-its-up-to-grid-operators-to-bring-them-in
    - There is a healthy market for DERs in the retail energy market supported by the decreasing cost of DERs as well as government policies and programs that subsidize DER installation.

        - DER installations will continue to grow. This will happen regardless of the extent to which DERs will be able to access the wholesale market.
            - NOTE: (essentially, regulatory obstacles exist, but these obstacles will not prevent the expansion of DERs, but rather, prevent the benefits of DER integration into the wholesale market from being realized)
    - These obstacles create significant interdependencies between the financial considerations factor and the FERC Order 2222 and Regulatory Framework factors. The extent to which the benefits of this factor are accessed largely depend on these factors.
- ***Resistance from Current Energy Generators:*** Current energy generators would likely oppose extensive integration of DERs into the wholesale energy market, as it reduces the demand for new energy generation facilities.

Section 4: Matrix Characterization
Energy Cost Savings

Likelihood of Occurrence: Med
Reasoning: Depends largely on regulatory decisions. Unclear what those decisions will be at this point.
Level of Influence: High
Reasoning: This is seemingly one of the main reasons for the passage of FERC Order 2222
Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): High.
Reasoning: This provides an economic incentive for DER integration into the wholesale market

Improved Grid Reliability

Likelihood of Occurrence: Med
Reasoning: Depends largely on regulatory decisions. Unclear what those decisions will be at this point.
Level of Influence: High
Reasoning: This is one of the primary benefits of DER integration besides cost savings and increased use of renewables.
Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): Med.
Reasoning: Grid operators could support additional DER integration if they realize the potential benefits it provides for reliability.

Use of ITCs and PTCs

Likelihood of Occurrence: High
Reasoning: Drives incentives to use DER's
Level of Influence: High
Reasoning: Gives access to additional resources to implement DER's.
Inferred Efficacy (Impact) (How effective is this strategy for increasing renewables into the grid's energy mix?): High
Reasoning: Past data.

Factor Outcomes	Likelihood of Occurrence	Level of Influence	Impact
Energy Cost Savings	Medium	High	Beneficial
Improved Grid Reliability	Medium	High	Beneficial
Use of ITCs and PTCs	High	High	Beneficial

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

DER Integration and Energy Cost Savings

- ***Optimizing Overall Asset Utilization:***
- ***Competition:***
    - Increased competition reduces prices. This should manifest in relatively lower costs for energy consumers.
- ***Reduced Need for Capital Investment:***
    - DERs can displace other modes of energy generation as demand increases.
        - Traditionally, the increase in demand would be met by building new generation facilities.
            - These generation facilities are costly to build. If DERs can offset the additional demand these facilities are needed for, this cost can be avoided.
        - Reduced capital investment costs should manifest in relatively lower energy costs for energy consumers.

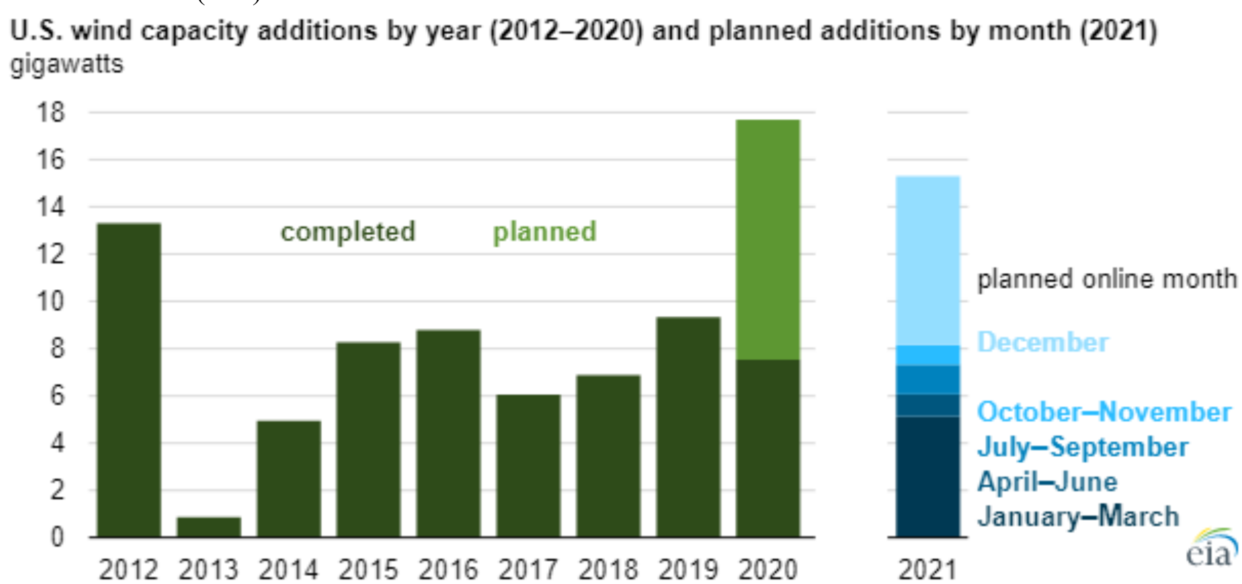
DER Integration Improved Grid Reliability

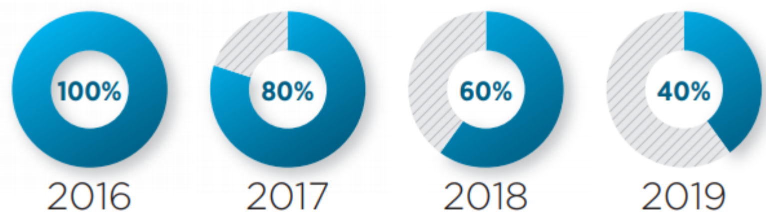
- ***Increased Grid Capacity:*** The installation of DERs often requires a new grid-connected energy storage system. The expansion of these grid-connected energy storage systems increases the overall capacity of the grid, improving reliability.
- ***Grid Resilience:*** DERs improve grid resiliency by providing energy downstream from more vulnerable generation, transmission, and distribution systems. If a major event such as extreme weather or a terrorist attack negatively impacted the more vulnerable, upstream systems, DERs would be able to pick up some of the slack, improving overall grid resilience.
- ***DER Optimization :*** Optimizing DERs has the potential to increase reliability
    - NOTE: (not sure this justifies its own section but keeping it separate for now, pending further research)

Production Tax Credits (PTC) / Investment Tax Credit (ITC)

Production Tax Credits (PTC)

- The renewable electricity production tax credit (PTC) is a per kilowatt-hour (kWh) federal tax credit included under Section 45 of the U.S. tax code for electricity generated by qualified renewable energy resources
    - Extended through 2023
    - Before the extension, estimated revenue losses (tax expenditure) associated with the PTC are $19.3 billion between 2019 and 2023
        - Congress extended the PTC at 60% of the full credit amount, or $0.018 per kWh ($18 per megawatt hour), for another year through December 31, 2021. In 2020, the credit was 60% of the full credit amount. Under the new PTC legislation, qualifying wind projects must begin construction by December 31, 2021.
    - Joint committee on taxation (JCT) estimated that tax expenditures for the PTC would be $19.3 billion between 2019 and 2023
    - Subsidy reduced the average cost of electricity, increasing demand for electricity overall, countering energy-efficiency and emissions reduction objectives
    - In 2021, project developers expect 12.2 GW of wind capacity to come online, of which they expect 7.2 GW (59%) to come online in December
    - The 2015 PTC and ITC extensions are projected to result in approximately 50 GW of additional renewable capacity by the early 2020s
    - The amount that may be claimed for the PTC is set to phase out once the market price of electricity exceeds threshold levels
    - PTC-eligible taxpayers have the option of claiming the 30% energy investment tax credit (ITC) in lieu of the PTC





2.3 cents per kilowatt-hour

FIGURE 3. The annual value of the federal wind production tax credit (PTC) expressed as a percentage of the full wind PTC credit of 2.3 cents per kilowatt-hour (in year 2016 dollars).[6] The schedule reflects commenced-construction dates.

Investment Tax Credits (ITC's)

- ITC covers photovoltaics and solar thermal technologies. Businesses that develop or finance commercial and utility solar projects claim a credit on their corporate taxes (under Section 48 of the IRC)
- Since the ITC was enacted in 2006, the U.S. solar industry has grown by more than 10,000%
- The federal investment tax credit (ITC) is an economically valuable tax incentive offered to taxable business entities that invest in certain energy technologies. The ITC is based on a percentage of the qualifying upfront capital costs of a project and directly reduces a business's tax liability
    - homeowners that purchase their own residential solar systems claim the credit on their personal income taxes (under Section 25D of the IRC).
        - Large wind energy systems are eligible to claim the ITC in lieu of the PTC; the ITC for large wind is 30%

Table 1. Solar Investment Tax Credit Deadlines

Year of Commence Construction	Deadline for Placement in Service	ITC Amount
2019	End of 2023[a]	30%
2020		26%
2021		22%
2022 onward	2022 onward	10%

- Subsidies reduce the average cost of energy, encouraging energy consumption, countering energy conservation initiatives, and offsetting emissions reductions

- Subsidies approach is not the most efficient way to achieve the policy objective
- Tax subsidies do not necessarily provide a comparable incentive for all emissions reduction alternatives and may favor more costly reductions over less costly ones. Finally, tax subsidies also reduce tax revenues. To the extent that these subsidies are financed by distortionary taxes on other economic activities, they reduce economic efficiency
- The 2020 extension of the ITC has provided market certainty for companies to develop long-term investments that drive competition and technological innovation, which in turn lowers energy costs for consumers.
- Renewable energy tax credits have been included in a $1.4 trillion federal spending package alongside a $900 billion COVID-19 virus relief spending bill. The solar investment tax credit (**ITC**), which was scheduled to drop from 26% to 22% in 2021, **will** stay at 26% for two more years.
    - Commercial and utility-scale projects which have commenced construction before December 31, 2023 may still qualify for the 26 or 22 percent ITC if they are placed in service before January 1, 2026.

Section 6: Implementation

Implement favorable regulations that encourage DER participation in the market. Less participation barriers the better.

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1. Cross-Institutional Information Exchange and Communication

Analyst: Ananya Rao

Section 1: Background/Composition:

There is a limited, and in some instances no, institutional relationship which has been established between ISOs and local distribution departments within IOUs. This operational separation has functioned in the status quo market, but as DER integration continues to increase this lack of information exchange will lead to problems including real-time monitoring issues. Through demand monitoring DERs usually reveal themselves as reductions in demand but increasing the visibility of DERs could lead to real benefits for the grid. Further, institutional relationships built between distribution departments of IOUs and MISO transmission can lead to increased cooperation between the two entities as DERs become more popular. Theoretically, creating additional information exchanges and communications between entities can lead to enhanced grid monitoring, reduced operating costs, increased reliability and increased grid capacity.

Section 2: Stakeholder Overview:
- IOUs, distribution operations
- MISO
- DER owners

Section 3: Challenges and Interdependence with Related Module Factors
- This relationship is not currently established and is not a typical relationship.
- The types of information that should be exchanged between distribution departments, IOUs and MISO needs to be established.

Section 4: Matrix Characterization

Factor Outcomes/Components	Likelihood of Occurrence	Level of Influence	Impact
Increased communication between MISO and DER aggregators	High	High	Beneficial
Create communication networks at the regional-level	High	High	Beneficial

Section 5: References

1. https://www.powermag.com/press-releases/new-iiot-application-gateway-technology-enhances-der-and-smart-grid-monitoring
2. https://pubs.naruc.org/pub/67F0F5A8-F49D-9E86-FD4D-EDDE825B007E
3. https://www.energy.gov/sites/prod/files/2017/04/f34/2_T-D%20Interface%20Panel%20-%20Lorenzo%20Kristov%2C%20CAISO.pdf
4. https://www.powermag.com/distributed-energy-resources-affecting-transmission-system-operators/

3. Distributed Energy Resource Ownership Structure Availability

Analyst: Hannah Abell

Section 1: Composition
There are four main structures of DER ownership: individual ownership, utility ownership, third-party ownership, and community ownership.

For consumers that are able to purchase DERs, a purchase can be made through covering all costs or taking out a loan (potentially through a low-interest loan like HELOC - home equity line of credit). In this model, the purchaser typically must be a home or business owner. For consumers not wanting to outright purchase a DER system, the other option for home or business owners is third-party ownership which often takes the form of leasing or power purchase agreements (ILSR). This ownership structure helps to reduce upfront costs and other barriers to adopting rooftop solar (or other DERs) (ILSR). However, this third-party ownership option is not available in all states (and currently not available in Indiana) (ILSR).

For consumers who are not home or business owners, the options for ownership become sparse. In the US, the discussion of distributed energy resource (DER) ownership for non-homeowner consumers mainly centers around two options: utility-centered ownership and nonutility-centered ownership (or third-party ownership) of a community solar project. The Department of Energy and AEE suggest that utility ownership of DERs can be appropriate in certain instances where there is not a current market for DERs. These are spaces for which utilities and another party could work together to create a small-scale solar project. This method is often thought of as the foundation for a future competitive market (Advanced Energy Economy, 2017). The drawback to this model is that the communities of low- and moderate income (LMI) consumers are not included/or are still unable to take advantage of these projects.

There is an additional model for community-ownership. In this model, community members and local stakeholders own most of the project and act as decision-makers within the process. This model allows for many of the project's socio-economic benefits to be applied to the local community (IRENA). This model can mean full ownership by the community, but other ownership structures such as community owners combined utility owners are also possible. Community ownership in DER projects has been highlighted as a way to increase DER deployment in communities of low- and moderate-income consumers (Baker, 2021). However, community/shared DER (solar) projects are not currently available in Indiana (ILSR).

Section 2: Stakeholder Overview

PUC and Legislators: PUCs may need to work with State legislators to create DER enabling policy which can reduce barriers for all consumers to participate in DER ownership. These policies can request certain types of projects be started by utilities such as co-ownership between IOUs and communities.

Utility (IOUs): IOUs can take part in co-ownership of DERs and also gain benefits from these projects. This co-ownership also gives way for the potential for increased visibility of the systems for the distribution (IOU) and transmission (RTO) teams.

Ratepayers/Consumers: Reducing barriers to ownership will give consumers more opportunity to tap into the benefits provided by DER systems.

Third-party DER Providers: These providers can become key to middle- or high-income consumers who want a DER system, but do not feel equipped to manage the administrative burden or high upfront costs associated with installing a system.

RTOs: Ownership structure could impact level of visibility for grid management

Section 3: Challenges and Interdependence with Related Module Factors

The success of DERs and impacts on ownership have additional considerations:

Regulatory framework- Use of net metering, net metering allows users to gain credit for excess power they produce that is then used on the grid. Virtual net metering could also play a role.

Financial considerations- Tax credits such as the Investment Tax Credit (ITC), the PV owner could receive this credit if they are commercial, industrial, or utility. A residential panel owner may only receive credit for panels installed on a home the taxpayer owns and uses as a resident.

Financial considerations- Pricing and valuation of the solar project will be the basic test to decide if a project is feasible. Further, the incorporation of intangible benefits like public health and other social benefits should be included. (Baker et al, 2019)

Regulatory framework- Potential for leasing or PPAs, this is essential for third-party ownership structures

As discussed in Section 1, Indiana does not presently allow third-party ownership (through leasing programs) and does not allow community/shared projects. This is a major barrier to increasing deployment of DERs because it greatly reduces the types of consumers who can own DERs.

Section 4: Matrix Characterization

Table 1. Factor Outcomes as Ownership Structures with characterization for each

Factor: Ownership Structures	**Likelihood of Occurrence**	**Level of Influence**	**Impact**
Individual Ownership Dominant	High	High	Neutral
Utility Dominant	Med	Med	Beneficial
Third-party Dominant	High	High	Beneficial
Community Ownership	Med	Med	Beneficial

Likelihood of Occurrence: Half of all states currently allow third-party ownership and about twenty states allow community or shared solar. Indiana currently allows individual ownership and there has been a pilot program for utility ownership-based models.

Influence: Indiana does not currently have strong enabling policies for the expansion of DER ownership. Further, it is unclear how strongly legislatures would like to pursue an expansion of DER ownership.

Impact: Expanding ownership options should highly influence the availability of DERs.

Section 5: Comparison of Various Ownership Structures (Comparison of Factor Outcomes)

DERs provide benefits including "deferrals of generation, transmission, and distribution capacity expansion; reductions of air pollution, system losses, and demand during peak times; savings of fuel and other costs associated with energy production; provision of ancillary services; and reliability enhancement." (Peskoe, 2016)

(Benefit = +, Con = -)

Individual Ownership

+ Full benefits to owner/host
+ Control on placement
- Due to high upfront costs this method is not available to all consumers
- Administrative process falls to individual owner
- Smaller constrained project sizes (home-sized)

An individual ownership dominant structure is the current landscape for DER system ownership in Indiana. This model is typically available to middle or more likely high-income consumers. This limits the deployment of DERs to a smaller subset of energy consumers. Additionally, it limits the financial benefits available from the purchase of DER systems to this subset of the population as well. The financial burden of DERs is a roadblock to increasing the prevalence of the technology.

Third-party Ownership
+ Works well for home and business owners
+ Reduces barriers to attaining DER systems
+ Host and third-party company receive benefits
- Not currently allowed in Indiana,

Allowing leased solar removes some stress from home or business owners. This reduced administrative stress and reduction of upfront costs can also increase DER deployment. This option is mainly available to home or business owners, so certain subsets of the population would be left without access to DER ownership if this were the dominant ownership structure.

Utility-Centered Model
+ Increased control for distribution
+ Increased local resilience (concern for customers)
+ Consumers can subscribe to projects if a system is not appropriate for their home/business
+ Can be larger project
- No current legislation/PUC rules on this model in Indiana
- Fair competition concerns

This ownership model has concerns with decreasing competition, especially in areas where there is a solar market via third-party or individual ownership. If the model is implemented through policy, special considerations may be needed for various income level customers to increase inclusion. IURC did approve a pilot program to lease solar through Duke Energy in 2019.

Based on the research of AEE, utility dominant ownership models create concerns with fair competition in a free market environment. For this reason, ownership dominated by utilities would not be appropriate for all areas of the market. For instance, low- and moderate- income consumers would not typically be able to afford to be a part of a solar project through individual ownership, yet if available, these consumers might be able to take advantage of a utility owned project. Another subset of the population unable to take advantage of individual ownership include renters, homeowners with shaded rooftops, and owners of inappropriately oriented homes. Utility owned projects could also allow participation of these market segments. In these markets, DER deployment should increase. Additional increases might be seen if policies enable underserved communities to gain access to DERs.

Community-Ownership models (IRENA)
+ Costs can be shared, which lowers upfront investments
+ Lower energy costs for the community
+ Community owned projects could also be community scaled and potentially paired with storage

+ Expands ownership availability
- Not currently allowed in Indiana

Similar to the above ownership model, this structure can expand ownership capabilities to low- and moderate- income consumers, renters, homeowners with shaded rooftops, and owners of inappropriately oriented homes. Community ownership alleviates siting issues by providing decision making opportunities to the community in which the project is sited. Further, many of the benefits of the project will go to the community in which it is placed. If policies enable underserved communities to gain access to DERs, then DER deployment should increase.

Section 6: Implementation

Implementation 1: *To expand DER deployment, a policy of co-ownership of DERs should be established for qualifying LMI households and communities in partnership or co-ownership with IOUs.*

Indiana does not currently allow shared/community solar but co-ownership of DERs for community style projects should be included in policy initiatives for states that wish to increase DER deployment (ILSR). This co-ownership can be between LMI consumers/community stakeholders and utilities. This uses the principles discussed in AEE regarding the need for utility-centered projects in areas where there is not a current market. DERs are typically for higher income households and the related benefits, therefore, typically are unavailable to low-and moderate-income households.

This recommendation advances DER deployment for communities that may otherwise miss out on DERs due to high upfront costs and provides these communities with the socio-economic benefits of DERs. This method may also reduce the concern of utilities for cross-subsidization. IOUs argue the consumer most impacted by DERs are the LMI customers, because current rate structures "subsidize customers who can afford to implement renewable energy at the cost of those who cannot."(Peskoe, 2016) This structure would reduce this argument by placing benefits with LMI customers and customers who can

Implementation 2: *Allow middle/higher income households to utilize leased DER systems through third-party or utility ownership.*

Half of all states allow leased DER systems for residential homes (Peskoe, 2016). Currently, neither solar leasing nor power purchase agreements are available in Indiana through a third-party (Solar-Nation and ILSR). IURC did approve a pilot program to lease solar through Duke Energy in 2019. This third-party ownership structure for middle-high income households decreases barriers to adoption. The counterfactual for Indiana is the current landscape for ownership- this is one in which the only way to have reduced upfront costs is to receive a loan.

Section 7: References

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4. Compliance and Implementation of FERC Order 2222 by ISOs

Analyst: Logan Pollander

Section 1: Background/Introduction

FERC Order 2222 is the latest in a series of federal rules in which the Federal Energy Regulatory Commission has intervened in regional markets to attempt to increase the presence of small-scale energy resources in the grid. It is preceded by Order 719, which directs RTOs to establish rules for demand-response in their markets; Order 745, which requires that RTOs compensate DERs at locational marginal prices just as any other energy resource would be compensated; and Order 841, which directs RTOs to establish rules for the participation of storage resources in energy markets.

Order 2222 mandates that RTOs and ISOs allow DER aggregators to compete on a level playing field "in all regional organized wholesale electric markets." RTOs and ISOs are required to have a plan for compliance with Order 2222 in place by July 19, 2021. However, compliance is complicated by a number of factors, such as locational requirements, metering and telemetry, exemptions for certain regulatory bodies, and communication between RTOs, state regulators, and local utilities. Therefore, it is anticipated that nearly all RTOs will require additional time to complete their compliance plans.

Section 2: Overview of Stakeholders

MISO: As the RTO overseeing electric resource distribution in this region, MISO is responsible for creating a plan for compliance with Order 2222. Ultimately, the guidelines they develop will determine the extent to which DERs are able to be successfully integrated into the grid.

Other RTOs, especially PJM: MISO and PJM have formed a "joint and common market" to reduce interconnection costs and create uniform market rules. Therefore, PJM's compliance scheme could influence MISO's, and vice versa.

FERC: As the federal authority that wrote Order 2222, and will ultimately approve both compliance plans and requests for extension. At present, although FERC has successfully defended its rulemaking in the past (for example, Order 719), it appears that they are willing to show leniency regarding timeline extension and allow ISOs to have jurisdiction over the finer minutiae of compliance in their respective regions.

Utilities/current generation resources: As the dominant source of electricity generation, traditional electric utilities have a financial stake in the presence of DERs on the grid; their interests may influence the rules and regulations MISO ultimately creates for compliance with Order 2222.

States and RERRAs: The intention of Order 2222 is for RTOs to work alongside states and Relevant Electric Retail Regulatory Authorities to implement the Order; this will necessitate holistic and proactive communication and coordination between RTOs and other regulatory bodies. Of note, Order 2222 does not apply to all RERRAs--this will be discussed below.

Section 3: Different Considerations for Compliance/Issues and Challenges

Communication between MISO and other regulatory bodies: As mentioned above, the spirit of Order 2222 is that MISO and other RTOs will work alongside transmission and distribution utilities, state regulators, and DER aggregators to reach agreements about compliance. Some of the framework for coordination between these parties may already be in place. Regardless, new challenges will arise as DER presence increases, and continued open communication will be necessary.

DER Aggregation: Just as DERs themselves can take a number of forms, DER aggregators are varied and diverse. Aggregators can encompass one or multiple assets and can have a capacity as small as 100 kilowatts. It will fall upon MISO to determine locational requirements and geographical size constraints (i.e., how spread-out a single DER aggregation can be) for DERAs. However, Order 2222 specifies that these constraints must be "as broad as technically feasible."

Availability of Information: Many DERs are behind-the-meter resources, which makes them increasingly difficult for RTOs and utilities to effectively monitor and quantify them and their overall impacts on the distribution system. As a result, DERs are not accurately reflected in grid models and projections, and their presence may have unforeseen effects on the necessity of deployment of other energy generation resources.

Metering and Telemetry Requirements: Under Order 2222, RTOs have the authority to set requirements for metering and telemetry, defining the type and quantity of information that DERAs and their users must provide to parties such as regulatory bodies and the RTOs themselves. Increased metering and telemetry will increase the amount of data available to transmission planners and help them better conceptualize the total presence of DERs within their footprint. However, excessive metering requirements could prove prohibitively expensive for DERAs to implement; therefore, the Order prohibits requirements that "pose an unnecessary and undue barrier to individual DERs."

Control Over DERs: Especially without adequate metering, it is uncertain which parties will have access or authority to control DER operation. Generally, RTOs plan generation and transmission through day-ahead and real-time markets, ensuring that supply matches demand in real time. If they do not have control over DERs and DER aggregators, then these sources of energy may not be able to be reliably used by RTOs to meet forecasted energy demands. Rather, the inverse will be true, and RTOs will face the challenge of forecasting the impacts that DERAs have on energy demand.

Small-Scale RERRAs: Regulatory authorities that see sales of <4,000,000 megawatt-hours per year are specifically exempt from Order 2222. Rather than facing the same requirements as other regulatory bodies by default, they are at the liberty to opt in and allow or prohibit DER aggregation as they choose. For especially small municipalities, the regulatory complexity presented by DERs may prove too complex, while small-scale generation utilities may see additional DER deployment as a financial threat. Although they may choose to opt in, if any RERRAs choose not to, then the effects of MISO's compliance plan will not be uniform across the board, and certain stakeholders will interact with it differently.

Section 4: Matrix Characterization

Factor Outcomes/Components	Likelihood of Occurrence	Level of Influence	Impact
Quick Compliance	Low	High	Beneficial
Slow Compliance	High	High	Neutral
Extensive metering & telemetry requirements	Medium	Medium	Neutral
High rate of opt-in amongst small-scale RERRAs	Low	Medium (potentially low?)	Beneficial
Low rate of opt-in amongst small-scale RERRAs	High	Medium	Detrimental

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

Compliance Speed

If MISO and other PUCs are faster in their crafting of compliance plans for Order 2222, the pathway to DERA integration will be developed more quickly, allowing DERAs to enter the market sooner. However, quicker compliance will reduce the amount of time available for stakeholders, especially DERAs and utilities, to communicate their needs and concerns, increasing the chances that those needs, and concerns will not be adequately accounted for in compliance plans. If the latter is the case, PUCs and small-scale RERRAs may not have time to adjust to new grid conditions, or the barrier to entry for DERAs may remain too high

Opt-In Amongst RERRAs

If small-scale RERRAs voluntarily opt in to 2222, the regulatory landscape throughout MISO's footprint will be more uniform. However, this may be at the expense of smaller RERRAs lacking the ability to adequately track or regulate all generation capacity in their area.

Metering & Telemetry Requirements

MISO and other regulatory authorities would benefit from the increase in available information, which would allow them to more accurately understand the assets within MISO's footprint. However, higher metering requirements may necessitate more equipment for DERs, forcing them to incur additional costs that may prove prohibitive for smaller DERs.

Section 6: References

a. MISO meeting, 2/19/21--DER market integration
b. MISO Order 2222 compliance timeline
c. FERC article on Order 2222
d. ISO New England description of Locational Marginal Pricing
e. AEE article on Order 2222
f. ISOs request extension for 2222 compliance filings
g. A Primer for Understanding FERC Order 2222
h. FERC's factsheet
i. ISO New England's progress on compliance
j. MISO and PJM's joint and common market
k. FERC Order 719 and denying rehearing of 719-A

5. Regulatory Framework of DERs in Retail Markets

Analyst: Fatima Khalid

Section 1: Background/Composition

This factor considers the possibility of DER integration with the grid without aggregation of DERs at the local or state levels. Here issues of double-counting may arise, which may undermine the cost-feasibility of DERs. If DER services are being overpaid for, state and local authorities may not be too favorable towards them and would push for having an opt-in clause.

While FERC Order 2222 addresses the integration of Distributed Energy Resources (DERs) into the wholesale electricity market, the regulatory framework governing DER grid-integration at the distribution level remains weak. A retail framework that allows for DERs to provide multiple services at both the wholesale and retail market levels will allow for increased resiliency, lower costs, and energy independence for consumers. However, when DERs are directly connected to the transmission system (or inject net energy into the transmission system, whether behind-the-meter or in-front of the meter) there may be some jurisdictional issues as the power does not directly go to an end-user but to an intermediary through a transmission system that is interstate. This potentially puts it under FERC jurisdiction, but is not very clear-cut as the distribution system interconnections may be state- or locally- regulated. Additionally, when retail suppliers purchase electricity from behind-the-meter DERs (mostly consumer-owned) they are reselling it and hence wholesale market rules which again fall under FERC regulations apply.

Finally, provisions for net-metering of behind-the-meter DERs need to be clearly established. Historically, net-metering which is the purchase of power from behind-the-meter DRs owned by consumers to supplement the grid has caused stability and transmission congestion issues because of grid-loading. Developing a comprehensive body of law governing compensation of net-metering through tax credits could encourage more consumers to install behind-the-meter renewable DERs.

Section 2: Stakeholder Overview

- **PUC and Legislators:** To determine compensation rates for both aggregated and non-aggregated DERs that have inter-connections with the retail markets and with wholesale markets. To also negotiate with FERC to determine jurisdictional boundaries.
- **FERC and MISO:** To develop mechanisms to ensure that all DER energy/electricity transactions are communicated with PUCs that oversee retail markets.
- **Retail Electricity Suppliers:** To improve monitoring of behind-the-meter DER facilities owned by consumers, and to improve communication with ISOs/RTOs to be updated/aware of what DER wholesale transactions have taken place in their regions.
- **Ratepayers/Consumers:** To register installed DERs that they are using for either selling to retail & wholesale markets or using for load reduction. To establish clear communication channels with retail suppliers and MISO about transactions conducted with both to ensure transparency and avoid over-counting.

Section 3: Factor challenges and interdependencies with other related factors

- **Financial Considerations:** Compensation mechanisms for consumers that own DERs supplying power to both wholesale and retail markets need to be clearly defined to avoid double-counting the sale of one unit power produced by DERs in both wholesale and retail markets. Financial incentives for DER owners through net-metering.
- **FERC 2222:** Clearly defined boundaries for where the wholesale market jurisdiction ends (FERC rule stops), and retail market jurisdiction begins (state regulated authorities).
- **Communication:** Clearly established communication channels between prosumers (consumers that also produce electricity with DERs), state or local authorities (PUCs) and wholesale market authorities (ISO/RTOs).
- **Ownership:** Clearly defined endpoints of who needs to be compensated via net-metering and by whom.

Section 4: Matrix Characterization

- **Wider geographical area for Locational & Time-varying Net-Metering Mechanism for Compensation of Prosumers:**
  Likelihood of Occurrence: The possibility of developing a time-of-use and locationally adjusted net-metering mechanism for large clusters of prosumers as compared to individual prosumers is High at the distribution level.

Reasoning: While not all DERs can be aggregated due to various issues including siting and proximity to other DERs, financial scope of owners, and intended use of DERs, proliferation of behind-the-meter DERs, energy storage and demand response on the level of a distribution grid (or microgrid) through appropriate financial incentives will be simplified if the distribution grid serves a larger area with high DER penetration.
Level of Influence: High.
Reasoning: This factor may change how people view electricity supply in general, in addition to adding a degree of stability to grid operations. Once finalized, this would be a steppingstone towards a highly transactive, peer-to-peer relationship between entities on one grid.
Impact: Beneficial
Reasoning: Simplified net-metering has a direct impact on cost of energy and grid resilience and reliability by removing the cost obstacles to DER grid integration.

- **Prevent Double-Counting of DERs:**
  Likelihood of Occurrence: High.
  Reasoning: The issue of DER double counting must be addressed.
  Level of Influence: High.
  Reasoning: Double counting impacts the economic feasibility of DERs and is therefore directly related to the increased integration of DERs.
  Impact: Beneficial
  Reasoning: Solving this issue will strengthen the argument for increases in DER deployment.

- **Participation of Aggregated DERs Allowed in Both Wholesale & Retail Markets:**
  Likelihood of Occurrence: High.
  Reasoning: Recent court rulings have denied the request of states to opt-out of the process of DER integration with the wholesale market. Local or States authority can no longer limit the ability of DERs to participate in wholesale markets (this falls under FERC ORDER 2222). The charge of regulating the development of inter-connections for grid integration falls on local authorities. In areas where the cost of electricity is high as well as high grid congestion, it may serve/drive local authorities to introduce policies to sustain reliability and hosting capacity thresholds of the electricity generation from DERs. This may involve revision to management plans for quicker response to energy demands.
  Level of Influence: High.
  Reasoning: Removal of barriers to entry in either type of market will increase the number of applications for grid integration, which will in turn increase visibility of DER resources for the relevant regulatory authorities, it will also increase DER presence in the energy mix.
  Impact: Beneficial
  Reasoning: Participation in both types of markets speeds up the integration process by pushing innovation, creating economic opportunities and promising a more decentralized, energy-efficient power supply that is more resilient to weather changes

Factor Outcomes/Components	Likelihood of Occurrence	Level of	Impact

		Influence	
Participation of aggregated DERs in both Wholesale and Retail Markets	High	High	Beneficial
Prevent double-counting of DERs	High	High	Beneficial
Net-metering through tax credits	High	High	Beneficial

Section 5: Comparison of Factor Outcomes (Pros/Cons of each)

- **Participation of aggregated DERs in both Wholesale and Retail Markets:** While this may help increase the contribution of DERs in the energy mix and thereby increase resiliency, cost effectiveness and reduce carbon footprint, it also gives rise to the possibility of over-counting (the benefits of DERs are overestimated). This may lead to unsound investments and high expectations.
- **Net-metering through tax credits:** While this may encourage smaller consumers, as well as big industrial consumers, to invest more in renewable DERs it may also lead to an overwhelming volume of applications that may not be efficiently managed due to resources constraints.

Section 6: Implementation (Preferred Outcome or Recommendation based on above section)

Both outcomes can be successfully implemented if a decentralized entity for managing retail market transactions is established. This entity will be separate from MISO, possibly within the state utility commission that closely interfaces with MISO to coordinate parallel retail and wholesale transactions. Such an entity will also be able to closely monitor DER development and increase its visibility to include in the state's resource energy planning. It can address both outcomes addressed in section 5 as it will steward compensations for behind-the-meter generation (removing this responsibility from utility providers) and adjust it to time varying demands. It would also ensure that all retail transactions with DERs are documented properly and compared with DER transactions in wholesale markets for the same region.

Section 7: References

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Appendix B: Scenario Outlines

Appendix B presents full detail on scenario construction and other factors which were cut from the final consideration of outcomes.

This document contains a suite of six scenarios, two from each research module of the project. These are designed to investigate, in a qualitative and conceptual manner, how a series of factors ("input variables") might interact to generate a set of outcomes.

The basic framing of each scenario is briefly described, followed by a table in which the factors, and their respective impacts, are itemized. The concept of the table is to itemize what happens when a specific factor outcome is actuated in a given scenario. A factor outcome is a specific circumstance that results from the implementation of a factor. The impact of each factor is characterized as 1) **what** does it do to change the circumstance in which it is operating (denoted in the second column as "What Changed"), 2) **how** the change impacted the outcome ("How Changed"), 3) **why** this implementation of this factor is important ("Why Important"), 4) **who** are the key stakeholders in this scenario ("Stakeholders"), 5) the ideal **sequence** in which actuating this factor lies relative to the implementation of other factors ("Factor Sequence"), and 6) actions or elements that might facilitate or **catalyze** the factor being actuated and the scenario taking place ("Catalyst").

Note: Not every factor may be represented in a given scenario, as certain factors may not have outcomes that are relevant in a given scenario.

Planning Module - Scenario Summaries

Scenario 1: Changes in state policy mandate increased data sharing between IOUs and PUCs, MISO and PUCs, or both.

This possible policy change would likely resemble something like what is the intent of IN HB 1520, which mandates increased data sharing between IOUs and the IURC and grants the IURC authority to conduct an investigation and mandate resource changes if utilities are found to have acquired insufficient summer/winter capacity. This policy would increase mandated data sharing between IOUs and PUCs and could also foster additional communication between other stakeholders. This collaborative data sharing would improve forecasting models for MISO, IOUs, and PUCs. In addition to allowing the state to regulate more efficiently, changes to the forecasting process could drive improvements in generation and transmission planning processes and facilitate the integration of renewables into the grid.

Scenario #1: State Policy change mandating increased data sharing						
Factor Outcome	**What Changed**	**How Changed**	**Why Important**	**Stakeholders**	**Factor Sequence**	**Catalyst**
Increase data sharing Factor: Regulatory Uncertainty	transmission, generation, and distribution data transparency	PUCs create a plan for timely information sharing (with possible input from stakeholders)	Data sharing improves transparency, forecasting models, fosters collaboration	MISO and the PUCs, IOUs and PUCs	1 After policy change	Policy change (like IN HB 1520)
Improve forecasting models Factor: Generation Planning and Forecasting	Greater access to data improves forecast models	Greater volume of data shows areas for model improvement	Improves system transparency, fosters collaboration, allows for more efficient regulation by PUCs	IURC, utilities, MISO	2 After data sharing processes established	Increased data sharing
Improve generation planning Factor: Generation Planning and Forecasting	Improve operation in periods of seasonal instability	Driven by changes in forecast models	Improved planning increases system efficiency, preparedness for extreme events	IOUs, MISO (PUCs)	3 As forecast models are improved	Improved forecasting models & collaboration
Improve transmission planning and LRTP processes Factor: Transmission and IRP	facilitate better incentives/ investments for transmission capacity	Use forecasting models and state policy tools to increase transmission capacity	to facilitate dispersed renewables (i.e., to discourage clustering)	MISO	4 As forecast models are improved, before allowing >30% renewables	Improved forecasting models & collaboration

Scenario 2: States or the federal government enact new policies in response to extreme weather events in February 2021.

In response to the ever-increasing concern about system reliability, states and the federal government have a number of policy options at their disposal, several of which, if enacted, will generate outcomes that are not mutually exclusive but interact. Additionally, multiple policies may be enacted by different state governments and the federal government. It may be the case that the policy response is disjointed across states or between states and the federal government. It is likely that utilities (and potentially ISOs) will face increased reporting requirements. Additionally, market actors may modify their cost-benefit analysis process in response to greater access to data or policy change. Improvements to the cost-benefit analysis will improve generation and transmission processes. Further, federal policy may mandate increased interconnectedness across ISOs. This would improve reliability of the grid by both enhancing disaster readiness and long-range transmission capacity, thus facilitating the integration of renewables into the grid. Finally, the federal government may take steps to create a regulatory framework that is less disjointed and more evenly spreads the benefits and burdens of regulatory policy across both regulators and market actors.

Scenario #2: Policy change relating to extreme weather events						
Factor Outcome	**Circumstance Changed**	**Degree of Change**	**Why Changed**	**Stakeholders**	**Factor Sequence**	**Catalyst**
Increase interconnectedness between ISOs Factor: Regulatory Uncertainty	Improve communication, data sharing, and long-range transmission	Iterated feedback loops, joint councils or operations	Mandated by policy, improve disaster readiness	ISOs, Federal agencies	1 After policy change	Extreme weather unpreparedness, policy change
Increased data sharing and reporting for utilities Factor: Regulatory Uncertainty	Requirements to share data, certify that certain requirements are met	Reports to PUCs or other parties as mandated	Mandated by policy	IOUs, potentially MISO, PUCs	2 After policy change as mandated	Policy change
Aligning processes and information flows across institutions (FERC, NERC, etc.) Factor: Transmission and lRP	Align goals, costs and benefits of policy across federal agencies, state and federal levels	Sharing information and data across agencies, coordinating policy efforts	Create unified regulatory framework and policy responses	Federal agencies	3 After policy change	Federal policy change
Changes to cost-benefit analysis methods Factor: Generation Planning and Forecasting	Must incorporate resiliency into CBAs	incorporate uncertainty in extreme weather to determine those costs and benefits	in response to recent events, policy recommendation by NARUC-NASEO task force	MISO, IOUs	4 when planning transmission & generation	Federal (FERC) or internal (MISO or IOU) policy change

Improve power generation & transmission planning methods Factor: Generation Planning and Forecasting	Change generation and transmission planning based on changes in cost-benefit analysis conclusions	by making preparation changes in resiliency to try and recognize benefits and avoid costs	Improve generation and transmission efficiency, weather preparedness, increase capacity for renewable integration	MISO, ISOs	5 After CBA changes are made	Changes to cost-benefit analysis

Operation Module - Scenario Summaries

Scenario 1: Modify Incentives and Market Rules for Reduced Inefficient Generation

Under the current system, some IOUs are inefficiently self-committing coal plants. Other causes of inefficient generation are inadequate demand signals and distortion of the market encouraged by reliability imperatives. The table below outlines several potential reforms aimed at reducing inefficient generation. Allowing fuel tracker information to be shared with PUCs internalizes costs and spurs securitization of inefficient coal plants. Seasonal operation policy and creating a hybrid generation market participation give more market share to renewables. Catalysts of positive change include greater awareness and information sharing, legislative changes, and the falling prices of clean energy and storage technologies.

Scenario #1: Reduction of Inefficient Generation						
Factor Outcome	**Who**	**What**	**Factor Sequence**	**How**	**Why**	**Catalyst**
Restrict Self-Commitment Factor: Market Rules	State regulators, IOUs	Only allow self-commitment under strict conditions, e.g., mandatory output testing	First	State regulation on self-commitment	Prevent unnecessary inefficiencies of coal plants	Multiple reports of uneconomic coal power generation
Market Data Sharing Factor: Oversight Policy	MISO, IOUs, PUCs, Arbitrageurs, ratepayers	Policy to implement private data sharing behind/in front of meter	After restricting self-commitment	Increased access and investment in self-supplier meter reading, protected dissemination of real-time market data among stakeholders	Limit disadvantages between actors and IOUs	Multiple reports of uneconomic generation; market share of energy self-suppliers reaches a critical threshold and/or consequential shift toward DER energy portfolios by legislators.
Seasonal Operation of Coal Plants Factor: Market Rules	IOUs, PUCs	State PUCs incentivizing or mandating seasonal operation	After MISO shares IOU data with PUCs	Ability to reject IRP, and disallow IOU costs	Coal plants are more efficient and profitable in certain months	Growing number of IOUs deciding to seasonally operate plants; growing awareness of inefficient generation
Hybrid generation market participation model Factor: Market Rules	IOUs, MISO, Arbitrageurs	Institute a hybrid generation participation model which gives equal access for hybrid generators to participate in day-ahead and ancillary markets	This would come after restriction of self-commitment	MISO creating new tariff to set out rules for hybrid generation like Order 841	MISO will be prepared for influx of hybrid generation, as well as giving renewable energy greater market power against fossil fuel generators.	High integration rate of storage in California and western grids decreasing battery prices.

Increase Securitization Offers Factor: Oversight Policy	IOUs, ratepayers, state legislators	Increased offering of buyouts for coal fired stranded assets	After seasonal coal operation implemented	Request larger securitization budget from FERC or DOE	The most economically efficient and rapid method of taking coal fired power plants off the grid.	IOUs are pushing for support with this method.

Scenario 2: Increased Inter-Agency Communication and Enhanced Data Sharing

Communication between technical experts, such as MISO and state PUCs and those less experienced with energy policies, such as legislators, has been nearly non-existent, leading to frustrations among all stakeholders and a lack of progress in better grid management. Better intercommunication between technical experts and synthesizing recommendations for legislators may ultimately facilitate behaviors among the general public that are the result of better communication between technical experts and lay people. Although these factors can be implemented at different intensities, the process of consolidating technical information between experts, synthesizing this information into understandable terms, and then conveying this understandable information to the general public can create a more well-informed audience that will better respond to changes in grid management.

Scenario #2: Increased Communication Between MISO and Stakeholders						
Factor Outcome	**Who**	**What**	**Factor Sequence**	**How**	**Why**	**Catalyst**
MISO shares technical data with PUCs	MISO, IOUs, PUCs	Technical data gathered from MISO and its independent observer on IOU fuel purchasing and dispatch	This would be the first step to increase transparency	Create a specific database which updates monthly on IOU operations. Specific section dedicated to when fuel contracts are up for renewal	Giving PUCs independent but controlled access to data will ease tensions and allow MISO to relinquish responsibility for what they do with the information.	Multiple Reports on uneconomic coal power generation
Market design incorporates price signals	MISO, IOUs	MISO shares price signal information from generators to ratepayers/regulators	This would be initial steps to increase transparency	MISO creates market design where price signals are shared to ratepayers and regulators	Setting price signals will allow ratepayers and regulators make more informed decisions of how and from whom they consume energy, pressuring generators to improve performance and reliability	Multiple Reports on uneconomic coal power generation
Coordinate/ Schedule with Legislators and MISO	State legislators, MISO, PUCs	Technical information from MISO synthesized for less technical audiences	One of last steps	Regular meetings to convey information and answer clarifying questions by legislators	Legislators are important conduits to delivering information to public, so they must understand info being delivered to public	Frustrations derived from lack of communication between legislators and PUC/MISO

Create Specific Info Portal for Members of State Congress	State legislators, general consumers, IOUs	Synthesized communications from MISO	Last step to allow for information to be synthesized and finalized for general audiences	Range of information delivery from simply making info available to consistent messaging	Behaviors ultimately change via the public and they can only do so if info is provided to them	Repeated confusion of new members of state congresses.

DER Module - Scenario Summaries

Scenario 1: Increased information exchange between DERAs and MISO/RERRAs

Under Order 2222, MISO and other RTOs may implement metering and telemetry requirements for DERs. Increased sharing of information will allow MISO and local regulatory authorities to create a more holistic picture of the distributed energy resources present within their footprints. However, more advanced metering imposes higher operating costs on DERs and aggregators, who lack the financial resources of large utility companies. As such, these requirements "must not pose an unnecessary and undue barrier to individual DERs." Mutualistic cooperation between DERAs and MISO are necessary to ensure that all necessary metering information is provided without creating excessive regulatory burdens that may not be manageable for smaller-scale DERs.

Scenario #1: Increased information exchange between DERAs and MISO/RERRAs						
Factor Outcome	**Circumstance changed**	**Degree of change**	**Why changed**	**Stakeholders**	**Factor sequence**	**Catalyst**
Slower compliance timeline for Order 2222 *Factor: Compliance and Implementation of FERC Order 2222 by ISOs*	No current metering or telemetry requirements for DERs for wholesale market	Minimal increase in requirements for telemetry and metering	Giving stakeholders adequate time to determine mutually beneficial regulatory regime	FERC, MISO, DER owners and aggregator	2	Need to reduce barriers to compliance of Order 2222 and barriers to DER aggregation
Reduced Energy Costs & Improved Grid Resiliency *Factor: Financial Considerations relating to DERs*	DERs can now access the wholesale market & capacity market	Integration of DERs in wholesale market should marginally decrease energy costs and improve grid resiliency	Lower telemetry and metering costs would reduce capital and operational costs for DER aggregators.	MISO, DERA, Energy Consumers, Current Energy Generators	3	High current electricity prices
Increased communication between MISO and DER aggregators *Factor: Cross- Institutional Information Exchange and Communication*	Little to no channels of communication between MISO/RTOs and DER aggregators	Increased collaboration between MISO, DERA and RTOs	Necessity of better understanding of RTOs' information needs and DERs' technical limitations	MISO, DERA	1	Need for better information exchange between regulators and regulated bodies

Scenario 2: Creation of an efficient manager of DERs at the local distribution level with a role in the aggregated wholesale market

This scenario assesses how the creation of an aggregation entity separate from but closely interfacing with MISO could serve to facilitate the coordination in parallel of both retail and wholesale transactions. Such an entity will also be able to closely monitor DER development and increase its visibility to include in the state's resource energy planning. It will operate at the local distribution level. This group could also steward behind-the-meter generation compensation. Additionally, this group can allow for the participation of aggregated DERs in both Wholesale and Retail Markets. It would also ensure that all retail transactions with DERs are documented properly and compared with DER transactions in wholesale markets for the same region.

Scenario #2: Distribution-level Entity Overseeing regional DER interactions/transactions						
Factor Outcome	**Circumstance changed**	**Degree of change**	**Why changed**	**Stakeholders**	**Factor sequence**	**Catalyst**
Simplifying regional/local DER operations Factor: Regulatory Framework of DERs in the Retail Market	Ambiguity in jurisdictional boundaries between MISO and PUCs	Increased local regulator involvement	Regulatory ambiguity hinders smaller entities and DERs participating in either wholesale or retail markets from participating in both	MISO, PUCs, Legislators, DER Owners	2	Lack of regulatory clarity
Preventing Double-counting that would reduce cost-effectiveness of DERs *Factor: Regulatory Framework of DERs in the Retail Market*	Limited participation in wholesale or retail market	Increased percentage of renewable DERs in the energy mix	Projected cost effectiveness could be higher, as current DERs are not being used optimally.	MISO, Energy Consumers, Current Energy Producers	3	Concerns of double counting
Creating communication networks at the regional-level *Factor: Increased Information Exchange and Communication*	Lack of a conduit for regional DER data sharing	Higher degree of DER data inter-connections	Centralized module for DER integration is currently inefficient, hence moving to a decentralized system for better communication management	IOU Distribution Departments, DER Owners, PUCs	1	Lack of peer-to-peer communication channels
Increased promulgation of grid efficient ownership type *Factor: DER Ownership Structure Availability*	Lack of alternate DER ownership structures	Prioritize DER installations by size and ownership	Current ownership structure equates individual ownership with larger DER projects	DER Owners, IOUs, PUCs	4	Limited ownership structures available