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December 4, 2024

Ms. Lisa Felice
Executive Secretary
Michigan Public Service Commission
7109 W. Saginaw Highway
P.O. Box 30221
Lansing, MI 48909

Re: **MPSC Case No. U-21471 and U-21472**

Dear Ms. Felice:

Attached for electronic filing in the above-referenced matter, please find the Direct Testimony and Exhibits of Natalie Lyijynen and the Direct Testimony and Exhibits of Michael Goggin on behalf of the Michigan Energy Innovation Business Council, the Institute for Energy Innovation, and Clean Grid Alliance, together with the Proof of Service. Thank you for your assistance in this matter.

Very truly yours,

Justin K. Ooms
Digitally signed by Justin K. Ooms
Date: 2024.12.04 17:44:34 -05'00'

Justin K. Ooms

JKO/srd
Enclosure
c. All parties of record.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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In the matter of the application of **MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC** for an Act 30 certificate of public convenience and necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan, and between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan.	)	**Case No. U-21471** **Case No. U-21472**

DIRECT TESTIMONY OF NATALIE LYIJYNEN

ON BEHALF OF

THE MICHIGAN ENERGY INNOVATION BUSINESS COUNCIL,

INSTITUTE FOR ENERGY INNOVATION,

AND

CLEAN GRID ALLIANCE

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I. INTRODUCTION AND QUALIFICATIONS

Q. State your name, business name and address.

A. My name is Natalie Lyijynen, and I am a Sustainable Business Associate at the Michigan Energy Innovation Business Council ("Michigan EIBC") and the Institute for Energy Innovation ("IEI"), located at 115 West Allegan, Suite 710, Lansing, Michigan 48933.

Q. On whose behalf are you appearing in this case?

A. I am appearing here as an expert witness on behalf of Michigan EIBC, IEI, and Clean Grid Alliance, collectively referred to as "MEIC."

Q. Summarize your educational background.

A. I have a Bachelor of Science degree in Biology and Environmental Studies from the University of Michigan, conferred in December 2022.

Q. Summarize your professional experience in transmission.

A. I have been Michigan EIBC and IEI's Sustainable Business Associate since April 2023. In this role, I serve as the organizations' expert on electricity transmission and related policy issues for our membership. I also work to advance public education around the needs and benefits of transmission buildout. Specifically, on October 9, 2024, I spoke at an EUCI course on the topic of "Transmission Expansion for Renewable Integration in the Midwest" and I co-authored an opinion piece focused on transmission infrastructure that was published in the Detroit Free Press.[1] In addition, I engage with policy makers at the state level regarding transmission issues and the Midcontinent Independent System Operator, Inc. ("MISO") long range transmission planning process including at state agencies and the Executive Office of the Governor. My work experience is set forth in detail in my resume, attached as Exhibit MEIC-1 (NL-1).

Q. Have you testified before this Commission or as an expert in any other proceeding?

A. No.

Q. What is the purpose of your testimony?

A. The Michigan Electric Transmission Company, LLC ("METC") is requesting Commission approval of its petition for an Act 30[2] Certificate of Public Convenience and Necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, and an Act 30 Certificate of Public Convenience and Necessity for the construction of a major transmission line between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County. Collectively, these two proposed transmission lines will be referred to as "the Projects." The purpose of my direct testimony is to address the need for the Projects, as part of MISO's Response to the Reliability Imperative Long Range Transmission Plan ("LRTP"). I will also support the assertion that the public benefits associated with the Projects justify their construction.

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[1] Detroit Free Press, $1B Plan Could Save Michiganders $3.4B with New Lines for Renewable Energy (July 2024), available at https://www.freep.com/story/opinion/contributors/2024/07/04/new-transmission-lines-could-make-way-renewable-energy-use-in-michigan/74296403007/.

[2] The Electric Transmission Line Certification Act, 1995 PA 30, MCL 460.561 *et seq*., ("Act 30").

Q. Please outline your testimony.

A. In my testimony, I first outline MISO's LRTP, including a discussion of its Future scenario planning, phases of the LRTP (called "Tranches"), and stakeholder engagement. Next, I provide context for the public benefits under consideration. Finally, I focus specifically on four key benefits: 1) the reliability benefits, including reduced congestion and grid flexibility; 2) improved access to lower cost energy resources; 3) the encouragement of innovation and cost savings through increased competition; and 4) alignment with recent state decarbonization goals.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

- Exhibit MEIC-1 (NL-1): Resume of Natalie Lyijynen
- Exhibit MEIC-2 (NL-2): MISO Comments in Case No. U-21471 (September 2024)
- Exhibit MEIC-3 (NL-3): MISO Futures (April 2021)
- Exhibit MEIC-4 (NL-4): Tranche 1 and Tranche 2.1 Maps
- Exhibit MEIC-5 (NL-5): Report by 5 Lakes Energy and the Michigan Energy Innovation Business Council, "Michigan's Clean Energy Economic Comeback: How Local Economies in Michigan Are Benefitting from State and Federal Climate Policies," (September 2024)
- Exhibit MEIC-6 (NL-6): Letter from Midwestern Governors to MISO, Support for MISO's Long-Range Transmission Planning Effort (June 2021)

II. MISO LRTP 1 PORTFOLIO

Q. Please provide an overview of MISO's LRTP process.

A. The MISO LRTP process is a comprehensive, multi-phase initiative aimed at enhancing the regional grid's reliability, resilience, and capacity to integrate renewable energy resources.[3] It focuses on developing transmission infrastructure to meet future energy demands and policy goals, such as decarbonization, while addressing system congestion and improving regional connectivity. The LRTP is part of MISO's Response to the Reliability Imperative, which is a host of initiatives developed first in 2020 and updated in 2024 to address the challenges facing the MISO grid.[4] The LRTP process falls under a key pillar of this Reliability Imperative and currently includes four portfolios of projects, or Tranches. The process was rigorous and included extensive stakeholder engagement, data-driven modeling, and scenario-based planning to ensure that the proposed transmission projects align with evolving market needs, regulatory requirements, and environmental considerations.[5] The four Tranches each focus on specific regional transmission solutions. Tranches 1 and 2 focus on transmission in MISO's Midwest subregion, while Tranche 3 targets the South subregion, and Tranche 4 addresses the North/South interface limit.[6]

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[3] MISO, Long Range Transmission Planning, available at: https://www.misoenergy.org/planning/long-range-transmission-planning/.

[4] MISO, Response to the Reliability Imperative (February 2024), available at: https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216.

[5] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 7.

[6] MISO, Long Range Transmission Planning. Available here: https://www.misoenergy.org/planning/long-range-transmission-planning/.

Q. What scenario-based plans were the LRTP Tranches modeled from?

A. MISO's scenario-based planning, known as Futures, provides the foundation for the LRTP Tranches. Each is an outline of what the generation mix will look like over a 20-year timeframe, including the gigawatts ("GW") of generation additions and retirements, peak load, and resulting emissions. These Futures serve as the basis for forecasts of generation resources and load that would be cost-effective and consistent with member plans and state policies.[7] For example, Future 1, from which Tranche 1 of the LRTP ("LRTP1") is modeled from, reflects known utility integrated resource plans ("IRPs") and 85% of utility announcements, state mandates and goals.[8] Futures 2 and 3 encompass increasing decarbonization and electrification plans. See Exhibit MEIC-3 (NL-3) at page 5[9] for a visualization of the Futures.[10] The set of three future planning scenarios was originally developed in 2019-2020 to plan for the rapid changes occurring in the generation resource mix in MISO's footprint. Although completed only a few years ago, these Futures have already been updated because the pace of the transition is accelerating.[11] MISO acknowledged that since completing the Futures in 2020, "member and state plans were refined, new legislation and policies took effect, and prices, along with incentives for various resources, saw significant changes."[12] These updated Series 1A Futures continue

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[7] Exhibit MEIC-2 (NL-2), p. 6.

[8] MISO, Futures (April 2021), available at: https://cdn.misoenergy.org/MISO%20Futures%20Summary%20Presentation538220.pdf, p. 3.

[9] The pagination of the MISO Futures report is distorted, in that page 4 appears twice and there is no page identified as page 5. The reference to page 5, therefore, is intended to refer to the second page 4.

[10] This is a visualization of the three future planning scenarios developed in 2019-2020. Future 1, from which LRTP1 is modeled, reflects known utility IRPs and 85% of utility announcements, state mandates and goals. Futures 2 and 3 encompass increasing decarbonization and electrification plans. These Futures were recently updated in 2023 due to the accelerating pace of the changing resource mix that MISO is seeing.

[11] MISO, Futures Report Series 1A (November 2023), available at: https://cdn.misoenergy.org/Series1A_Futures_Report630735.pdf, p. 2.

[12] *Ibid*.

to inform the planning of MISO members and states. Future 2A, for example, is the basis of the LRTP Tranche 2 analysis, a portfolio of projects currently under development.

Q. Please describe the LRTP1 Portfolio.

A. LRTP1 is the first set of recommended major transmission infrastructure developments in the LRTP and is aimed at enhancing grid reliability and resiliency as the resource mix continues to change across the region. Approved by the MISO Board of Directors in July of 2022, LRTP1 includes 18 projects across the Midwest,[13] with an estimated investment of $10.3 billion.[14] These upgrades are designed to support long-term decarbonization goals, enable efficient energy delivery, and enhance regional interconnections, ultimately reducing system costs and increasing grid resilience.[15] The METC proposed projects that are the subject of this proceeding are known as projects 17 and 18 in LRTP1 and are part of the East-Central Corridor from Iowa to Michigan. See Exhibit MEIC-4 (NL-4) for a map of the LRTP1 projects.

Q. What is happening with regard to generation resource fleets across the MISO region?

A. It is widely accepted that the resource mix is changing. More conventional power plants are being retired and more weather-dependent renewable resources, such as wind and solar, are being built as many utilities and states work toward decarbonization goals. For

[13] MISO, LRTP Tranche 1 Portfolio Detailed Business Case (June 2022), available at: https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 12.
[14] *Ibid*, p. 14.
[15] *Ibid*, p. 9.

example, in Michigan, both DTE Energy[16] and Consumers Energy[17] have goals to reach net zero emissions by 2050. At least partially as a result of these changes, carbon emissions across the MISO region have declined more than 30% since 2005.[18]

Q. What is LRTP1 intended to address?

A. The changing resource mix comes with its own challenges, including to the region's electric reliability. According to MISO's Response to the Reliability Imperative,[19] the Midwest subregion faces the most urgent reliability challenges of any subregion in MISO due to imminent generation retirements and resource portfolio changes.[20] LRTP1 is intended to address the fact that these shifting energy needs are more significant than the previous portfolio of regional transmission projects, developed back in 2011, was built to accommodate.[21] LRTP1 is also intended to address other challenges to reliability in the Midwest region, including increasingly extreme weather events, load additions from new energy-intensive facilities like data centers, and incremental load growth from electrification in transportation and building sectors, among others. LRTP1 is referred to as a "portfolio of least-regrets transmission projects,"[22] meaning that the projects meet the

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[16] DTE Energy, Michigan Public Service Commission Approves DTE's Landmark Clean Energy Plan, (July 2023), available at: https://ir.dteenergy.com/news/press-release-details/2023/Michigan-Public-Service-Commission-approves-DTEs-landmark-clean-energy-plan/default.aspx.
[17] Consumers Energy, CMS Energy to Combat Climate Change by Achieving Net Zero Greenhouse Gas Emissions from Entire Natural Gas System by 2050, (March 2022), available at: https://www.consumersenergy.com/news-releases/news-release-details/2022/03/30/13/14/cms-energy-to-achieve-net-zero-greenhouse-gas-emissions-from-natural-gas-system-by-2050.
[18] MISO, Response to the Reliability Imperative (February 2024), available at: https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216, p. 1.
[19] *Ibid*.
[20] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, Figure 4, p. 5.
[21] *Ibid*, p. 1.
[22] *Ibid*, p. 5.

needs of the conservative, expected case for what the future holds and are a critical backbone for expansion as the resource mix continues to change.

Q. How does LRTP1 meet the conservative, expected case of the region's changing generation mix?

A. LRTP1 was specifically developed to meet the projections of the first of the three future planning scenarios (*i.e.*, Future 1) outlined in Exhibit MEIC-3 (NL-3). As stated above, Future 1 reflects known utility IRPs and 85% of utility announcements, state mandates and goals, making it the most moderate and cautious scenario, while Futures 2 and 3 are based on increasing decarbonization and electrification assumptions. LRTP1 is modeled from this "expected case" Future 1 scenario, which is why MISO describes LRTP1 as a "yes-and set of transmission that further Tranches will build off to continue to meet the increasing renewable penetration levels and electrification growth that MISO is expected to see in the future."[23]

Q. Please elaborate on the process of developing the LRTP1 portfolio.

A. LRTP1 was developed through a rigorous process including extensive stakeholder engagement.[24] MISO describes it as a "bottom-up, top-down" approach.[25] In addition to relying on input from transmission owners with regard to their local systems (*i.e.*, bottom-up), MISO provides a top-down review of local planning to ensure cost-effectiveness and

[23] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 5.
[24] MISO, Long Range Transmission Planning "Overview," available at: https://www.misoenergy.org/planning/long-range-transmission-planning/.
[25] Exhibit MEIC-2 (NL-2), p. 6.

works with stakeholders to plan for the future of the region. To develop LRTP1, MISO held over 200 internal and external stakeholder meetings, with between 200 and 300 attendees at each external workshop, between 2021 and 2022.[26]

Q. How do the proposed transmission lines in this proceeding fit into the context of MISO's LRTP?

A. The Projects are an integral part of MISO's LRTP1. MISO's analyses found that

> the projects will be needed in order to ensure the continued reliable operation of the regional transmission system, including the METC transmission system, while meeting the expanding role of renewable generation resources in the Midwest subregion.[27]

Notably, "without the projects, Michigan and other states in the MISO footprint would not receive the full set of economic benefits that are provided by the LRTP Tranche 1 portfolio"[28] and may have to pursue less optimal solutions to address the issues that LRTP1 was designed to resolve.[29]

In addition, MISO is continuing its LRTP process with subsequent proposed tranches of necessary regional transmission upgrades. The recently finalized Tranche 2.1, which is likely to be approved by the Board of Directors in December 2024, plans for additional new or upgraded transmission lines across Michigan.[30] The success of this future build-out

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[26] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 8.
[27] Exhibit MEIC-2 (NL-2), p. 10.
[28] *Ibid*, p. 2.
[29] *Ibid*, p. 15.
[30] MISO, Long Range Transmission Planning: Tranche 2, available at: https://www.misoenergy.org/planning/long-range-transmission-planning/.

depends on the initial backbone projects included in LRTP1. As can be seen in Exhibit MEIC-4 (NL-4), according to the Tranche 2.1 map, the Tranche 2.1 planned projects assume the Tranche 1 projects will be built, making Tranche 1 projects – such as the Projects subject of this proceeding – necessary backbone projects for future expansion to meet reliability needs of the region.

Q. What role does timeline play in transmission development and resource generation?

A. Compared to the development of generation resources, transmission development typically requires significantly more time, making it essential to have processes like the LRTP in place to plan for infrastructure needs well in advance of anticipated new generation. While generation can be developed in as few as 3–5 years for resources such as solar[31] or wind,[32] transmission infrastructure—especially regional infrastructure such those projects included in the LRTP1—can take as many as 10 years to develop.[33] Given this extended planning horizon and the rapidly changing energy landscape in Michigan and the surrounding region, it is crucial that transmission planning and development continue to occur in a timely manner. This proactive approach will ensure that the necessary infrastructure is in place to support the evolving energy needs of the region.

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[31] Lawrence Berkeley National Laboratory, Utility Solar Project Development, available at: https://ei-spark.lbl.gov/generation/utility-scale-pv/project/innov/#:~:text=Typically%2C%20a%20utility%2Dscale%20solar,interconnection%20(REF%3A%20SEIA).

[32] U.S. Department of Energy, Land-Based Wind Energy Economic Development Guide, available at: https://windexchange.energy.gov/economic-development-guide

[33] *Ibid*.

IV. PUBLIC BENEFITS

Q. What benefits are considered by MISO as part of its LRTP process?

A. MISO outlined seven reliability and economic benefits in its LRTP Tranche 1 Portfolio Detailed Business Case:[34]

- Congestion and fuel savings
- Avoided capital costs of local resource investments
- Avoided transmission investment
- Reduced resource adequacy requirements
- Avoided risk of load shedding
- Decarbonization
- Reliability issues addressed by LRTP

Q. In his direct testimony, METC witness Charles L. Marshall states, "Michigan will receive the following primary benefits from the Project: 1. Facilitation of 1,292 MW increase in the capacity import limit ("CIL") to Michigan's lower peninsula, Local Resource Zone 7 ("LRZ 7"); 2. Enhanced grid resilience by expanding the grid with new segments/paths often referred to as 'new steel in the air' that hardens the grid, provides geographic diversity, supports climate adaptation, and reduces the overall risk profile of the grid; and 3. Support of the State of Michigan's energy policy goals by developing needed transmission infrastructure in a cost effective, forward-looking, and right-sized manner."[35] Do you agree?

A. Yes. In his testimony, METC witness Marshall outlines several significant benefits that the Projects would bring to Michigan, and I agree with his assessment. Additional transmission

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[34] MISO, LRTP Tranche 1 Portfolio Detailed Business Case (June 2022), available at: https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 10.

[35] Direct Testimony of Charles L. Marshall on behalf of Michigan Electric Transmission Company, Case No. U-21471, ("Marshall U-21471 Direct"), p.11.

infrastructure in general is helpful in increasing the CIL[36] and the LRTP1 projects – including the two in this proceeding – have been shown to increase transfer capability to allow access to resources in otherwise constrained areas.[37] The LRTP1 projects will also support reliability and resilience, reducing the risk of load loss especially when it is caused by severe weather events.[38] Additionally, transmission expansion, like the Projects, can help states achieve their renewable energy goals[39] by enabling greater access to the best available and lowest cost resources.[40] The Projects are designed to support the modest load growth that is modeled in Future 1, while also serving as a critical backbone for supporting future growth as Michigan increasingly transitions to more renewable generation.

Q. Which benefits will be further expanded on in subsequent sections of this testimony?

A. I will specifically expand on the following four benefits in subsequent sections of this testimony:

- The Projects, as a part of the LRTP1 portfolio, address the rapidly changing energy landscape (i.e., increasing renewable generation) and support reliability, grid flexibility, and reduced congestion.
- The Projects are expected to improve access to lower-cost generation resources (i.e., renewables).

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[36] MISO, Michigan Capacity Import/Export Limit Expansion Study (June 2021), available at: https://cdn.misoenergy.org/20210603%20MTSTF%20Item%2002%20Michigan%20CIL-CEL%20Expansion%20Study%20Report556522.pdf.
[37] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 3.
[38] *Ibid*.
[39] FERC, Report on Barriers and Opportunities for High Voltage Transmission (2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf.
[40] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 9.

- The Projects will support increased competition, and in combination with the above benefits, can help lower energy costs.
- The Projects will help Michigan reach its state goal of achieving 100% clean energy by 2040 and support additional decarbonization policies.

A. The Projects Support Reliability, Grid Flexibility and Reduced Congestion.

Q. Please describe the challenges to reliability addressed in MISO's LRTP.

A. In its Region Reliability Imperative Report, MISO cited several large-scale trends that its regions, specifically the Midwest, are experiencing. These included transitioning to zero-carbon resources, challenges of extreme weather, supply chain and permitting delays, large single-site load additions like energy-intensive production facilities or data centers, and incremental load growth due to electrification.[41] The key takeaway of this Report is that the energy mix is changing and to ensure reliability, additional transmission investment is needed.

Q. Broadly, why does transmission infrastructure development support reliability?

A. Transmission infrastructure plays an important role in maintaining grid reliability.[42] Specifically, new or upgraded high-voltage transmission lines improve the reliability and

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[41] MISO, Response to the Reliability Imperative Report, (February 2024), available at: https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216, p. 2.

[42] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 52.

resilience of the system by allowing utilities to more broadly source and distribute energy from generating resources, which helps to stabilize the existing system—particularly during periods of high risk, like extreme weather.[43]

Q. How do the Projects, as a part of MISO's LRTP1, support grid reliability in the region?

A. As stated in the Reliability Imperative Report, "The ongoing shift in the resource fleet and the substantial projected increase in load pose significant challenges to the design of the transmission system in the MISO region."[44] The LRTP1 portfolio as a whole was developed to address this need for regional transmission solutions and the projects were each designed to support future reliability of the region. In reference to the two proposed lines which are the subject of this proceeding, MISO analyses found that

> the Projects will be needed in order to ensure the continued reliable operation of the regional transmission system, including the METC transmission system, while meeting the expanding role of renewable generation resources in the Midwest subregion.[45]

One project—the proposed construction of a major transmission line between the Indiana/Michigan state border at Gilead Township and the new Helix Substation in Calhoun County—is especially important for regional connectivity. It will establish an

[43] FERC, Report on Barriers and Opportunities for High Voltage Transmission (June 2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf, p. 52.
[44] MISO, Region Reliability Imperative Report, (February 2024), available at: https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216, p. 18.
[45] Exhibit MEIC-2 (NL-2), p.10.

additional interstate connection and help to relieve constraints on the existing transmission facilities in southern Michigan.[46]

Q. Regionally, can the current system support the expected load growth and increased renewable resources?

A. No, the current transmission system in the MISO region cannot adequately support the expected load growth and increased renewable integration.[47] The existing grid infrastructure is not designed to handle the significant and rapid expansion of renewable energy sources like solar and wind. As more renewable resources come online, without upgrades the current grid would face challenges related to balancing supply and demand, managing congestion, and ensuring reliability. Additionally, these new weather-dependent resources do not have the same reliability characteristics as the resources they are replacing, further underscoring the importance of planning for reliability needs of the future.[48] Expanding transmission allows much higher levels of these weather-driven resources to be accommodated by accessing a diverse portfolio of resources with geographic diversity in their output profiles.

Q. What else indicates that the regional transmission system is strained?

A. Lengthy generator interconnection queues and rising interconnection costs also indicate that the system is already strained.[49] According to a whitepaper by the Solar and Storage

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[46] Exhibit MEIC-2 (NL-2), p.12

[47] MISO, Region Reliability Imperative Report, (February 2024), available at: https://cdn.misoenergy.org/2024%20Reliability%20Imperative%20report%20Feb.%2021%20Final504018.pdf?v=20240221104216.

[48] *Ibid*, p. 8.

[49] Lawrence Berkeley Lab, Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection, (April 2024), available at: https://emp.lbl.gov/queues.

Industries Institute, "Interconnection queues have grown, wait times to connect projects have increased, and the costs associated with interconnecting projects to an aging grid have skyrocketed."[50] While the interconnection queue is a larger, complex issue with many factors, and transmission planning and expansion broadly is not sufficient to solve all these issues, it is still necessary to help support more generation resources' coming online. A recent U.S. Department of Energy Transmission Interconnection Roadmap identified transmission planning as a core element for improving the efficiency of the interconnection process,[51] explaining that more coordinated planning could alleviate the need for one-off actions to ration queue capacity.[52]

Q. In addition to supporting reliability, how does transmission expansion increase the flexibility of the grid?

A. Transmission expansion is crucial for increasing the flexibility and reliability of the electric grid. Generally, by enhancing transmission capacity, the grid can better accommodate the growing number of renewable energy projects, which are often geographically dispersed. This expanded infrastructure allows energy to flow more efficiently across regions, ensuring that electricity from areas of surplus generation, like those with abundant wind or solar resources, can reach areas of high demand.[53] According to a 2020 Federal Energy Regulatory Commission ("FERC") report on Barriers and Opportunities for High Voltage

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[50] Solar and Storage Industries Institute. "Game Changing Interconnection Reform: Reshaping Transmission Planning and Realigning Incentives" (April 2024), available at: https://www.ssii.org/interconnection-whitepaper-2024/, p. 3.
[51] U.S. Department of Energy, Transmission Interconnection Roadmap (April 2024), available at: https://www.energy.gov/sites/default/files/2024-04/i2X%20Transmission%20Interconnection%20Roadmap.pdf, p. 9.
[52] *Ibid*, p. 10.
[53] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 3.

Transmission, expanding transmission improves system reliability by allowing utilities to share generating resources, stabilizing the grid, and enhancing recovery after disruptions.[54] This was demonstrated during the 2019 polar vortex, when the Midwest relied on transmission imports from other regions to maintain reliability after local generators became unavailable.[55]

Q. How do the Projects, as a part of MISO's LRTP1, support grid flexibility?

A. Regional projects, like LRTP1, can help meet the flexibility requirements of increasing renewable generation.[56] As previously stated, one project—the proposed construction of a major transmission line between the Indiana/Michigan state border at Gilead Township and the new Helix Substation in Calhoun County—is especially important for regional connectivity. It establishes an additional interstate connection and helps to relieve constraints on the existing transmission facilities in southern Michigan.[57] In sum, transmission expansion boosts grid resilience by providing alternative energy pathways and ensuring clean energy resources are fully utilized, reducing the risk of shortages and grid outages.

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[54] FERC, Report on Barriers and Opportunities for High Voltage Transmission (June 2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf, p. 8.
[55] *Ibid*.
[56] U.S. Department of Energy, National Transmission Planning Study, Chapter 6: Conclusions, p. 4. Available at: https://www.energy.gov/sites/default/files/202410/NationalTransmissionPlanningStudy-Chapter6.pdf
[57] FERC, Report on Barriers and Opportunities for High Voltage Transmission (June 2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf, p. 12.

Q. How are the Projects, as part of MISO's LRTP1, expected to reduce congestion?

A. Simply put, congestion happens when transmission lines are overloaded and cannot carry additional electricity.[58] When demand exceeds the transmission system's capacity to deliver power efficiently, this can result in higher-cost resources' being dispatched instead of lower-cost ones, which is reflected in higher prices in the Regional Transmission Organization ("RTO") energy markets.[59] One of the best ways to reduce transmission congestion is to increase transmission capacity,[60] which is an expected result of the LRTP1 portfolio.[61] The LRTP1 projects are specifically focused on identifying bottlenecks where there is not enough capacity to meet demand and future needs. By constructing additional transmission lines such as the Projects, electricity is expected to be able to flow more freely across regions, thereby reducing congestion and reducing the degree to which generation resources must be dispatched out of economic merit order in order to balance generation and load in real time.

Q. Please summarize the main conclusion of this section.

A. There are several large-scale challenges to reliability that the Midwest region is facing, which are expected to continue with increasing levels of renewable generation. Transmission infrastructure broadly plays an important role in supporting grid reliability and the Projects, as part of the LRTP1 portfolio, will be needed in order to ensure continued

[58] Independent Market Monitor for the Midcontinent ISO, 2023 State of the Market Report for the MISO Electricity Markets (June 2024), available at: https://www.potomaceconomics.com/wp-content/uploads/2024/06/2023-MISO-SOM_Report_Body-Final.pdf, p. 47.
[59] *Ibid*, p. ix.
[60] Grid Strategies LLC, Transmission Congestion Costs Rise Again in U.S. RTOs (July 2023), available at: https://gridstrategiesllc.com/wp-content/uploads/2023/07/GS_Transmission-Congestion-Costs-in-the-U.S.-RTOs1.pdf, p. 3.
[61] MISO, LRTP Tranche 1 Portfolio Detailed Business Case (June 2022), available at: https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 19.

reliability of the regional transmission system. In addition, transmission expansion is critical for supporting flexibility, and the Projects are expected to help increase connectivity across the region as well as reduce congestion.

B. The Projects Are Expected to Improve Access to Lower-Cost Generation.

Q. Is renewable energy the cheapest form of generation?

A. Increasingly, yes. A recent Lazard analysis from June 2024 shows that many renewable generation technologies are cost-competitive with conventional generation.[62] Additionally, the International Renewable Energy Agency ("IRENA") states that "almost two-thirds or 163 gigawatts (GW) of newly installed renewable power in 2021 had lower costs than the world's cheapest coal-fired option in the G20."[63]

Q. Are these cost trends occurring in Michigan as well?

A. Yes. The Commission's 2023 report on the Status of Renewable Energy, Distributed Generation, and Legacy Net Metering in Michigan recognizes the "increasingly favorable economics" of solar installations.[64] In their integrated resource plan ("IRP") filings, Michigan utilities also recognize that renewables are an increasingly economic option. As explained by Consumers Energy witness Sara Walz, the Company's Proposed Course of

[62] Lazard, Levelized Cost of Energy+ (June 2024), available at: https://www.lazard.com/media/xemfey0k/lazards-lcoeplus-june-2024-_vf.pdf, p. 9.
[63] International Renewable Energy Agency, Renewable Power Remains Cost-Competitive Amid Fossil Fuel Crisis (July 2022), available at https://www.irena.org/news/pressreleases/2022/Jul/Renewable-Power-Remains-Cost-Competitive-amid-Fossil-Fuel-Crisis.
[64] MPSC, Status of Renewable Energy, Distributed Generation, and Legacy Net Metering in Michigan (September 2023), available at https://www.michigan.gov/mpsc/-/media/Project/Websites/mpsc/regulatory/reports/RE-DG/2023-Renewable_Energy_Distributed_Generation_Legacy_Net_Metering_Report.pdf, p. 1.

Action ("PCA") in its most recent approved IRP (Case No. U-21090) "was developed based on the resources chosen by computer optimization models that select the least-cost portfolio of resources available."[65] According to Walz, the PCA includes "large amounts of solar"[66] and it is "evident that solar is a more widely selected resource due to more favorable economics."[67]

Similarly, in its Application related to its most recent IRP proceeding, DTE Electric stated, "Through the IRP process, DTE Electric has developed a PCA that identifies the most reasonable and prudent means of meeting the Company's energy and capacity needs through 2042."[68] DTE Electric's PCA included 6,500 MW of solar and 8,900 MW of wind, and, as DTE stated at the time, "allows DTE Electric to time affordable, cost-competitive solar and energy storage early in the planning period in advance of initiating Monroe's phased retirement."[69] DTE Electric Witness L.K. Mikulan stated that "renewable resources such as solar and wind are an economic source of clean, carbon free power."[70]

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65 Direct Testimony of Sara Walz on behalf of Consumers Energy Company, Case No. U-21090 ("Walz U-21090 Direct"), p. 5.
66 *Ibid.*
67 *Ibid*, p. 63.
68 Application of DTE Electric Company ("DTE IRP Application"), Case No. U-21193, Filing No. U-21193-0014, p. 2.
69 Direct Testimony of J.E. Leslie on behalf of DTE Electric Company, Case No. U-21193 ("Leslie U-21193 Direct"), p. 16; see also DTE IRP Application, p. 2.
70 Direct Testimony of L.K. Mikulan on behalf of DTE Electric Company, Case No. U-21193 ("Mukulan U-21193 Direct"), p. 27.

Q. How are the Projects, as part of MISO's LRTP1, expected to improve access to lower-cost renewable generation resources?

A. Generally, regional transmission expansion, like LRTP1, significantly improves access to renewable resources by expanding the capacity of the bulk electric grid and connecting renewable energy projects, such as wind and solar farms, to areas with high energy demand.[71] Many renewable resources are in remote regions far from population centers, where the existing transmission infrastructure is inadequate to deliver the energy generated. By building new transmission lines, renewable energy from these distant sources can be efficiently transported to consumers, ensuring that renewable energy can be fully integrated into the grid. According to MISO, LRTP1 "will result in enablement of significant renewable resources to support meeting energy requirements and renewable goals of members."[72]

Additionally, the new transmission lines will help to balance and integrate renewable resources by allowing energy to be transferred across the MISO region. This means that when electricity generation from renewable resources in one area is low due to weather conditions, power can be imported from other regions where renewable generation is high. Overall, the Projects will enhance the grid's capacity to accommodate renewable energy, increase the geographic diversity of energy sources, and help accelerate the transition to a cleaner energy system.

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[71] MISO, LRTP Tranche 1 Portfolio Detailed Business Case (June 2022), available at: https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 41.

[72] Exhibit MEIC-2 (NL-2), p. 14.

Q. How can more transmission lines ultimately reduce costs?

A. Reducing transmission constraints is an important way to help address high energy costs. According to the U.S. Department of Energy's National Transmission Needs Study, "[additional] transmission could remove or reduce the variation in prices caused by congestion, allowing lower cost energy to reach high demand areas."[73] Further, in light of the increasingly favorable economics of renewable energy sources, transmission constraints limiting the amount of renewable energy that can feasibly be interconnected are not only causing delays and withdrawals of projects, but are costing Michigan residents money. According to a report by the Solar and Storage Industries Institute, "This backlog ultimately burdens homes and businesses with higher costs for electricity and delays access in areas that need clean energy now."[74] In this case, the Projects will begin to relieve these transmission constraints, allowing the integration of more low-cost renewable energy sources. MISO articulated the primary economic benefits for the LRTP1 portfolio as stemming from "its reinforcements that enable reliable and efficient delivery of energy from low cost, regionally sited renewable resources to economically serve load in Michigan and throughout the MISO footprint."[75]

[73] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 48.
[74] Solar and Storage Industries Institute, Game Changing Interconnection Reform: Reshaping Transmission Planning and Realigning Incentives (April 2024), available at: https://www.ssii.org/interconnection-whitepaper-2024/, p. 9.
[75] Exhibit MEIC-2 (NL-2), p. 14.

Q. Please summarize the main conclusions of this section.

A. Renewable generation is increasingly becoming cost-competitive compared to conventional generation. The LRTP1 portfolio, and the Projects specifically, are expected to increase access to these lower-cost resources, which can help reduce costs for ratepayers.

C. THE PROJECTS WILL SUPPORT INCREASED COMPETITION.

Q. Does METC address the benefit of increased competition that the Projects will provide?

A. Yes, in his testimony, METC witness Charles L. Marshall emphasizes that the Projects would allow for access to additional resources, including renewable energy sources. He notes that once constructed, the Projects "will provide more flexibility in the state for bringing new power on the grid and servicing new load."[76] Marshall further explains that this "additional supply creates greater competition[,] and greater competition (all else equal) results in lower costs for ratepayers."[77]

Q. Do you agree with witness Marshall's assessment?

A. Yes, I agree that the Projects will increase the ability of Michigan's grid to support additional renewable resources. This is, in fact, one of MISO's primary reasons for developing the LRTP1 projects. MISO recognized that the resource mix is rapidly changing

[76] Marshall U-21471, p. 49.
[77] *Ibid.*, p. 50.

and planned for projects to support that changing landscape.[78] The fundamental economic argument is straightforward: with increased supply—driven by the integration of more renewable resources enabled by the Projects—comes greater competition. MISO summarizes this idea, stating that "these improvements will increase market efficiency, competitive supply of energy, and will provide economic benefits to retail electric consumers well in excess of the LRTP1 portfolio costs."[79]

Q. What is the value of competitively priced renewable energy?

A. Generally, when competition is allowed and lower-cost, often renewable projects win, lower energy costs result. Michigan EIBC, IEI, and Advanced Energy United (collectively "MEIU") previously outlined this relationship in testimony in both the latest Consumers Energy Voluntary Green Pricing case (Case No. U-21374)[80] and the DTE Electric IRP case (Case No. U-21193).[81] MEIU witness Dr. Laura S. Sherman referenced a whitepaper commissioned by the National Association of Regulatory Utility Commissioners, that states "by allowing the market to compete for the opportunity to supply power, utilities can obtain electricity supply that has the best fit to customers' needs at the best possible financial terms."[82] Additionally, greater access to lower-cost renewable resources in a competitive market is expected to lead to reduced energy costs for ratepayers.[83] This is

[78] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 1.
[79] Exhibit MEIC-2 (NL-2), p. 10.
[80] Direct Testimony of Dr. Laura S. Sherman on behalf of MEIU, Case No. U-21374, p. 9–10.
[81] Direct Testimony of Dr. Laura S. Sherman, Case No. U-21193, p. 6.
[82] Susan Tierney, Todd Schatzki, Competitive Procurement of Retail Electricity Supply: Recent Trends in State Policies and Utility Practices, The Electricity Journal, Volume 22, Issue 1 (2009), available at: https://doi.org/10.1016/j.tej.2008.12.005, p. 50–62.
[83] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 20, 64.

partly due to the ability of additional transmission to reduce price variations caused by congestion, allowing lower-cost resources to reach high demand areas.[84]

Q. Broadly, how does expanding transmission infrastructure result in increased competition?

A. Expanding transmission infrastructure opens opportunities for more projects and innovation within the region, facilitating greater interconnection of renewable energy projects.[85] In 2023, solar and battery storage, which account for over 80% of new capacity, were the fastest-growing resources in the interconnection queues across all seven ISOs/RTOs.[86] As energy generation changes and demand continues to rise, the existing transmission system will face limitations in many areas. To accommodate this growth, expanding and improving transmission infrastructure will be necessary. Regional transmission projects, such as LRTP1, will allow for additional low-cost resources to connect to the grid, which will result in more competitively priced renewable energy.

Q. Is Michigan's renewable energy sector currently seeing an increase that could lead to greater supply and competition?

A. Increasingly yes, Michigan is experiencing growing interest in renewable energy development, with the state leading the Midwest in clean energy job growth, as noted in

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[84] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 20.

[85] Brookfield, Gridlock: Why Investment in Transmission is Critical to Reach Net Zero, (June 2024), available at: https://www.brookfield.com/news-insights/insights/gridlock-why-investment-transmission-critical-reach-net-zero.

[86] Lawrence Berkeley Lab, Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection. (April 2024), available at: https://emp.lbl.gov/queues.

the recent Clean Jobs Midwest report.[87] Clean energy and vehicle jobs in Michigan set a record in 2023, growing to more than 127,000 jobs, a more than 4% increase over the previous year.[88] Importantly, the industry is poised for more growth in 2024, with job growth expecting to increase more than 8%.[89]

Q. How are the Projects expected to increase competition?

A. The statistics above represent an overall trend—both in Michigan and the entire Midwest region—towards renewable energy and electrification of buildings and vehicles. This changing resource mix was a critical reason, alongside other urgent reliability challenges, for developing MISO's Response to the Reliability Imperative and the associated LRTP1 and Future 1 planning scenario. In summarizing the need for LRTP1, MISO states that "the anticipated landscape changes are much more significant and require transformational changes at a faster rate than the previous 2011 portfolio of projects were built to accommodate."[90] To accommodate this growth, new infrastructure, such as the Projects, will be necessary. The Projects will provide more flexibility in Michigan to interconnect additional renewable generation, and the increased supply of generation will result in greater competition.

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87 Clean Jobs Midwest, Michigan Fact Sheet (October 2024), available at: https://www.cleanjobsmidwest.com/state/michigan.
88 *Ibid.*
89 *Ibid.*
90 MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 2.

Q. Please summarize the main conclusion of this section.

A. The renewable energy sector in Michigan is experiencing significant growth, and the Projects will allow for more flexibility to bring new low-cost generation on the grid and to service new load. This increases the competitive supply of energy in the market and can help reduce costs for ratepayers.

D. The Projects are Needed to Reach Michigan's Decarbonization Goals.

Q. METC witness Marshall testifies that the Projects will support Michigan's "energy policy goals by developing needed transmission infrastructure in a cost effective, forward-looking, and right-sized manner."[91] Do you agree?

A. Yes, I agree with witness Marshall's assessment that the LRTP1 portfolio, and the Projects specifically, are needed to support decarbonization.[92] High voltage transmission lines, like the Projects, can help states achieve their renewable energy goals[93] by enabling greater access to the best available and lowest cost resources.[94] The Projects are designed to support the modest load growth that is modeled in Future 1, while also serving as a critical backbone for supporting future growth. The Future 1 assumptions reflect existing economic conditions, with an annual energy growth rate of 0.5% and annual demand growth rate of 0.6% over the next 20 years.[95] Given MISO's acknowledgement that the

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[91] Marshall U-21471 Direct, p. 11.
[92] *Ibid.*, p. 37.
[93] FERC, Report on Barriers and Opportunities for High Voltage Transmission (2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf.
[94] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 9.
[95] Exhibit MEIC-2 (NL-2), p. 14.

pace of transition is rapidly increasing, along with the growth of the industry and evolving policy environment in Michigan, it is reasonable to predict that this rate of growth will increase.

Q. Please outline Michigan's latest decarbonization goals.

A. The MI Healthy Climate Plan first outlined the commitment for Michigan to achieve 100% economy-wide carbon neutrality by 2050.[96] Then, in late 2023, a historic clean energy package[97] was signed into law, which includes, among other policies,

- A clean energy standard of 80% by 2035 and 100% by 2040;[98]
- A renewable portfolio standard of 50% in 2030 through 2034, and 60% after 2035;[99] and
- A statewide energy storage target of 2,500 MW by 2029.[100]

In addition to the increased renewable energy and energy efficiency standards, the laws make significant progress related to energy waste reduction programs[101] and renewable energy project siting, including a process to streamline permitting of new wind, solar, and storage projects.[102]

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[96] EGLE, MI Healthy Climate Plan, (April 2022), available at: https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Offices/OCE/MI-Healthy-Climate-Plan.pdf?rev=d13f4adc2b1d45909bd708cafccbfffa.
[97] Public Acts 229, 231, 233, 234, and 235 of 2023.
[98] MCL 460.1051.
[99] MCL 460.1028.
[100] MCL 460.1101.
[101] Public Act 229 of 2023, MCL 460.1071–MCL 460.1099.
[102] Public Act 233 of 2023, MCL 460.1221–MCL 460.1232.

Q. What is the expected impact of Michigan's latest decarbonization goals?

A. Combined with federal policies, these state policies are expected to significantly grow the renewable energy industry in Michigan. As previously mentioned, Michigan utilities are increasingly incorporating renewable generation in their latest IRPs. In addition, according to recent modeling conducted before the laws were signed, policies similar to those enacted in Michigan are expected to lead to the creation of over 160,000 good-paying jobs in the next decade.[103] The latest Clean Jobs Midwest report confirms this growth, noting that clean energy and vehicle jobs set a record in 2023, and are projected to surge in 2024, increasing over 8%.[104] Recently, Michigan EIBC collaborated with 5 Lakes Energy on a report that includes updated projections of growth in each of Michigan's prosperity regions following the enactment of the 2023 clean energy laws (see Exhibit MEIC-5 (NL-5)).

Michigan EIBC surveyed its members about how recent federal funding and state polices are affecting their business operations and asked for their projections on how the implementation of recent state and federal policies will impact them in the future. Unsurprisingly, most respondents indicated plans to expand their workforce, with 75% either actively hiring or understaffed.[105] When asked about their workforce needs over the next three years, 90% of companies indicated they would need to hire or be understaffed, signaling an existing and future increase in labor demand.[106] In addition, the survey indicated a strong interest in renewable project development across the state. Three of

[103] The Michigan Clean Energy Framework: Assessing the Economic and Health Benefits of Policies to Achieve Michigan's Climate Goals (August 2023), available at: https://5lakesenergy.com/wp-content/uploads/2023/08/MI-Clean-Energy-Framework-report.pdf.
[104] Clean Jobs Midwest, Michigan Fact Sheet (October 2024), available at: https://www.cleanjobsmidwest.com/state/michigan.
[105] Exhibit MEIC-5 (NL-5), p. 24.
[106] *Ibid*, p. 25.

Michigan's prosperity regions were selected as targets for business expansion by over 70% of respondents.[107]

Q. Are the Projects needed to support this expected growth in renewable energy?

A. As decarbonization targets prompt higher levels of renewable energy resource integration, the need for additional transmission infrastructure to ensure reliability and resilience is expected to grow.[108] The policy changes discussed above will put additional pressure on the existing transmission system, necessitating significant investment.[109] Governor Whitmer, alongside Midwestern Governors from Illinois, Minnesota, and Wisconsin emphasized this urgency in a letter highlighting the need for the LRTP1 lines, stating they are "urgently needed to allow carbon-free and low-cost electricity to flow across the region" (see Exhibit MEIC-6 (NL-6)). Renewable energy resources are often located in remote areas far from population centers,[110] making transmission vital for transporting this energy from generation sites to end users. Additionally, interconnection-related delays are becoming a significant barrier to achieving state decarbonization goals, with many new energy resources stuck in backlogged interconnection queues.[111]

Q. Please elaborate on the current state of the interconnection queue across RTOs.

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[107] *Ibid.*
[108] Brookfield, Gridlock: Why Investment in Transmission is Critical to Reach Net Zero, (June 2024), available at: https://www.brookfield.com/news-insights/insights/gridlock-why-investment-transmission-critical-reach-net-zero.
[109] U.S. Department of Energy, National Transmission Needs Study (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. vii.
[110] FERC, Report on Barriers and Opportunities for High Voltage Transmission (2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf, p. 11.
[111] FERC, Report on Barriers and Opportunities for High Voltage Transmission (2020), available at: https://www.congress.gov/116/meeting/house/111020/documents/HHRG-116-II06-20200922-SD003.pdf, p. 9.

A. Across all seven Independent System Operators ("ISOs")/RTOs, most projects applying for interconnection to the transmission system are ultimately withdrawn, and those that are built are taking longer to become operational, according to a Lawrence Berkeley National Lab report.[112] By the end of 2023, only 19% of projects seeking interconnection between 2000 and 2018 had been built.[113] In 2023, nearly 42% of capacity stuck in ISO/RTO interconnection queues came from solar projects, and 40% from storage.[114] Wait times are also increasing: the typical duration from interconnection request to commercial operation grew from less than 2 years for projects built between 2000 and 2007 to over 4 years for those built between 2018 and 2023, with a median wait time of 5 years for projects completed in 2023.[115] A U.S. Department of Energy National Transmission Needs study from October 2023 highlighted the high withdrawal rates, with 72% of projects seeking interconnection between 2000 and 2017 eventually withdrawing their requests.[116]

Q. Why are transmission system improvements, like the Projects, needed to allow increasing amounts renewable generation to interconnect?

A. Transmission system improvements are critical to enabling renewable energy projects to interconnect,[117] and the Projects, as a part of LRTP1, will increase the ability of Michigan's

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[112] Lawrence Berkeley Lab, Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection, (April 2024), available at: https://emp.lbl.gov/queues.
[113] *Ibid*.
[114] *Ibid*.
[115] *Ibid*.
[116] U.S. Department of Energy, "National Transmission Needs Study" (October 2023), available at: https://www.energy.gov/gdo/national-transmission-needs-study, p. 48.
[117] U.S. Department of Energy, Transmission Interconnection Roadmap (April 2024), available at: https://www.energy.gov/sites/default/files/2024-04/i2X%20Transmission%20Interconnection%20Roadmap.pdf, p. 9.

grid to support more renewable generation.[118] According to MISO, its 2022 interconnection queue cycle, which began studies in March 2023, includes 8.9 GW of new generation resources in Michigan that are essential for meeting decarbonization targets.[119] Many of these interconnection requests were made with the assumption that the LRTP1 will be made part of the network, so they could be negatively impacted if LRTP1 projects, like the proposed transmission lines in this proceeding, are delayed or denied.[120] Without these necessary infrastructure improvements, renewable energy projects will continue to face delays in interconnection, increasing costs and slowing progress toward clean energy goals. Thus, the Projects are needed to support Michigan's decarbonization goals by being the necessary infrastructure to grow renewable generation in the state.

Q. Please summarize the main conclusion of this section.

A. Michigan has recently enacted decarbonization goals and other state policies that are expected to grow renewable energy generation. To support reliable energy delivery, additional transmission infrastructure, such as the Projects, must be built to help deliver this influx of generation resources to load centers.

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118 MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1 Executive Summary, available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 1.
119 Exhibit MEIC-2 (NL-2), p. 13.
120 *Ibid*.

V. <u>CONCLUSIONS AND RECOMMENDATIONS</u>

Q. Please summarize your conclusions and recommendations to the Commission.

A. Without taking a position on any route issues related to either proposed Project, I recommend that the Commission find that the first condition listed under Section 8 of Act 30, that "[t]he quantifiable and nonquantifiable public benefits of the proposed major transmission line justify its construction," will be more than satisfied in the case of both Projects.

The Projects will provide significant public benefits – including:

- The Projects, as a part of the LRTP1 portfolio, address the rapidly changing landscape (*i.e.*, increasing renewable generation) and support reliability, grid flexibility, and reduced congestion.
- The Projects are expected to improve access to lower-cost renewable energy generation resources.
- The Projects will support increased competition, and in combination with the above benefits, can help lower energy costs.
- The Projects will help Michigan reach its state goal of achieving 100% clean energy by 2040 and support additional decarbonization policies.

Q. Does that complete your testimony?

A. Yes.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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In the matter of the application of **MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC** for an Act 30 certificate of public convenience and necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan, and between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan.	**Case No. U-21471** **Case No. U-21472**

EXHIBITS OF NATALIE LYIJYNEN

ON BEHALF OF

THE MICHIGAN ENERGY INNOVATION BUSINESS COUNCIL,

INSTITUTE FOR ENERGY INNOVATION,

AND

CLEAN GRID ALLIANCE

Natalie Lyijynen

PROFESSIONAL EXPERIENCE

MICHIGAN ENERGY INNOVATION BUSINESS COUNCIL AND INSTITUTE FOR ENERGY INNOVATION — **Lansing, MI**
April 2023 - Present
Sustainable Business Associate

- Serve as an expert on electricity transmission and related policy issues for Michigan EIBC members.
- Advance public education on the needs and benefits of transmission buildout for renewable energy, including teaching an EUCI course, and co-authoring an opinion piece in the Detroit Free Press
- Engage stakeholders at the state level, including organizing educational calls and coordinating with Governor Whitmer's office to support the LRTP
- Work closely with trade organizations and advocacy groups both in Michigan and in other Midwestern states to align messaging and support public communication goals

UNIVERSITY OF MICHIGAN, PROGRAM IN THE ENVIRONMENT — **Ann Arbor, MI**
Peer Advisor and Student Outreach Coordinator — April 2021 – April 2023

- Supported the advising team and career resources team in the Program in the Environment office

UNIVERSITY OF ALASKA FAIRBANKS — **Remote**
Arctic Policy & Energy Research Intern — June 2021 – August 2021

- Contributed to the report published by the Center for Arctic Policy Studies on energy issues and trends
- Researched 30+ literature reviews about what a transition of the hydrocarbon in Alaska might look like focusing on environmental justice and social trends
- Analyzed data about local climate and economic conditions, as well as looked into published viewpoints from Indigenous communities and professionals, and compiled research into an assessment of a possible transition

UNIVERSITY OF MICHIGAN, MICHIGAN QUARTERLY REVIEW — **Ann Arbor, MI**
Global Water Crisis Research Assistant — October 2019-April 2020

- Investigated 150+ environmental writing programs, anthologies, journals, and courses in order to reach out to diverse authors for MQR's Spring 2020 issue, with the goal of promoting the journal to a wider audience
- Edited 20+ creative writing submissions to the journal to further improve clarity and promote public education around climate and water issues
- Interviewed five professionals who bridge the gap between science and arts in order to shed light on the barriers faced in environmental communications; published interviews are on MQR's website

EDUCATION

UNIVERSITY OF MICHIGAN — **Ann Arbor, MI**
Bachelor of Science in Biology and Environmental Studies — December 2022
Concentration: environmental law & policy, Minor: sustainability
High Distinction

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Competitive Transmission
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VIA ELECTRONIC DELIVERY

September 30, 2024

Ms. Lisa Felice
Executive Secretary
Michigan Public Service Commission
P. O. Box 30221
Lansing, Michigan 48909-7721

Re: ***In the Matter of the Application of Michigan Electric Transmission Company, LLC for an Act 30 Certificate of Public Convenience and Necessity for the Construction of a Major Transmission Line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan***
Comments by the Midcontinent Independent System Operator, Inc.; Case No. U-21471

In the Matter of the Application of Michigan Electric Transmission Company, LLC for an Act 30 Certificate of Public Convenience and Necessity for the Construction of a Major Transmission Line between the Indiana/Michigan State Border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan
Comments by the Midcontinent Independent System Operator, Inc.; Case No. U-21472

(Consolidated)

Dear Ms. Felice:

The Michigan Public Service Commission ("Commission") in the above-referenced cases[1] provided interested persons the opportunity to comment upon requested certificates of Public Convenience and Necessity for the Oneida-Nelson Road and State Border – Helix (a new substation) transmission projects (together, the "Projects"). I submit comments on behalf of the Midcontinent Independent System Operator, Inc. ("MISO") in support of the grant of the requested certificates for the Projects.

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[1] The cases were consolidated by the administrative law judge at the conference held on August 29, 2024 and documented in the case dockets by a Memorandum dated September 6, 2024.

As an overview to my comments, the Projects will help ensure the ability of the transmission system to meet challenges presented by the on-going and projected transition of generation resources and the need for development of long-term transmission planning solutions. The Projects will help realize the benefits identified by MISO and stakeholder review of the Long Range Transmission Planning ("LRTP") Tranche 1 portfolio of projects that were approved by MISO as an important part of the MISO Transmission Expansion Plan ("MTEP"). The MISO analyses of the existing transmission system during the MTEP21 planning cycle identified numerous transmission facilities that will be loaded above safe operating levels or below adequate voltage levels without the Projects. The overall system would also be more secure with the addition of the Projects, which address additional voltage and transient stability limitations. Without the Projects, Michigan and other states in the MISO footprint would not receive the full set of economic benefits that are provided by the LRTP Tranche 1 portfolio.

Background

I am the Director for Cost Allocation and Competitive Transmission within MISO's Transmission Planning Department, which is the Planning Coordinator for the MISO region and prepares the MTEP annually. My office is located at 720 City Center Drive, Carmel, Indiana 46032. I am responsible for directing the teams focused on multiple areas of transmission planning: (i) LRTP business case development, including for the first portfolio of LRTP projects (the aforementioned LRTP Tranche 1 projects); (ii) all parts of MISO's competitive transmission process and the "variance analysis" process for after-the-fact review of regionally cost-shared transmission projects; (iii) MISO's regional and interregional transmission cost allocation; (iv) annual MTEP report development; and (v) MISO's seams coordination strategy.

MISO is a not-for-profit, member-based, regional transmission organization ("RTO") providing reliability and market services over approximately 70,000 miles of transmission lines in fifteen states and one Canadian province. MISO's regional area of operations stretches from the Ohio-Indiana line in the east to eastern Montana in the west, north to the Canadian province of Manitoba, and south to New Orleans. MISO is governed by an independent ten-member Board of Directors.[2]

As an RTO, MISO is responsible for operational oversight and control, market operations, and planning of the transmission systems of its member Transmission Owners ("TOs"). Among many other responsibilities, MISO monitors and calculates Available Flowgate Capability and provides tariff administration for its Open Access Transmission, Energy and Operating Reserve Markets Tariff ("Tariff"),[3] which has been accepted by the Federal Energy Regulatory

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2 MISO has nine independent directors, and its Chief Executive Officer fills a tenth seat on the Board.

3 MISO Tariff, available at: https://www.misoenergy.org/legal/rules-manuals-and-agreements/tariff/.

Commission ("FERC").[4] MISO is the Reliability Coordinator for its regional area of operations, providing real-time operational monitoring and control of the transmission system. MISO operates real-time and day-ahead energy markets based on Locational Marginal Prices ("LMPs") in which each market participant's offer to supply energy is matched to demand and is cleared based on a security-constrained economic dispatch process. In addition, MISO operates a market for Financial Transmission Rights, which are used by market participants to hedge against congestion costs, and an ancillary services market, which provides for the services necessary to support transmission of capacity and energy from generation resources to load. MISO is responsible for approving transmission service, new generation interconnections, and new transmission interconnections within MISO's regional area of operations, and for ensuring that the system is planned to reliably and economically provide for existing and forecasted usage of the transmission system. MISO is the Planning Coordinator for its regional area of operations, which includes most of Michigan, and performs planning functions collaboratively with input from its TOs and other interested stakeholders, while also providing an independent assessment of and perspective on the needs of the overall transmission system.

The Michigan Electric Transmission Company, LLC ("METC") filed Applications in these cases seeking certificates of public convenience and necessity pursuant to Michigan's Electric Transmission Line Certification Act, 1995 PA 30, MCL 460.561 *et seq*. METC seeks authorization to construct the Projects, which include approximately 40 miles of new, double-circuited 345 kV lines for the Oneida-Nelson Road portion of the Projects and approximately 55 miles of new, double-circuited 345 kV lines from a (new) Hiple Substation to the state border with Indiana. The Projects were included as part of the East-Central Corridor from Iowa to Michigan in the development of the LRTP Tranche 1 portfolio. These Projects are an integral part of the LRTP Tranche 1 portfolio of projects that were approved in MISO's 2021 MTEP process.

<u>Purpose and Scope of These Comments</u>

The purpose of these comments is to generally describe the planning functions performed by MISO, including the development of MTEP. I also provide a summary of findings regarding the Projects based on MISO's analyses and discuss the integration of the Projects into MISO's regional transmission plan. I explain how the LRTP Tranche 1 portfolio, including the Projects, reliably and economically supports a wide range of energy policies and generation scenarios. I explain how the benefits of the portfolio have been defined and confirmed. I will refer to the benefits of the Projects and the benefits of the 2021 Multi-Value Project ("MVP") portfolio. MVP is a transmission project type within the MISO Tariff. The 2021 MVP portfolio is commonly referred to as the LRTP Tranche 1 portfolio. I will refer to the "MISO Midwest MVP Cost Allocation Subregion" (or "Midwest Subregion") in these comments. This region, which includes Michigan, refers to MISO's Central and North Regions that begin in Missouri and extend northward (and bounded by Michigan in the east and eastern Montana in the west). This

[4] MISO's Tariff was initially accepted by FERC in 1998, but was suspended until subsequently adopted in 2001. *See Midwest Indep. Transmission Sys. Operator, Inc.*, 97 FERC ¶ 61,326 (2001); *Midwest Indep. Transmission Sys. Operator, Inc.*, 97 FERC ¶ 61,033 (2001), *order on reh'g*, 98 FERC ¶ 61,141 (2002). MISO began providing transmission service under its Tariff in 2002.

identification of a subregion within the MISO footprint is relevant to responsibility for costs associated with the LRTP Tranche 1 portfolio of which the Projects are a part.

The Projects are part of the LRTP Tranche 1 portfolio, a MISO report concerning which is discussed in the Applications for these cases ("MTEP21 Report Addendum," Exhibit METC-3A in the Application in U-21471 and Exhibit METC-3B in the Application in U-21472).[5] The portfolio was approved by the MISO Board of Directors on July 25, 2022, as part of MISO's MTEP21 process. This approval was based on a set of reliability, economic, and public policy analyses conducted between 2020 and 2022 that documented the reliability benefits of the Projects and the combined reliability, economic, and public policy benefits of the full LRTP Tranche 1 portfolio.

The Projects provide a high voltage transmission path that increases the reliability of the regional transmission system while enhancing the ability of the Michigan transmission system to meet local load serving needs. The Projects are part of the LRTP Tranche 1 portfolio that, as part of the MISO regional plan, will deliver economic benefits in excess of costs under a future system scenario, known as "Future 1,"[6] that is guided by assessments of future conditions that include federal, state, and individual utility energy policies. Tranche 1 provides a robust transmission network that supports a broad range of generation and policy futures. Support for the Projects, as a planned part of LRTP Tranche 1 portfolio, is described further in these comments and is summarized as follows:

1) MISO Regional Transmission Planning and MVP Planning Process
   MISO's regional planning process ensures continued system reliability in a least cost manner while considering a series of potential future policy and economic conditions. These comments discuss the high-level goals and key considerations of the MISO planning process, as well as the planning process utilized to define and justify the projects in the MVP portfolio.

2) Reliability Planning Considerations
   MISO's analyses ensure that load has access to reliable energy. These comments discuss the key criteria applied in MTEP reliability analyses and the importance of each of these factors in maintaining a safe and reliable supply of energy to end-use customers.

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5 A copy of MISO's publicly available MTEP21 Report Addendum that discusses the LRTP Tranche 1 portfolio is also available at: https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf. The MTEP21 Report Addendum is comprised of an Executive Summary and a Tranche 1 Portfolio Report, and refers to the transmission lines that encompass the instant Project as "Oneida – Nelson Road" and "Hiple-Duck Lake" (the LRTP project extends from the Michigan/Indiana state border to the Hiple Substation, the latter of which is located in Indiana).

6 Future 1 is extensively discussed in the MTEP21 Report Addendum.

3) Reliability Justification
   The Projects were justified based on the ability of the Projects to resolve reliability issues within and bordering on Michigan. These comments discuss the reliability benefits of the Projects and explain why alternatives to the Projects were not selected.

4) Economic and Public Policy Considerations
   The MISO planning process assessed benefits of the LRTP Tranche 1 portfolio under the Future 1 economic and public policy scenario. These comments elaborate on the structure of these analyses.

5) Economic and Public Policy Portfolio Benefits
   The Projects, as part of the overall LRTP Tranche 1 portfolio, provide economic benefits in excess of its costs while enabling compliance with public policy requirements such as renewable energy mandates. These comments discuss the economic benefits of the LRTP Tranche 1 portfolio as a whole. I also discuss the ability of the portfolio to enable existing public policies, along with a wide variety of other potential future generation options.

6) Regional System Planning and MVP Policies
   The projects in the LRTP Tranche 1 portfolio (an MVP portfolio), including the Projects, have been incorporated in the MISO transmission plan and subsequent analyses. These comments discuss the cost implications of the Projects and the near-term impacts of a failure to approve the Projects.

MISO Regional Transmission Planning

Regional planning at MISO is performed in accordance with several guiding documents. The Agreement of Transmission Facilities Owners to Organize the Midcontinent Independent System Operator, Inc., a Delaware Non-Stock Corporation ("Transmission Owners Agreement" or "TOA") includes the planning framework that describes the planning responsibilities of MISO and its transmission owning members.[7] MISO's responsibilities include the development of the MTEP in collaboration with TOs and other stakeholders. MISO also adheres to the nine planning principles outlined in FERC Order No. 890.[8] In so doing, MISO provides an open and transparent

7 *See* MISO Transmission Owners Agreement (TOA), Version: 36.0.0 Effective: 7/29/2020, Appendix B, Section VI, publicly available at: https://misodocs.azureedge.net/miso12-legalcontent/Rate_Schedule_01_-_Transmission_Owners_Agreement.pdf.

8 *Preventing Undue Discrimination and Preference in Transmission Service*, Order No. 890, FERC Stats. & Regs. ¶ 31,241, *order on reh'g*, Order No. 890-A, FERC Stats. & Regs. ¶ 31,261 (2007), *order on reh'g and clarification*, Order No. 890-B, 123 FERC ¶ 61,299 (2008), *order on reh'g*, Order No. 890-C, 126 FERC ¶ 61,228 (2009), *order on clarification*, Order No. 890-D, 129 FERC ¶ 61,126 (2009). "The Transmission Provider's planning process shall satisfy the following nine principles, as defined in the

regional planning process that results in recommendations for expansion that are reported in the MTEP. FERC Order No. 1000 furthered the planning principles outlined in FERC Order No. 890 and included the requirements to plan for public policy and for coordinated inter-regional planning and cost allocation.[9]

Consistent with these planning principles, the objectives of the MTEP process are to (i) identify transmission system expansions that will ensure the reliability of the transmission system that is under the operational and planning control of MISO, (ii) identify expansion that is critically needed to support the reliable and competitive supply of electric power by this system, and (iii) identify expansion that is necessary to support energy policy mandates in effect within the MISO footprint. MISO's MTEP report provides assessments of resource adequacy, analyses of various energy policy scenarios, and the development of long-term resource forecasts based on those scenarios.

MISO uses a "bottom-up, top-down" approach in developing the MTEP plan. The "bottom-up" portion relies on the ongoing responsibilities of the individual TOs to continuously review and plan to reliably and economically meet the needs of their local systems. MISO then reviews these local planning activities with stakeholders and performs a "top-down" review of the adequacy of, and appropriateness of, the local plans in a coordinated fashion to most efficiently ensure that all of the needs are cost-effectively met. In addition, MISO, together with stakeholders, considers opportunities for improvements and expansions that would reduce consumer costs by providing access to new, low-cost resources that are consistent with and required by evolving legislative energy policies.

MISO's planning process examines congestion that may limit access to the most efficient resources and considers improvements that may be needed to meet forecasted energy requirements. Stakeholders from each MISO member sector, including state regulatory authorities, public consumer advocates, environmental representatives, end-use customers, and independent power producers, among others, are engaged to develop a wide range of future system scenarios that are guided by assessments of possible future state and federal energy policy decisions. These possible future scenarios and energy polices ("Futures") form the basis for forecasts of generation resources and load that would be economical and consistent with member plans and policy. Transmission needs are then assessed, and plans developed to reliably and economically deliver the necessary energy from generation resources to load.

The MTEP consists of the many individual projects or portfolios of projects that are recommended by the MISO staff to the MISO Board of Directors. In accordance with the TOA, approval of a MTEP by the MISO Board of Directors certifies the MTEP as MISO's plan for

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Final Rule in Docket No. RM05-25-000: coordination, openness, transparency, information exchange, comparability, dispute resolution, regional participation, economic planning studies, and cost allocation for new projects." Order 890-B, Attachment K.

9 *Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities*, Order No. 1000, 136 FERC ¶ 66,051 (2011), *order on reh'g*, Order No. 1000-A, 139 FERC ¶ 61,132 (2012), *order on reh'g and clarification*, Order No. 1000-B, 141 FERC ¶ 61,044 (2012).

meeting the transmission needs of all stakeholders, subject to any required approvals by federal or state regulatory authorities.

There are numerous considerations in planning for a regional transmission system; however, two considerations are crucial. First, the reliability of the transmission system must be maintained. That is, the transmission system must be able to withstand disturbances (generator and/or transmission facility outages) without interruption of service to load. This is achieved, in part, by assuring that disturbances do not lead to cascading loss of other generator or transmission facilities.

Second, the transmission system must be adequately planned to be able to accommodate load growth and/or changes in load and load growth patterns, as well as changes in generation and generation dispatch patterns without causing equipment to perform outside of its design capability. Additional considerations include planning the transmission system to address constraints that limit market efficiency and provide for expansions that enable energy policy mandates to be achieved.

Long Range Transmission Planning Process

The LRTP process, including its stakeholder process, focuses on the development of robust solutions that address future reliability challenges posed by the continuing trend towards increasing levels of carbon-free weather-dependent generation resources. Long-range planning provides a comprehensive, forward-looking assessment of future needs based on a range of anticipated future conditions that identify the regional transmission expansion needed to maintain reliable performance, cost efficient energy delivery, accessibility to resources, and flexibility in fuel mix.

Regional transmission projects identified in the LRTP process are MVPs whose costs are regionally or sub-regionally shared. An MVP is a type of transmission project developed by MISO and stakeholders that was accepted by FERC in 2010.[10] The MVP is a project that must be (i) evaluated as part of a portfolio of MVPs whose benefits are spread broadly across the MISO footprint and (ii) must meet at least one of the following criteria, as stated in Attachment FF of the MISO Tariff:[11]

a. Criterion 1. A Multi-Value Project must be developed through the transmission expansion planning process for the purpose of enabling the Transmission System to reliably and economically deliver energy in support of documented energy policy mandates or laws that have been enacted or adopted through state or federal legislation or regulatory requirement that directly or indirectly govern the minimum or maximum amount of energy that can be generated by specific types of generation. The MVP must be shown to enable the transmission system to deliver such energy in a manner

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10 *Midwest Independent Transmission System Operator, Inc*., 133 FERC ¶ 61,221 (2010), PP 1, 3, *order on reh'g,* 137 FERC ¶ 61,074 (2011) ("MVP Rehearing Order"), P 1.

11 MISO Tariff, Attachment FF, Section II.C.

that is more reliable and/or more economic than it otherwise would be without the transmission upgrade.

b. Criterion 2. A Multi-Value Project must provide multiple types of economic value across multiple pricing zones with a Total MVP Benefit-to-Cost ratio of 1.0 or higher where the Total MVP Benefit -to-Cost ratio is described in Section II.C.7 of this Attachment FF. The reduction of production costs and the associated reduction of LMPs resulting from a transmission congestion relief project are not additive and are considered a single type of economic value.

c. Criterion 3. A Multi-Value Project must address at least one Transmission Issue associated with a projected violation of a NERC or Regional Entity standard and at least one economic-based Transmission Issue that provides economic value across multiple pricing zones. The project must generate total financially quantifiable benefits, including quantifiable reliability benefits, in excess of the total project costs based on the definition of financial benefits and Project Costs provided in Section II.C.7 of Attachment FF.

The Tariff also requires that (1) MVPs must include transmission facilities at a voltage of 100 kV or above and (2) the total capital cost of the transmission project must be at least $20 million.[12]

The MVP cost allocation process was refined as part of the LRTP initiative that was filed with, and accepted by, FERC in 2022.[13] The initiative included subdividing the MISO footprint into two subregions – the Midwest Subregion and the MISO South MVP Cost Allocation Subregion ("South Subregion"). The Tariff provisions that provide for these subregions recognize that benefits from an MVP portfolio may be widespread and yet mostly contained within geographic subregions in the midwestern and southern portions of the MISO footprint. The LRTP Tranche 1 portfolio is a collection of eighteen (18) transmission projects whose benefits are mostly spread across the Midwest Subregion of the MISO footprint.

As early as 2002, in a process that would lead to approval of the first MVP portfolio in 2011, MISO began to conduct studies to investigate the regional transmission required to provide value to MISO stakeholders while responding to a growing desire for renewable energy in the MISO footprint. As time and analyses continued, renewable mandates were passed by an increasing number of states in the MISO footprint. At the same time, the MISO Interconnection Queue for generators saw a substantial increase in queued requests, and the study results for those generators continued to show the need for more large-scale transmission projects. These factors led to the definition of an MVP project type, and they also led to the ultimate analysis and approval of the 2011 MVP portfolio.

The need for further development of the high voltage transmission system to facilitate the integration of renewable generation resources accelerated after the 2011 MVP portfolio was approved. Subsequent to approval of the 2011 MVP portfolio, the MISO footprint had a major

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12 MISO Tariff, Attachment FF, Section II.C.3(d) & (e).

13 *Midcontinent Independent System Operator, Inc.*, 179 FERC ¶ 61,124 (2022), P 1.

change with the addition of MISO South in 2013 (*i.e.*, south of Missouri). At the start of the LRTP initiative in 2021, MISO recognized this change and provided an additional option for subregional cost allocation for MVP portfolios under its Tariff.

The LRTP Tranche 1 portfolio is a group of transmission projects distributed across the Midwest Subregion that will enable the reliable delivery of increased levels of renewable generation and provide for economic benefits in excess of the portfolio costs to the Midwest Subregion, primarily by reducing generator production costs and allowing for more economic resource and transmission investment decisions. The portfolio, which includes the Project, was approved for implementation by the MISO Board of Directors as part of MTEP 21. Each project within the LRTP Tranche 1 portfolio approved by the MISO Board of Directors was evaluated as part of the LRTP Tranche 1 portfolio. Each project was determined to be a necessary component of the portfolio that would together provide benefits that broadly span the MISO Midwest Subregion, and meet at least one of the criteria stated earlier to be classified as an MVP.

In conducting its RTO planning responsibilities, MISO undertook a multi-year planning process aimed at developing regional transmission plans to address the increasing transition from conventional dispatchable coal and natural gas generation in the Midwest to weather-dependent generation sources, such as wind and solar, in a manner that lowers total delivered wholesale energy costs. The MISO Futures analysis examined reliability, economic, policy, and technological impacts on resource changes and established future planning scenarios to be evaluated for regional transmission expansion needs. These future scenarios were used to identify a number of focus areas across the Midwest Subregion for evaluating potential transmission solutions. Reliability studies were performed to identify area thermal and voltage issues and the transmission projects that provided the most effective mitigation. The projects were further consolidated into a proposed LRTP Tranche 1 portfolio to meet overall regional planning objectives.

MISO worked with stakeholders, including METC, to identify potential transmission expansions that provide future benefits for the MISO Midwest Subregion. These potential expansions were then intensively studied through MISO's open and transparent stakeholder process.

This intensive process began with analyses of the challenges expected from the future resource transition and the need for long-term transmission planning solutions, and included discussions around the MVP cost allocation process in a number of MISO stakeholder forums that reached final MISO Board of Directors approval in July 2022. MISO conducted over 200 internal and stakeholder meetings, the latter of which included 200-300 attendees at each meeting to develop a final set of reliability, economic, and public policy assessments.

The overall goal for the LRTP Tranche 1 portfolio analyses was to design a transmission portfolio that takes advantage of the linkages between local and regional reliability and economic benefits to ensure a reliable and economic electric market. The portfolio was designed using reliability and economic analyses, applying a Future developed through the stakeholder process to determine a robust portfolio.

The LRTP Tranche 1 portfolio analyses evaluated the expected future conditions on the MISO regional transmission system. MISO's analyses found that the Projects will be needed in order to ensure the continued reliable operation of the regional transmission system, including the METC transmission system, while meeting the expanding role of renewable generation resources in the Midwest Subregion. In addition, MISO's analyses show that the LRTP Tranche 1 portfolio of projects that include the Projects provides additional connectivity across the transmission system, reducing congestion and enabling access to a broader array of resources by customers in Michigan. These improvements will increase market efficiency, competitive supply of energy, and will provide economic benefits to retail electric consumers well in excess of the LRTP Tranche 1 portfolio costs. The LRTP Tranche 1 portfolio represents a holistic solution for delivering these benefits when considering generation, transmission, and other factors under expected future conditions.

Reliability Planning Considerations

Determining whether a transmission system has capacity sufficient to meet projected power flows while maintaining required voltage levels and stability requires an engineering evaluation of the system as a whole, as well as an evaluation of critical individual system components (transformers, lines, switchgear), under both normal and contingency conditions (conditions where one or more system components are out of service). Power system simulation models are developed for use in these analyses. Projected power flows for each major component during peak loading conditions are checked to ensure that rated capacities are not exceeded. Voltage levels are also checked to ensure that they are maintained at, or above, the minimum levels required for safe and reliable operation of the system for end-use customers. The model system is tested for both generator and voltage stability following disturbances defined by the North American Electric Reliability Corporation ("NERC").

There are several reasons that it is necessary to provide capacity to meet projected power flows while ensuring that voltage levels are maintained. First, overloaded equipment or transmission voltages outside of specified tolerances threaten the transmission system's ability to continue to provide adequate and reliable service to its customers. Overloaded equipment can fail and cause brownouts and blackouts as well as potentially dangerous operating conditions. Voltage violations may cause relays or other voltage sensitive equipment to operate improperly. In addition, overloads reduce the service life of equipment and tend to increase the probability of component failure.

It is also necessary to ensure that system stability is maintained. Certain conditions could cause a generating unit to lose synchronism with the rest of the system or cause system voltages to decline rapidly in an uncontrolled manner. These severe contingencies, while unlikely, must be tested to ensure that the transmission system is strong enough to prevent a loss of system stability, or to allow protective systems to act in order to regain control of the system. Without these measures in place, such disturbances could both physically damage generation stations and affect the secure and reliable operation of wide areas of the interconnected transmission systems of the State and of the nation.

MISO plans its transmission system in compliance with NERC, regional entity, and the transmission owning members' planning standards or criteria. In addition, planning practices are dictated by FERC Order Nos. 890 and 1000, as mentioned earlier. MISO implements these practices through its governing and informational documents, including Attachment FF to MISO's Tariff, the TOA, and MISO's Business Practices Manuals ("BPM").[14]

FERC Order No. 890 is primarily concerned with ensuring that transmission planning takes place in an open and transparent environment where stakeholders to the planning process are engaged in and have opportunities to provide input and comment on the development of local as well as regional transmission plans, and this need for transparency was reinforced in FERC Order No. 1000. The planning process also addresses economic and regulatory policy considerations in addition to the NERC standards for reliability. There are also requirements aimed at ensuring coordination with neighboring planning regions and proper cost allocation.

Reliability and Justification for the Projects

A detailed reliability analysis using powerflow simulations was conducted to identify transmission system equipment loadings and voltages with respect to safe equipment design tolerances. The MISO reliability analyses included steady state analysis of thermal loading and voltages as well as system stability. NERC's Transmission Planning reliability standard ("TPL") is applicable to transmission planning and governs planning requirements to ensure reliable transmission system performance. The TPL standard addresses system performance under conditions ranging from normal operation (no contingency) to more extreme events that result in the loss (*i.e*. "outage" or "contingency") of many transmission elements. While criteria established by the TPL standard are used to evaluate acceptable performance, the objectives of MISO's LRTP process incorporate reliability and economic value that go beyond the minimum compliance requirements in the TPL standard.

MISO's steady state analysis included 10-year and 20-year models, described in the MTEP21 Report Addendum,[15] and monitored all system elements operated at 100 kV and above within the MISO Midwest Subregion as well as tie lines to the South Subregion and neighboring transmission systems. Category P1 - P7 contingency events from the NERC TPL standard were analyzed for the transmission system impacts within the MISO Midwest Subregion. All system elements where the worst loading was 95 percent or higher of the emergency rating were flagged as potential issues. A proposed transmission project was determined to be effective in resolving constraints if the worst overload decreased by 5 percent and was below 100 percent of the emergency rating after the addition of the transmission project.

To develop the steady state models, MISO created snapshots of stressed system conditions under a Future 1 resource expansion in the 10-year and 20-year timeframe. These scenarios, or base cases, varied based on season of the year, time of the day, load level, and coincident availability of renewable resources. Those models encompassed Summer Peak (day and night), Spring/Fall Light Load (day and night), Fall/Spring Shoulder Load, and Winter Peak Load (day

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14 *See* MISO's Business Practices Manual, Transmission Planning, BPM-020-r30, publicly available at: https://www.misoenergy.org/legal/rules-manuals-and-agreements/business-practice-manuals/.

15 *See* MTEP21 Report Addendum, pg. 19.

and night). Load levels for each of those model periods apply the Futures load forecast in a manner consistent with the regular MTEP process. Generation additions and siting assumptions were consistent with the Future 1 data set developed in collaboration with stakeholders. MISO then used the modeled scenarios to test the impact of the LRTP Tranche 1 portfolio. A full list of models with their corresponding assumptions can be found in the MTEP21 Report Addendum.[16] Transmission topology was developed by adding the transmission upgrades previously approved in the MTEP regional planning process and projects identified by MISO in prior MTEPs as expected to be needed to meet NERC reliability standards.

The Projects establish an additional interstate connection (State Border – Helix) that improves connectivity between renewable generation resources and Michigan load centers and helps to relieve reliability constraints on the 345 kV and 138 kV transmission facilities in southern Michigan. During periods of high transfers into Michigan, the increased flows cause congestion on existing 345 kV and 138 kV transmission facilities absent the Projects.

Steady state thermal and voltage analysis shows that the Projects, in conjunction with the other East-Central Corridor projects, reduce loadings on approximately 28 highly loaded system elements in the southwest portions of Michigan resulting from N-1 and N-1-1 contingency events.

The highest N-1 overloads addressed by the Projects are as follows:

- Argenta – Verona 138 kV line,
- Dean Rd – Oakland 138 kV line,
- Lafayette – Jaguar 138 kV line #2,
- Island Road 138 kV bus tie,
- David Jct – Hubston 138 kV line,
- Bluewater – Cornell 138 kV line,
- Ash Rd – Coldwater 138 kV line. and
- Tech Dr. – Hubston 138 kV line.

The highest N-1-1 overloads addressed by the Projects are as follows:

- Island Rd 138 kV bus tie,
- Tompkins - Majestic 345 kV line,
- Argenta – Verona 138 kV line,
- Dean Rd – Oakland 138 kV line, and
- Lafayette – Jaguar 138 kV line.

Approximately 22 unique N-1 and 127 unique N-1-1 contingencies resulted in issues that are relieved by the incorporation of the Projects into the transmission system.

There are other reliability benefits that result from the LRTP Tranche 1 portfolio in aggregate. Each project in the portfolio mitigated specific overloads across the MISO Midwest Subregion. In addition, the LRTP Tranche 1 portfolio as a whole mitigated overloading on 436

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16 *See* MTEP21 Report Addendum, pg. 19.

facilities, including many severe overloads over 125 percent that could cause cascading or system instability, as documented in the MTEP21 Report Addendum.[17] The LRTP Tranche 1 portfolio also provides increased transfer capability to address voltage stability concerns along the East-Central Corridor stretching from Iowa to Illinois, Indiana, and Michigan.

MISO evaluated alternative solutions to the Projects. These alternatives are discussed in the MTEP21 Report Addendum that was included in the Applications.[18]

Interconnection requests for new generation in MISO's 2022 Interconnection Queue cycle, which kicked off interconnection studies in March 2023, assume that the LRTP Tranche 1 portfolio will be made part of the existing transmission network. Those interconnection requests could be negatively impacted if the LRTP transmission projects such as the Projects are delayed or denied. This queue cycle includes 8.9 gigawatts ("GW") of new generation resources in Michigan[19] that are needed to help meet future decarbonization goals. In the absence of the LRTP Tranche 1 portfolio, the generating capacity that achieves commercial operation from the 2022 Interconnection Queue cycle may encounter substantial curtailment of output due to unresolved transmission constraints that could also result in higher energy costs and carbon emissions or create risks of unserved energy if a significant amount of generating capacity is trapped behind these constraints. These situations would be mitigated by completion of the Projects and other projects from the LRTP Tranche 1 portfolio.

Generation interconnection studies prior to the 2022 Interconnection Queue cycle were conducted before the LRTP Tranche 1 portfolio was included in MISO's transmission system base case, but may still identify new transmission projects from the LRTP Tranche 1 portfolio as mitigation for issues caused by the proposed generation interconnection requests. Operation of added generating capacity could be contingent on construction of LRTP projects if the proposed mitigation in a queue study was the same end-to-end project as an approved LRTP Tranche 1 project. Prior queue cycles that comprise 36 GW of generating resources are the subject of on-going negotiations of generation interconnection agreements ("GIA") and 49 GW of generating resources are under study in the MISO Midwest Subregion.[20] Some of this generating capacity may be dependent on LRTP Tranche 1 transmission development in order to secure GIAs.

Economic and Public Policy Considerations

The LRTP Tranche 1 portfolio justification was based upon an initial "least regrets" Future 1 Scenario that is described in the MTEP21 Report Addendum.[21] The assumed Future 1 uses the plans stated in utility integrated resource plans and most, but not all (*i.e.* eighty-five percent), of

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[17] *See* MTEP21 Report Addendum. The figures summarize reports in tables that begin on page 25.

[18] *Id*. at page 43.

[19] *See* https://www.misoenergy.org/planning/resource-utilization/GI_Queue/gi-interactive-queue/.

[20] *Id*.

[21] *See* MTEP21 Report Addendum, pgs. 11-12.

aspirational utility plans stated in utility announcements and state goals/preferences. The load growth in the Future 1 Scenario is assumed to continue along recent trends. The Future 1 assumptions reflect existing economic conditions, including a small increase in electric vehicle adoption with an annual energy growth rate of 0.5 percent and an annual demand growth rate of 0.6 percent over the next 20 years.

The primary economic benefits for the LRTP Tranche 1 portfolio stem from its reinforcements that enable reliable and efficient delivery of energy from low cost, regionally sited renewable resources to economically serve load in Michigan and throughout the MISO footprint. The LRTP Tranche 1 portfolio of projects will result in enablement of significant renewable resources to support meeting energy requirements and renewable goals of members.[22] The LRTP Tranche 1 portfolio provides for a more cost-effective regional build-out of generation resources rather than a greater amount of locally sited generation that would be required without greater transmission development (*i.e.* due to local transmission limitations). MISO's analysis of benefits shows that the portfolio achieves resource investment savings of $17.5 billion (2022 dollars) in 20-year present value terms. Additionally, the increased transmission capacity alleviates congestion for a more efficient dispatch of the energy market by allowing these lower cost renewable resources to displace more costly conventional resources to meet energy needs. These congestion and fuel savings represent $13.1 billion (2022 dollars) in 20-year present value benefits, which would vary based on the period over which benefits are calculated, discount rates applied, and assumptions about growth rates of energy and demand.

Other economic benefits were identified by MISO through its LRTP process. MISO's analysis of benefits identified additional value that is related to avoided transmission investment that reflects cost savings from facility upgrades or rebuilds not needed as a result of LRTP Tranche 1 portfolio, reduced resource adequacy needs that captures capital cost savings from deferred resource investment, avoided risk of load shedding that represents the value of protecting load from disruption due to severe winter weather events, and decarbonization that reflects carbon cost savings as a result of lower emissions. These financially quantifiable savings provide an additional $6.7 billion to $23.6 billion (2022 dollars) in 20-year present value benefits (depending upon future conditions) that are made possible by the LRTP Tranche 1 transmission investment.[23]

When compared to the present value of the revenue requirements for the LRTP Tranche 1 portfolio, the portfolio produces total benefits of between 2.6 and 3.8 times the costs on a present value basis over 20 years, under Future 1.[24] The low to high range stated in the MTEP21 Report Addendum reflects different assumptions regarding the value of lost load and the cost of carbon emissions. When these system-wide benefits were evaluated for their distribution across the Midwest Subregion, benefits to cost for Zone 7 amounted to between 2.2 and 3.4 times the portfolio costs. Zone 7 is comprised of MISO member companies within Michigan.

[22] *Id.*, pg. 49.

[23] *See* MTEP21 Report Addendum, pgs. 54-67.

[24] *Id.,* Executive Summary, pg. 4.

Regional Impacts and Policies

LRTP Tranche 1 project costs are recovered from MISO transmission customers based on their *pro rata* usage of energy in the Midwest Subregion. This recovery methodology is implemented in Attachment MM of the MISO Tariff.[25]

The LRTP Tranche 1 projects were approved by the MISO Board of Directors on July 25, 2022. These projects are part of a portfolio of projects that together form a new MVP portfolio. The timeline for the Projects designated by MISO places the transmission Projects in-service during 2030.

The purpose of the very extensive planning functions of MISO is to involve all stakeholders in a process that will derive the most cost-effective expansion plan that will meet local and regional needs for reliability, optimize access to economic generation resources, and deliver other important values that benefit the ultimate consumer and society. The MTEP process designs a very complex transmission system that will serve both short- and long-term needs of the Bulk Electric System in a coordinated manner. The inability to construct a key element of the regional expansion plan, especially a high voltage element such as the ones proposed in the Application that is designed for both reliability and its economic attributes, could result in the loss of the economic benefits provided by the Projects and the need to develop less optimal solutions to reliability concerns. The revised plan would likely have a negative economic impact on portions of customers located in the Midwest Subregion.

The result of not constructing the Projects would be the inability of the existing transmission system to reliably deliver power in support of the expanding set of renewable energy generators and the failure to realize the other benefits offered by the LRTP Tranche 1 portfolio. For southern Michigan in particular, the risk of not being able to reliably meet all load requirements increases without the Projects. As described within these comments, the MISO analyses of the LRTP projects identified numerous transmission facilities that will be loaded above safe operating levels or below adequate voltage levels without the Projects. The overall result would be a transmission system that would also be less secure, with additional voltage and transient stability limitations. In addition, without the Projects, Michigan and the other states in the MISO footprint would not receive the full set of economic benefits that is provided by the LRTP Tranche 1 portfolio.

Conclusion

The Projects proposed by METC would provide substantial reliability, economic, and public policy benefits to Michigan. These Projects also fit well as a component of the MISO regional plan for the continued development of a reliable and economic regional transmission system.

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25 *See* MISO Tariff, Attachment MM, Multi-Value Project Charge ("MVP Charge").

Sincerely,

/s/ Jeremiah Doner

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MISO Futures

April 2021

Updated December 2021

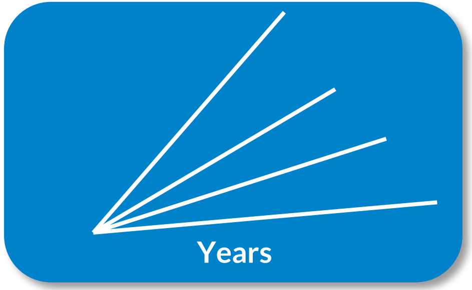
Purpose of MISO Futures

- It's very difficult to accurately predict the future, so we created three scenarios to hedge uncertainty and "bookend" a range of economic, political, and technological possibilities.

- These Future scenarios establish different ranges of economic, policy, and technological possibilities – such as load growth, electrification, carbon policy, generator retirements, renewable energy levels, natural gas price, and generation capital cost – over a twenty-year period.

Narrow and less useful

Broad and more useful



Three Futures incorporate & bookend uncertainty with members' plans

Future 1

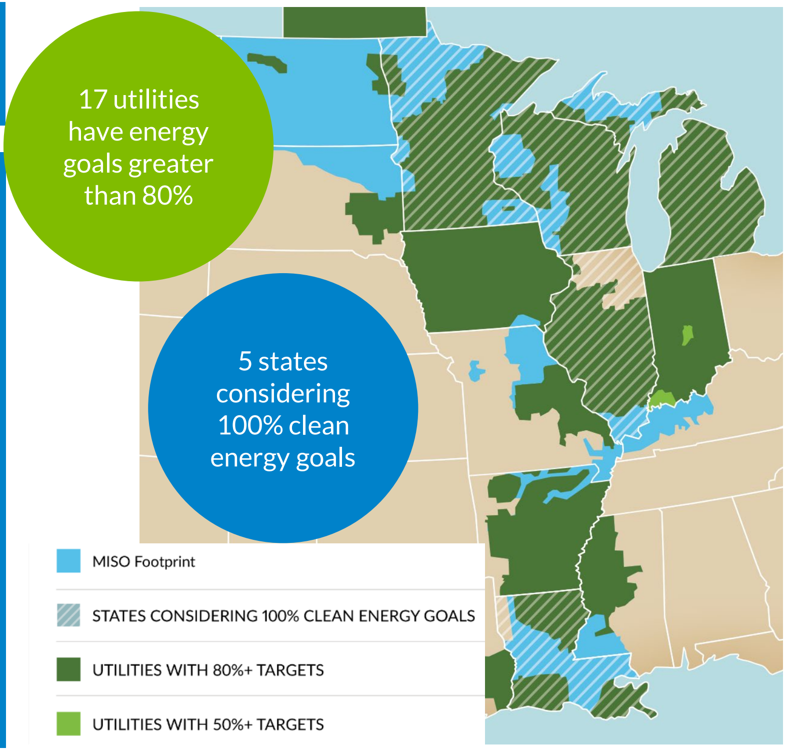
- The footprint develops in line with 100% of utility IRPs and 85% of utility announcements, state mandates, goals, or preferences.
- Emissions decline as an outcome of utility plans.
- Load growth consistent with current trends.

Future 2

- Companies/states meet their goals, mandates and announcements.
- Changing federal and state policies support footprint-wide carbon emissions reduction of 60% by 2040.
- Energy increases 30% footprint-wide by 2040 driven by electrification

Future 3

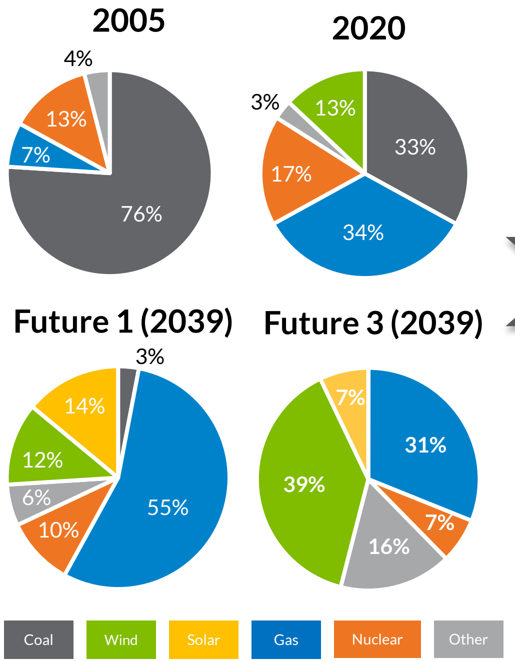
- Changing federal and state policies support footprint-wide carbon emissions reduction of 80% by 2040.
- Increased electrification drives a footprint-wide 50% increase in energy by 2040.



April 2021; changing rapidly.

MISO's actions as part of the Reliability Imperative address emerging operational needs on the system

GENERATOR ENERGY MIX



MISO FORWARD

NEEDS
- AVAILABILITY
- FLEXIBILITY
- VISIBILITY

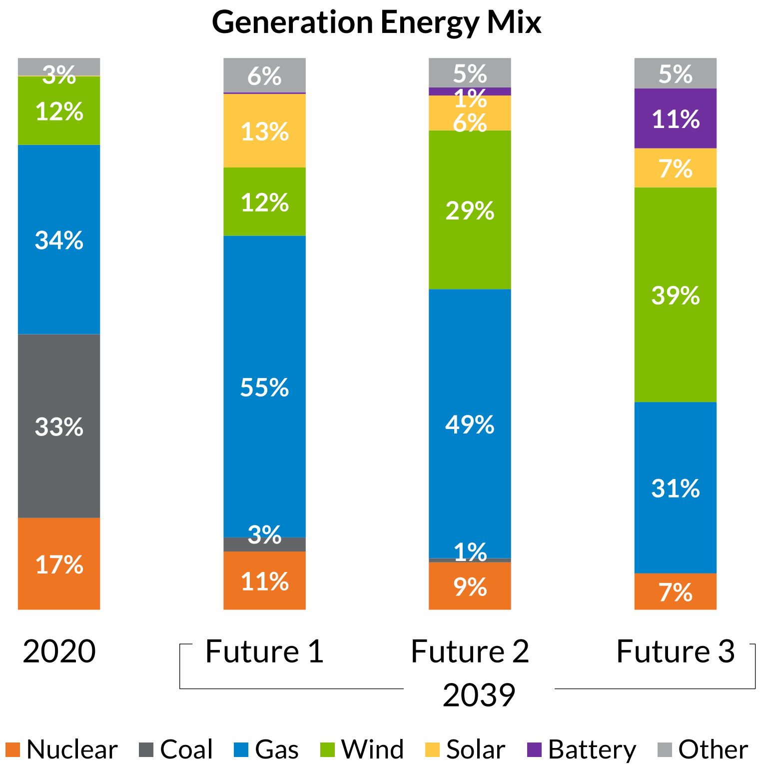
RELIABILITY IMPERATIVE

Market Redefinition
Long-Range Transmission Planning
Operations of the Future
Market System Enhancement

List is not representative of all efforts

MISO is actively pursuing multiple workstreams to ensure ongoing reliability and value creation

New Futures incorporate and build upon member plans to inform the resource transition and changing demand patterns

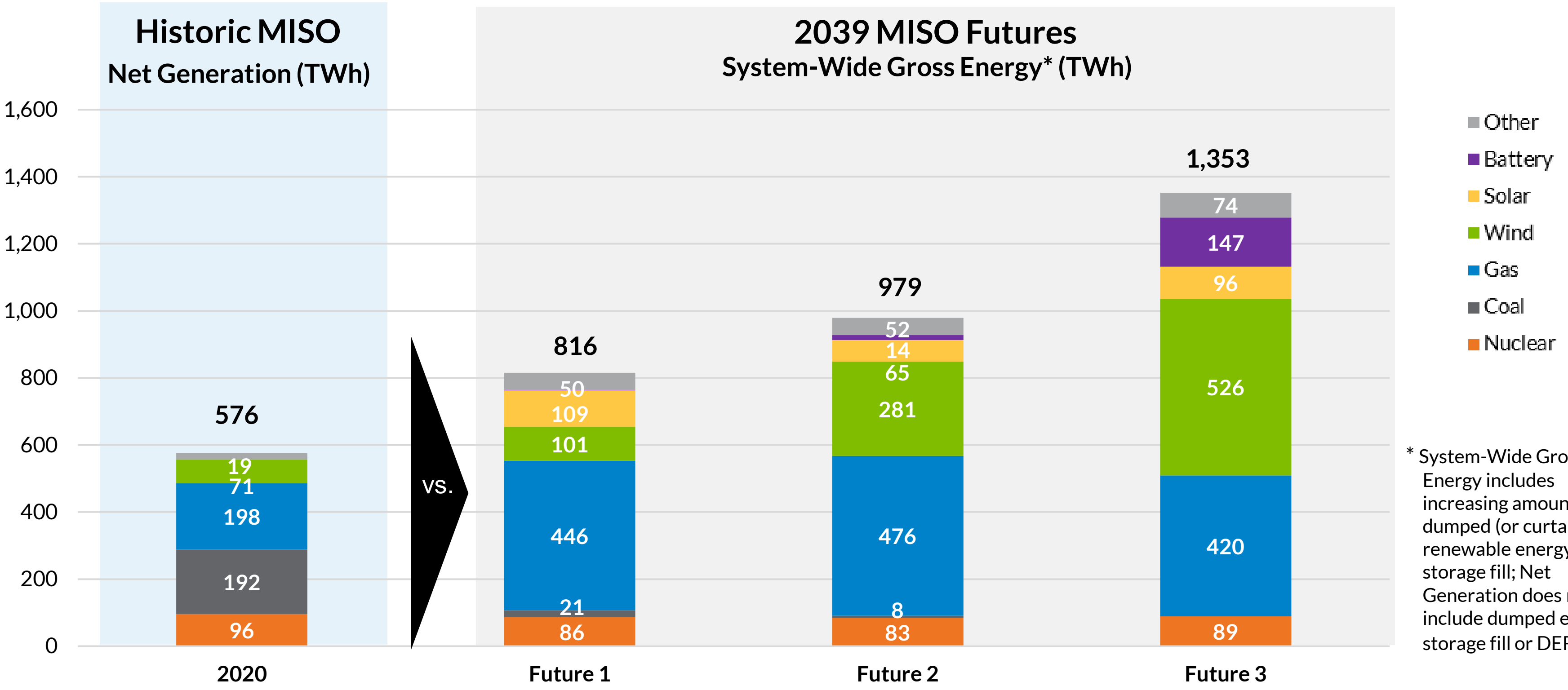


	Future 1	Future 2	Future 3
Additions	121 GW	170 GW	306 GW
Retirements	77 GW	80 GW	112 GW
Peak Load	136 GW	148 GW	164 GW
Emissions*	↓63%	↓65%	↓81%

* Resulting emission reductions based upon 2005 levels

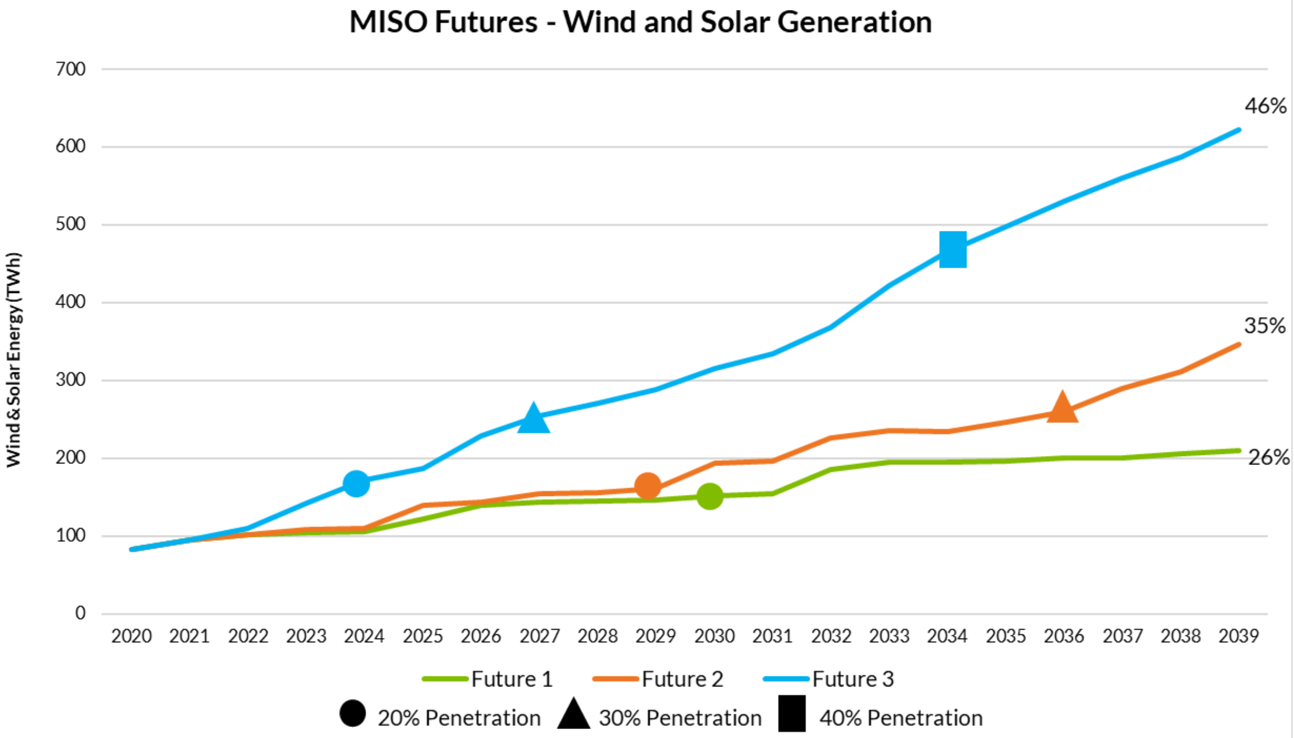
MISO

Futures energy mix transforms throughout the study to reflect announced plans and changing assumptions

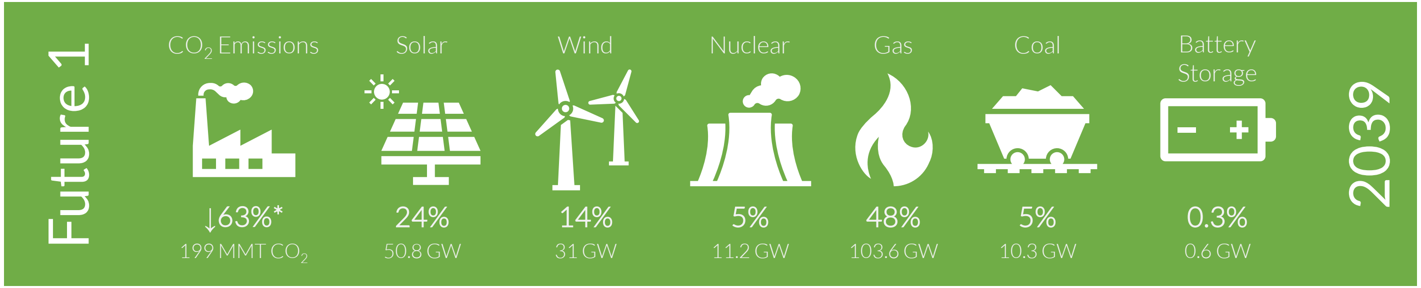


* System-Wide Gross Energy includes increasing amounts of dumped (or curtailed) renewable energy and storage fill; Net Generation does not include dumped energy, storage fill or DERs.

MISO's "Futures" reflect a broad range of how the fleet evolution may unfold, including large increases in renewables



Future 1



**Capacity Values

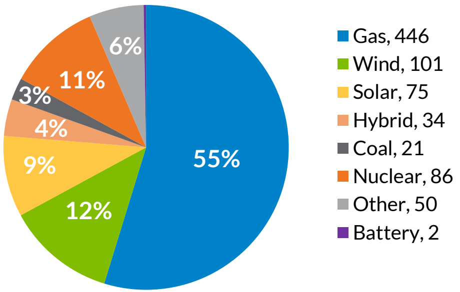
Carbon-free energy: ~43%

Carbon-based energy: ~57%

85% of announced state and utility goals and 100% of utility IRPs were included in Future 1

Stakeholder plans exceeded original MISO assumptions: Future 1 original assumption of 40% decarbonization, reached 63%* due to plans and retirements

Energy Mix (TWh, 2039)



Future 1 Details		
	Gross Load	Low-Base, EV Growth
	Total Growth	94,275 GWh
	Energy	0.48% CAGR
	Demand	0.60% CAGR
Electrification Growth & Technologies	Growth	2% of Total Growth; 14,147 GWh
	Technologies	PEVs
	Carbon Reduction*	40%
	Wind & Solar Generation Percentage	26% with no minimum enforced
	Utility Announced Plans	85% Goals Met, 100% IRPs met
Retirement Age-Based Criteria	CC	50 years
	Coal, CT	46 years
	Oil	45 years
	Nuclear	Retire if Publicly Announced
	Wind & Solar	25 years
Retirements	Coal	44.8 GW
	Gas	18.6 GW
	Oil	2 GW
	Nuclear	2.4 GW
	Wind	9.2 GW
	Solar	0.02 GW
	Other	0.04 GW
Additions	CC	37.1 GW
	CT	14.1 GW
	CC+CCS	0 GW
	Wind	18.7 GW
	Solar	34.7 GW
	Hybrid	12 GW
	DGPV	3.5 GW
	EE/DR	8.8 GW
	Hydro	0.1 GW
	Battery	0.6 GW

*Reduction from 2005 baseline; MISO Footprint currently at 29%

Future 2

Future 2 — 2039

CO$_2$ Emissions	Solar	Wind	Nuclear	Gas	Coal	Battery Storage
↓65%*	13%	29%	4%	46%	4%	1%
189 MMT CO$_2$	34 GW	75.4 GW	11.2 GW	119.8 GW	10 GW	3.4 GW

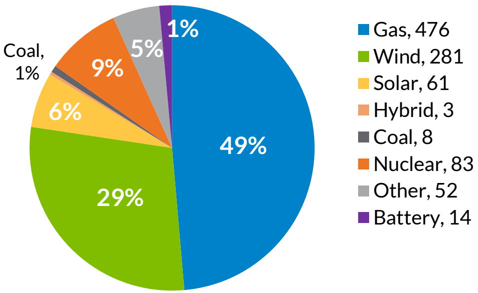
**Capacity Values

Carbon-free energy: ~47%   Carbon-based energy: ~53%

100% of utility IRPs and announced state and utility goals were included in Future 2. Goals surpassed MISO assumptions: Future 2 original assumption of 60% decarbonization, reached 65%* due to plans and retirements

Energy growth of 30% by 2040 in Future 2

Energy Mix (TWh, 2039)



Future 2 Details

Gross Load		30% Total Energy Growth by 2040
	Total Growth	196,996 GWh
	Energy	1.09% CAGR
	Demand	0.97% CAGR
Electrification Growth & Technologies	Growth from Electrification	15% of Total Growth; 109,101 GWh
	Electrification Technologies	PEVs; RES-HVAC, DHW, Appliances; C&I-HVAC, DHW
Carbon Reduction*		60%
Wind & Solar Generation Percentage		35% with no minimum enforced
Utility Announced Plans		100% Goals & IRPs Met
Retirement Age-Based Criteria	CC	45 years
	Coal, CT	36 years
	Oil	40 years
	Nuclear	Retire if Publicly Announced
	Wind & Solar	25 years
Retirements	Coal	45.1 GW
	Gas	21.6 GW
	Oil	2 GW
	Nuclear	2.4 GW
	Wind	9.2 GW
	Solar	0.02 GW
	Other	0.04 GW
Additions	CC	58.7 GW
	CT	10.5 GW
	CC+CCS	1.2 GW
	Wind	63.1 GW
	Solar	28.7 GW
	Hybrid	1.2 GW
	DGPV	3.5 GW
	EE/DR	9 GW
	Hydro	0.1 GW
	Battery	3.4 GW

*Reduction from 2005 baseline; MISO Footprint currently at 29%

Future 3

Future 3

CO_2 Emissions	Solar	Wind	Nuclear	Gas	Coal	Battery Storage
↓81%*	13%	37%	3%	33%	2%	10%
102 MMT CO_2	46.3 GW	135.4 GW	11.2 GW	121.3 GW	8.2 GW	35.4 GW

2039

**Capacity Values

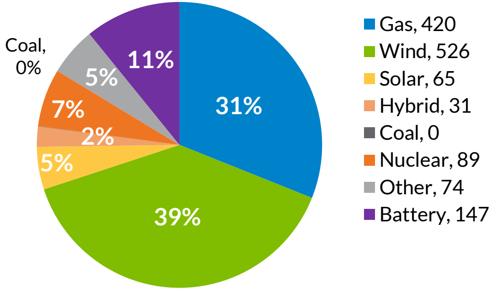
Carbon-free energy: ~63%

Carbon-based energy: ~37%

100% of utility IRPs and announced state and utility goals were included in Future 3. Original assumption of 80% decarbonization, reached 81%* due to plans and retirements

Energy growth of 50% by 2040 in Future 3

Energy Mix (TWh, 2039)



Future 3 Details		
Gross Load		50% Total Energy Growth by 2040
Total Growth		334,692 GWh
Energy		1.71% CAGR
Demand		1.41% CAGR
Electrification Growth & Technologies	Growth from Electrification	32% of Total Growth; 231,513 GWh
	Electrification Technologies	PEVs; RES-HVAC, DHW, Appliances; C&I-HVAC, DHW, Process
Carbon Reduction*		80%
Wind & Solar Generation Percentage		46%
Utility Announced Plans		100% Goals & IRPs Met
Retirement Age-Based Criteria	CC	35 years
	Coal, CT	30 years
	Oil	35 years
	Nuclear	Retire if Publicly Announced
	Wind & Solar	25 years
Retirements	Coal	47 GW
	Gas	51.4 GW
	Oil	2.3 GW
	Nuclear	2.4 GW
	Wind	9.2 GW
	Solar	0.02 GW
	Other	0.04 GW
Additions	CC	41.9 GW
	CT	17.7 GW
	CC+CCS	42 GW
	Wind	123.1 GW
	Solar	28.7 GW
	Hybrid	10.8 GW
	DGPV	6.2 GW
	EE/DR	12.7 GW
	Hydro	0.1 GW
	Battery	35.4 GW

*Reduction from 2005 baseline; MISO Footprint currently at 29%

MISO Futures include 14-232 TWh of electrifiable load across multiple technologies and consumer classes

Future 1

14 TWh of electrifiable load

- Plug-in electric hybrids

Future 2

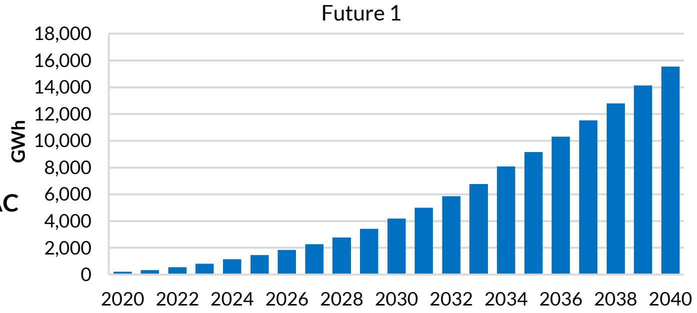
109 TWh of electrifiable load

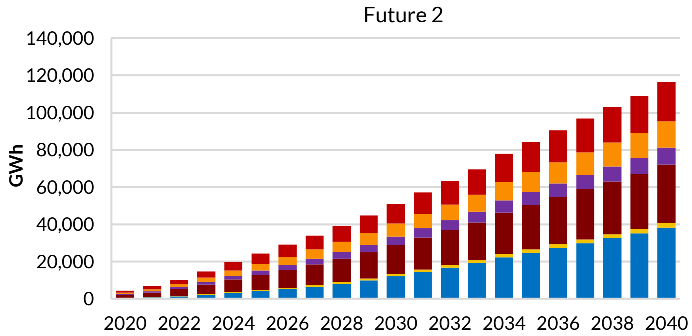
- Plug-in electric hybrids
- Commercial & industrial HVAC
- Residential HVAC
- Residential water heating
- Residential appliances
- Commercial & industrial water heating

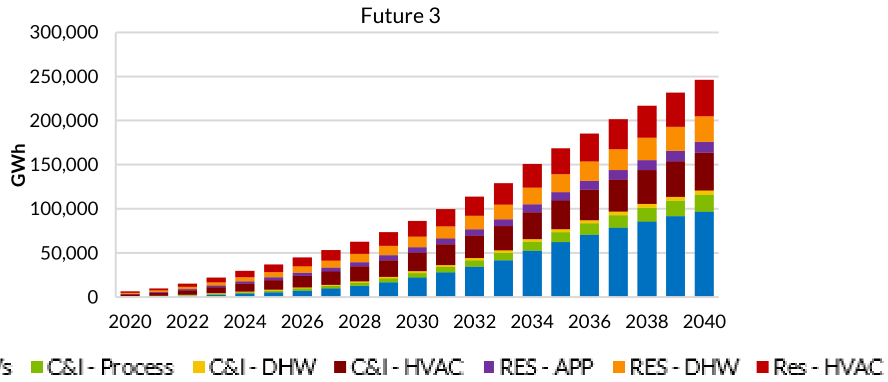
Future 3

232 TWh of electrifiable load

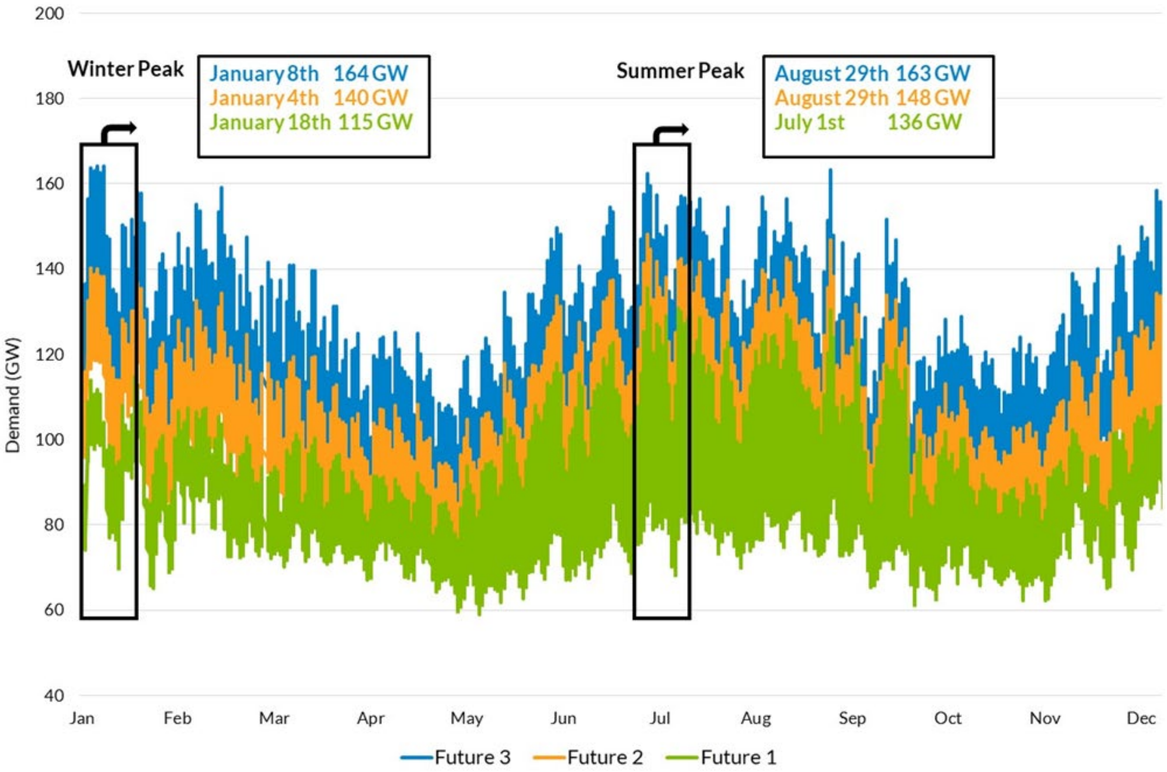
- Plug-in electric hybrids
- Commercial & industrial HVAC
- Residential HVAC
- Residential water heating
- Residential appliances
- Commercial & industrial water heating
- Commercial & industrial processes







Significant increase in electrifiable loads transforms MISO into a dual summer and winter peaking system by 2039



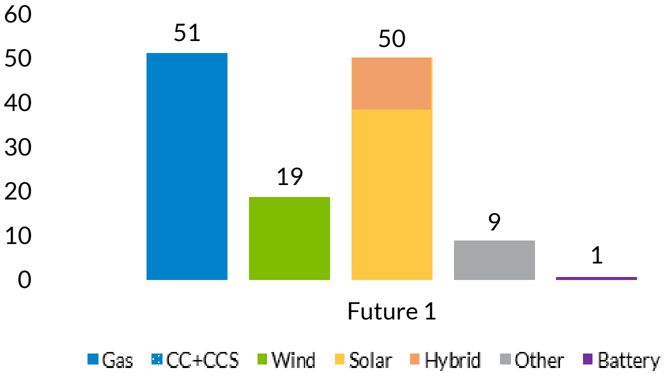
Key Findings of Expansion Results

- All scenarios have relatively large amounts of gas additions; this is due to increasing amounts of coal and gas retirements and the system's need for base generation to replace retired units. CC and CT gas units emit approximately half the amount of CO_2 that coal units emit. Decarbonization and load growth allow for gas to comprise 40% of the total expansion in Future 1, while CC+CCS comprises 40% of the gas units built in Future 3's expansion, illustrating the model's need for a low-carbon, high-capacity factor proxy resource.
- Wind, solar, and hybrid resource expansion is largely driven by decarbonization and each underlying load shape. In Future 3 there is significantly more wind than the other two cases; this is primarily due to the increase in load, 80% carbon reduction, and dual peaking system.
- Battery installation is driven by increased load and decarbonization.
- Age-based retirement assumptions for nuclear, wind, solar, and "other" resources remain the same across all scenarios. Additionally, all retired wind is repowered and reflected in the resource addition totals.
- Distributed solar and energy efficiency (EE) resources are composed of both selected DER programs and specific member feedback. No demand response (DR) resources were selected in the model but are present in the expansion due to member feedback.

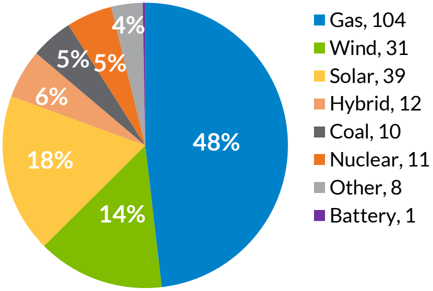
Future 1 Expansion Summary

- This Future incorporated 100% of utility IRPs and 85% of announced state and utility goals within their respective timelines, while also including an 40% carbon dioxide reduction. Modeling of Future 1 results in the retirement of 77 GW, addition of 121 GW of resources, and 9 GW of DSM programs to the footprint.

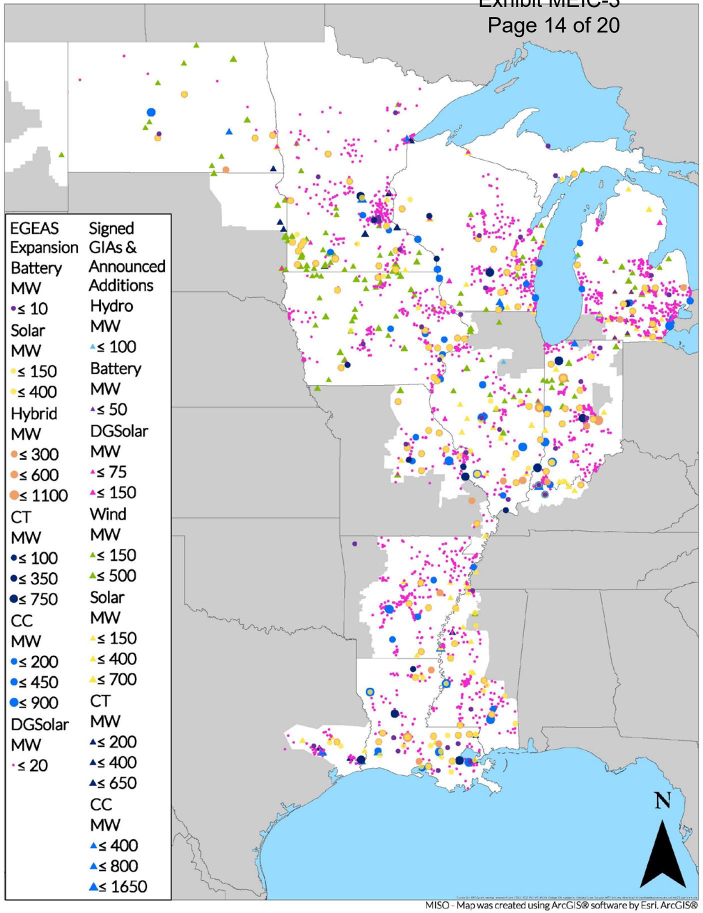
2020-2039 Expansion (GW)



Capacity Mix (GW,2039)



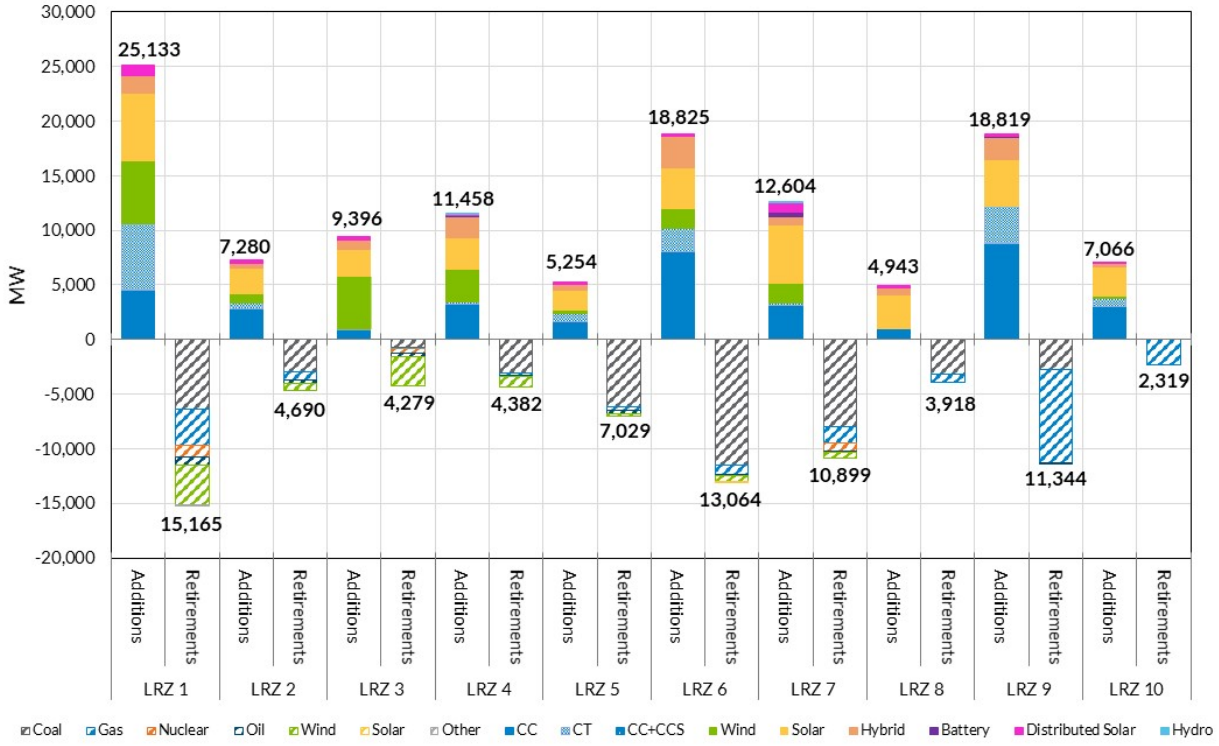
**Capacity mix includes existing and resource additions



MISO - Map was created using ArcGIS® software by Esri. ArcGIS®

IRP – Integrated Resource Plan
DSM – Demand Side Management Program
*No CC+CCS was selected in Future 1

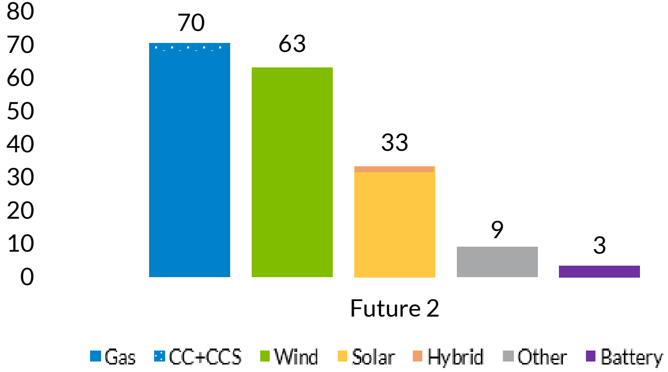
Future 1 LRZ Addition and Retirement Totals



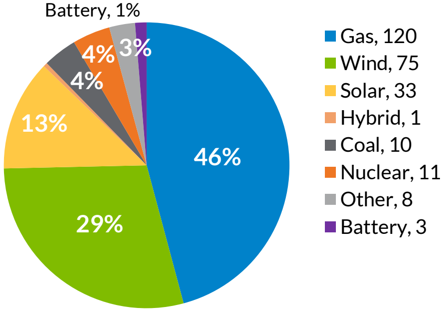
Future 2 Expansion Summary

- This Future incorporated 100% of utility IRPs and announced state and utility goals within their respective timelines, while also including an 60% carbon dioxide reduction. Modeling of Future 2 results in the retirement of 80 GW, addition of 170 GW of resources, and 9 GW of DSM programs to the footprint.

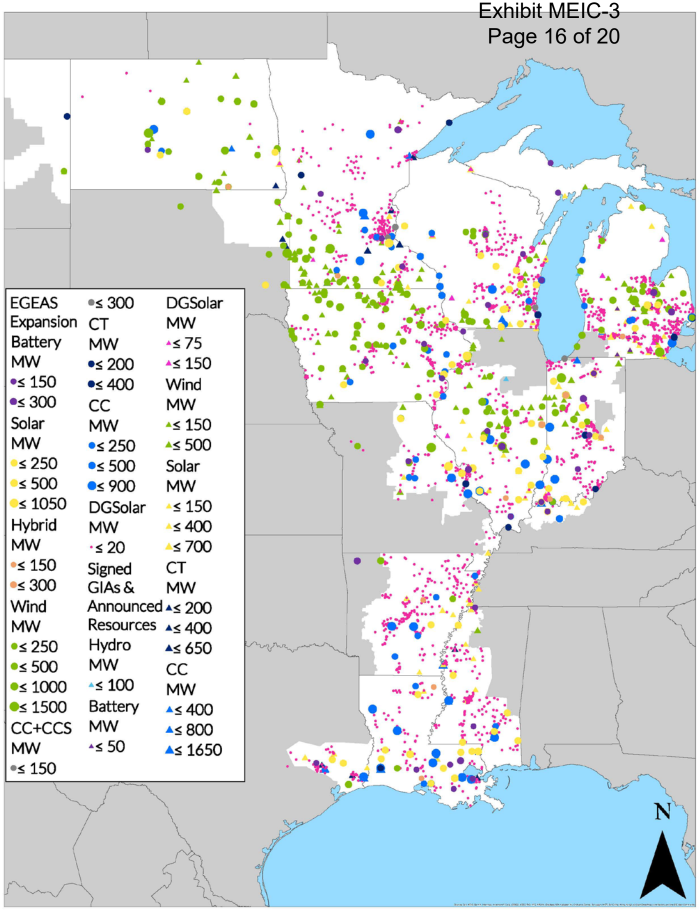
2020-2039 Expansion (GW)



Capacity Mix (GW, 2039)



**Capacity mix includes existing and resource additions

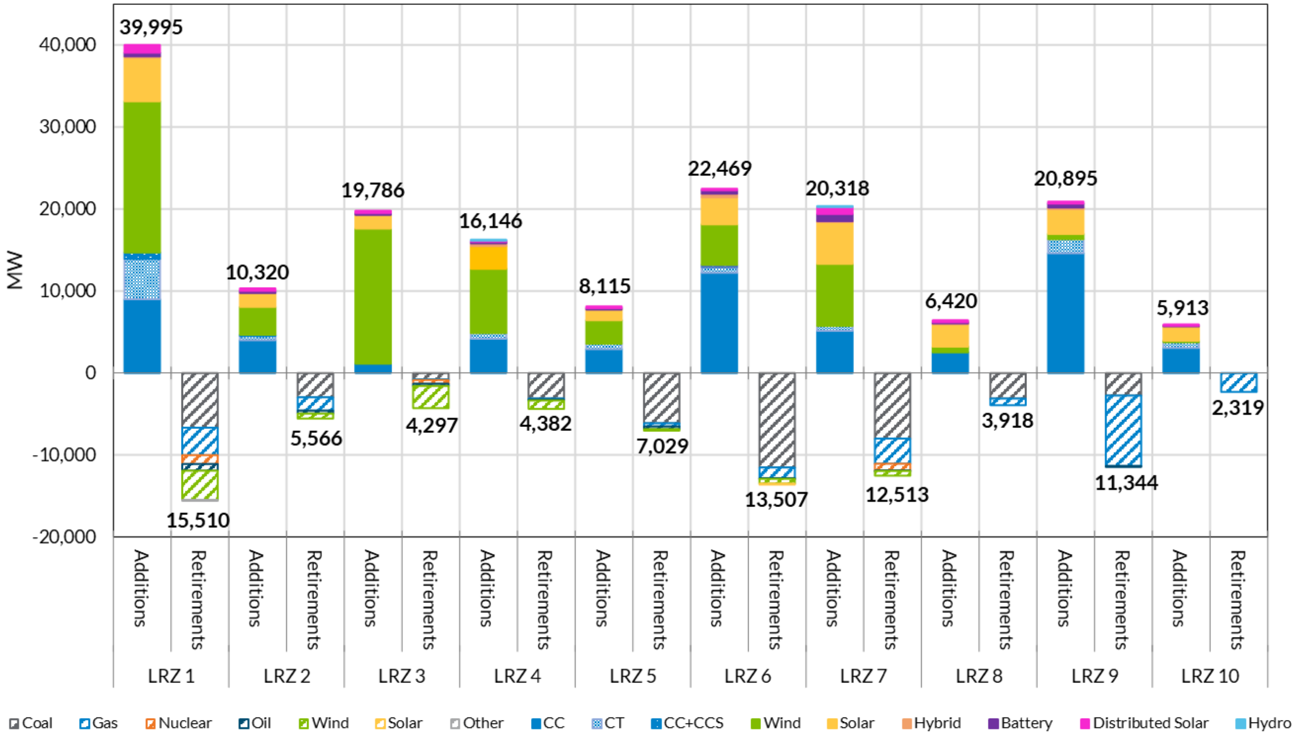


MISO - Map was created using ArcGIS® software by Esri. ArcGIS®

IRP – Integrated Resource Plan
DSM – Demand Side Management Program

MISO

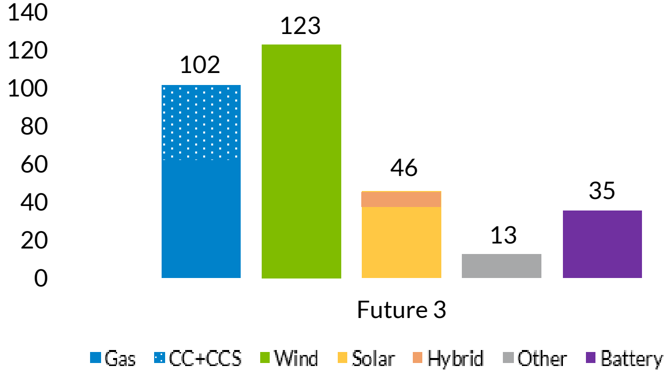
Future 2 LRZ Addition and Retirement Totals

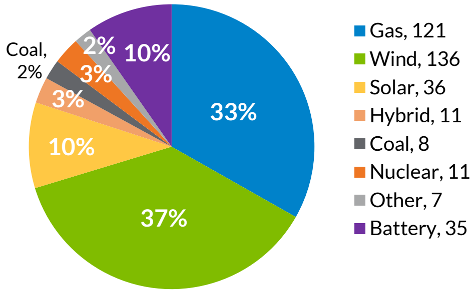


MISO

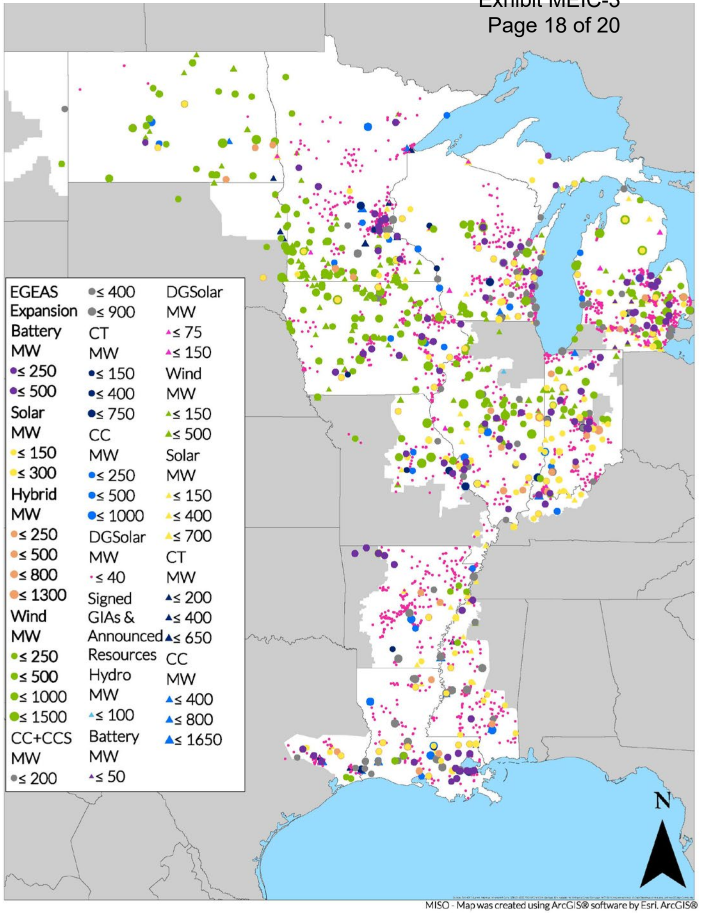
Future 3 Expansion Summary

- This Future incorporated 100% of utility IRPs and announced state and utility goals within their respective timelines, while also including an 80% carbon dioxide reduction. Modeling of Future 3 results in the retirement of 112 GW, addition of 306 GW of resources, and 13 GW of DSM programs to the footprint.





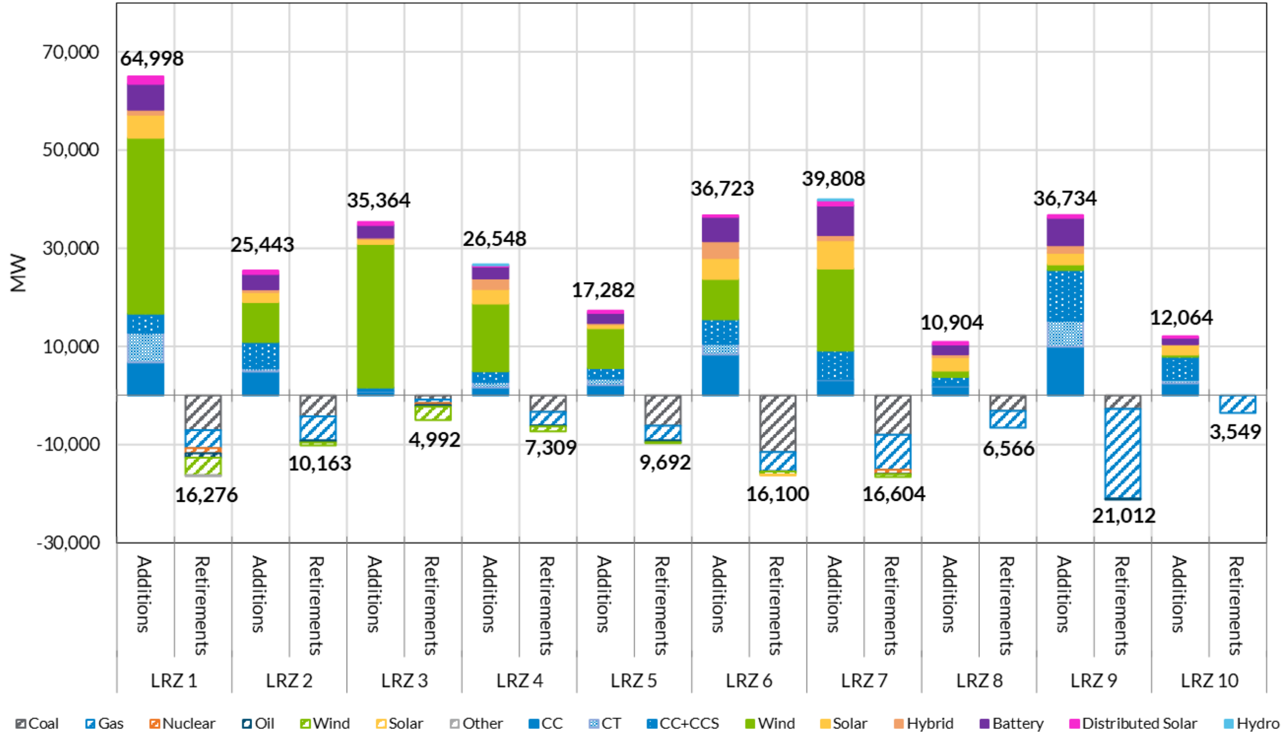
**Capacity mix includes existing and resource additions



IRP – Integrated Resource Plan
DSM – Demand Side Management Program

MISO

Future 3 LRZ Addition and Retirement Totals



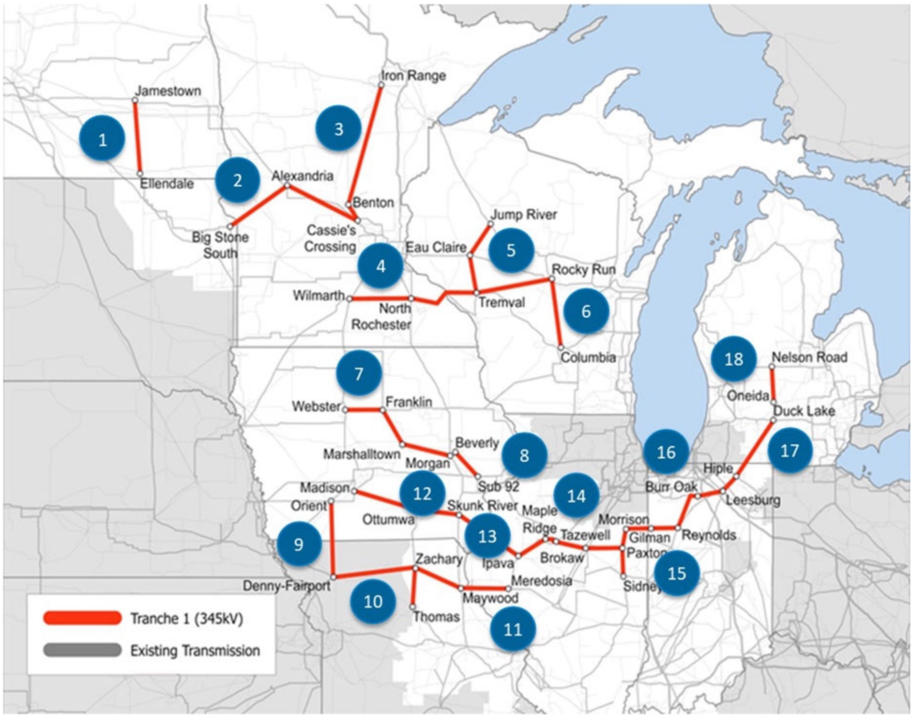
Contact Information

MTEP Futures Team:

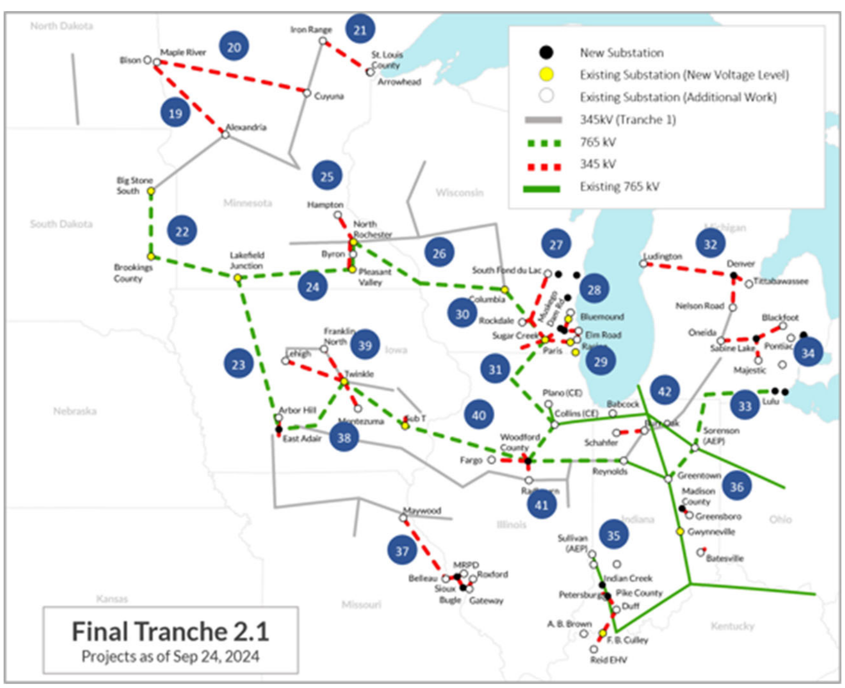
MTEPFutures@misoenergy.org

Tranche 1 and Tranche 2.1 Maps. Available at: https://www.misoenergy.org/planning/long-range-transmission-planning/

Tranche 1 Map (Approved July 2022):



Tranche 2.1 Map (Finalized September 2024):



MICHIGAN'S CLEAN ENERGY ECONOMIC COMEBACK:

How Local Economies in Michigan Are Benefitting from State and Federal Climate Policies

Analysis by 5 Lakes Energy

Case Studies and Business Surveys by the Michigan Energy Innovation Business Council

Prepared for Evergreen Collaborative

September 2024

Table of Contents

Executive Summary

Powered by the Biden-Harris administration's Inflation Reduction Act (IRA), Michigan is experiencing an economic resurgence, ranking among the top five states in the US for new clean energy projects and jobs. The state has attracted 62 major projects, created 21,748 jobs, and received over $26.6 billion in new investments.

The IRA represents the largest federal investment in clean energy and energy efficiency in US history. To capitalize on this investment at the state level, Michigan Governor Gretchen Whitmer signed a series of laws in November 2023– policies that are designed to accelerate the state's transition to clean energy by setting clean energy generation targets, streamlining renewable energy siting processes, improving energy efficiency statewide, and preparing the workforce and communities for clean energy reindustrialization.

The policies were designed to leverage federal IRA funding to communities across the state– helping Michigan grow its economy, create jobs, lower costs, and reduce emissions in line with Gov. Whitmer's MI Healthy Climate Plan.

Overall, this analysis finds that the combined effects of federal and state climate policies in Michigan are projected to:

- Reduce energy costs across the whole economy, including lowering Michigan families' energy bills by an average of **$297 per year by 2030 and $713 per year by 2040**, relative to the baseline expected energy cost (if federal and state climate policies were not in place).
- Bring the state **$15.6 billion in IRA investments cumulatively by 2030 and $30.7 billion cumulatively by 2040** (broken down by prosperity region in the full report).
- Reduce **Michigan's greenhouse gas emissions from the electric power sector by at least 65% by 2030 and 88% by 2040**.
- Save **Michigan $7.3 billion by 2030 in avoided public health costs** (deaths, hospitalizations, lost school & work days, and more) and **$27.8 billion cumulatively by 2040**.

The report also includes real-world testimonials from companies within each prosperity region and a survey of businesses with operations in Michigan– illustrating the tangible effects of these legislative measures on local economies, job markets, and quality of life.

By examining these impacts, this report provides a clear understanding if and to what extent federal and state clean energy policies are driving economic growth and quality of life benefits in the state of Michigan.

Introduction

The Biden-Harris administration's Inflation Reduction Act (IRA) and the state of Michigan's recent passage of a suite of clean energy legislation represent a transformative approach to expanding clean energy and progressing climate action. Utilizing the financial opportunities offered by the IRA, Michigan's laws focus on stimulating economic growth, creating jobs, lowering energy costs for residents, and reducing greenhouse gas emissions. These initiatives are intended to accelerate clean energy development and improve public health across Michigan, with substantial support through federal and state tax credits, grants, and rebates.

This report examines the effect of the combination of both federal (IRA) and state climate policies on Michigan's prosperity regions—ten distinct geographic areas defined by the state to organize and streamline economic development efforts. We use these districts as a way to measure the impact of new federal and state climate and clean energy policies on a more local, tangible level.

This analysis outlines the expected impacts of federal and state policies at both the state and regional (prosperity region) levels from 2030 to 2040, focusing on:

1. **State-level impacts:** Effects on energy costs greenhouse gas emissions reduction.
2. **Regional-level impacts:** Job creation, GDP growth, federal investments in the state, and reductions in costs associated with negative health outcomes.

It also incorporates local company testimonials and a survey of businesses with operations in Michigan to illustrate the tangible effects of these legislative measures on local economies, jobs, and quality of life.

Overall, this analysis finds that the combined effects of federal and state climate policies in Michigan are projected to:

1. Reduce energy costs across the whole economy, including lowering Michigan families' energy bills by an average of $297 per year by 2030 and $713 per year by 2040, relative to the baseline expected energy cost (if federal and state climate policies were not in place).
2. Bring the state $15.6 billion in IRA investments cumulatively by 2030 and $30.7 billion cumulatively by 2040 (broken down by prosperity region in following sections).
3. Reduce Michigan's greenhouse gas emissions from the electric power sector by at least 65% by 2030 and 88% by 2040.
4. Save Michigan $7.3 billion cumulatively by 2030 in avoided public health costs (deaths, hospitalizations, lost school & work days, and more) and $27.8 billion cumulatively by 2040.

This report focuses on and is organized in the following manner:

1. An analysis of assumptions used to inform this analysis—including the IRA and new electricity-sector-focused policies from a package of clean energy legislation the Michigan Legislature passed in November 2023.
2. The quantified impact of federal policies and Michigan's clean energy sector policies on statewide outcomes.
3. The quantified impact of federal policies and Michigan's clean energy sector policies on Michigan's ten prosperity regions (Upper Peninsula, Northwest, Northeast, West, East Central, East, South Central, Southwest, Southeast, and Detroit Metro), including testimonials from businesses with operations in the respective regions.
4. A survey of clean energy businesses focused on how recent federal funding and state policies are affecting their business operations. The survey also asked for their projections on how the implementation of the policies in this report will impact them in the future.
5. Suggested policy recommendations for Michigan to expand on its progress in clean energy to other economic sectors and continue growing a clean energy economy for communities and businesses across the state.

Assumptions Used in the Analysis: State and Federal Clean Energy Policies

State Policy: Michigan's Clean Energy Laws

In 2023, Michigan's Legislature passed a comprehensive package of clean energy laws aimed at reducing climate pollution from the state's electricity sector. This legislation includes a 100% Clean Energy Standard by 2040, enhanced energy efficiency programs, expanded access to solar energy development on farmland, and more. Our analysis incorporates these new state laws to examine their interaction with the IRA, evaluating their combined impact on Michigan's transition to clean energy, job growth, public health, and economic benefits.

The policies included in this analysis are:

- **Public Act 235 of 2023: Clean Energy, Storage and Distributed Generation Policies:** Sets a 100% clean energy standard by 2040, expands renewable energy standard to 60% by 2035, establishes a 2,500-megawatt storage standard by 2030, and increases access to rooftop solar from 1% to 10% of peak electricity load.
- **Public Act 229 of 2023: Energy Efficiency Programs:** Requires all utilities to offer energy efficiency programs and mandates increases in energy efficiency standards. Electricity energy waste reduction standards will rise from 1% to 1.5%, and natural gas efficiency standards will increase from 0.75% to 0.875% by 2026. The bill also allows for electrification and fuel switching, and it sets a requirement for utilities to provide low-income energy efficiency programs.
- Public Act 231 of 2023: Equitable Clean Energy Transition: Allows and encourages the Michigan Public Service Commission to consider climate, environmental justice, and affordability in energy planning.
- Public Act 232 of 2023: Worker and Community Protection: Creates the Office of Worker and Community Economic Transition to protect workers and communities during the energy transition.
- Public Act 233 of 2023: Streamlined Renewable Energy Deployment: Streamlines the process for deploying renewable energy projects and supports local governments. The reformed process also sets strong labor standards for new renewable energy projects, including prevailing wage and project labor agreements on specific developments.

Federal Policy: The Inflation Reduction Act

The IRA represents an unprecedented level of federal support for clean energy, especially in terms of the resources the law provides to states. It covers every sector of the economy from the electricity to transportation sector. As part of this analysis, we look at the elements of the IRA to understand how they interact with new state laws, evaluating their combined impact on Michigan's transition to clean energy, job growth, and economic benefits.

IRA Impact: Electricity Sector Assumptions

The IRA extends the eligibility timeline for tax credits for the investment and production of solar and wind energy and increases the value of the production tax credits. It also offers a new production tax credit for nuclear resources and a new investment tax credit for standalone energy storage resources. Combined, these provide the most robust discounts for producing and using carbon-free power in US history.

The IRA also has several programs to encourage the growth of clean energy sources– including rooftop and community solar. These programs especially prioritize low-income communities and communities of color. Some of these programs include, but are not limited to:

- The $27 billion Greenhouse Gas Reduction Fund
- The $3 billion Environmental and Climate Justice Block Grants program

The Energy Policy Simulator (EPS) has existing assumptions that quantify how much a given level of tax credits and rebates would reduce the cost of constructing distributed generation energy technologies (like rooftop solar and home battery storage systems). We included the IRA's new grant programs that offer robust incentives for the buildout of these technologies and then analyzed the aggregate impact it would have on lowering costs to construct more of these systems in Michigan in line with the state's own clean energy targets.

The IRA also incentivizes the construction of more interstate transmission electricity lines to transport clean power for electricity end-use. We modeled the effects of IRA Section 50151 (Transmission Facility Financing), Section 50152 (Grants to Facilitate the Siting of Interstate Electricity Transmission Lines), and Section 50153 (Interregional and Offshore Wind Electricity Transmission Planning, Modeling, and Analysis) by increasing the amount of new transmission lines assumed to be built in the EPS.

In addition to clean electricity incentives from the IRA included in this analysis, the Environmental Protection Agency (EPA) recently finalized new power plant rules that aim to reduce carbon dioxide emissions by requiring power plants to either adopt carbon capture and storage technology or transition to cleaner fuels. These rules, included in our analysis, are part of a broader effort to achieve significant emission reductions from the electricity sector by 2035, aligning with President Biden's climate goals.

IRA Impact: Building Decarbonization Assumptions

The IRA has several rebates, tax credits, and grants for retrofitting existing residential and/or commercial buildings with energy efficiency measures, electrifying building components and systems, and constructing highly efficient new buildings. We used an analysis from the American Council for an Energy-Efficient Economy to estimate the energy efficiency impact of these provisions. We then aligned the EPS' assumptions about the amount of energy savings in the building sector with the expected increase in energy efficiency savings specific to that provision.

IRA Impact: Transportation Sector Assumptions

We focused on the IRA provisions that offer credits for the purchase of new or previously-owned electric passenger vehicles and commercial vehicles that qualify as “clean” under the law. For each of these credits, we reduced the EPS’ assumed cost of the corresponding vehicle type to match the tax credit’s provided discount.

The IRA also includes the Advanced Technology Vehicle Manufacturing Program, which provides loans for manufacturing facilities that emit low- or zero-greenhouse-gas emissions, and the Domestic Manufacturing Conversion Grant Program, which provides grants for domestic production of efficient hybrid, plug-in electric hybrid, plug-in electric drive, and hydrogen fuel cell vehicles. We reduced the assumed cost of low-emissions vehicles in accordance with the amount of funding offered by these programs.

The effects of the EPA’s pollution rules for cars and trucks are also considered in our analysis. We adjusted the EPS to account for an increase in the share of electric vehicles in the US fleet that results from both these rules and IRA provisions. The increase in EV sales over the next decade is approximated by the EPA and used to inform the assumptions in this report.

IRA Impact: Industrial Sector Assumptions

We modeled the IRA’s Advanced Industrial Facilities Deployment Program, which provides funding to projects at industrial facilities that reduce emissions. To account for this program, we increased the EPS assumption for the amount of industrial carbon capture and sequestration deployed.

Geographies Used in the Analysis: Michigan's Prosperity Regions

Michigan's Prosperity Regions

Michigan's prosperity regions are ten distinct geographic areas defined by the state of Michigan to organize and streamline economic development efforts. Each region has unique economic characteristics, challenges, and strengths, which help tailor specific policies and initiatives to maximize local benefits. Using these regions allows for a more focused and efficient approach to implementing state and federal programs, ensuring that the distinct needs of each area are met and that resources are distributed equitably across the state.

In addition, examining the local impact of these policies is crucial to understanding and addressing distributive and environmental justice priorities— a focus of both Gov. Whitmer's MI Healthy Climate Plan and the IRA. This analysis offers a deeper understanding of how federal and state policies are beginning to make economic development more equitable, benefitting low-income communities, Tribal nations, and environmental justice communities. For instance, the advantages of lower energy costs and improved public health outcomes will benefit places like Region 1 (Upper Peninsula), Region 5 (East Central), and Region 7 (Southeast Michigan)— areas that have historically faced significant disinvestment, job losses, and high energy burdens. When implemented equitably and effectively, Michigan's new laws could reverse these trends and address the longstanding inequities in these regions, laying the groundwork for benefits that did not exist under previous policies.

This report uses these districts as a way to measure the impact of new federal and state climate and clean energy policies on a more local, tangible level.

These ten regions are:

> **Region 1 (Upper Peninsula):** Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, Schoolcraft Counties

> **Region 2 (Northwest Lower Peninsula):** Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, Wexford Counties

> **Region 3 (Northeast Lower Peninsula):** Alcona, Alpena, Arenac, Cheboygan, Crawford, Iosco, Montmorency, Ogemaw, Oscoda, Otsego, Presque Isle, Roscommon Counties

> **Region 4 (West Michigan):** Allegan, Barry, Ionia, Kent, Lake, Mason, Mecosta, Montcalm, Muskegon, Newaygo, Oceana, Osceola, Ottawa Counties

> **Region 5 (East Central Michigan):** Arenac, Bay, Clare, Gladwin, Gratiot, Huron, Isabella, Midland, Saginaw, Sanilac, Tuscola Counties

Region 6 (East Michigan): Genesee, Huron, Lapeer, Sanilac, Shiawassee, St. Clair, Tuscola Counties

Region 7 (South Central Michigan): Clinton, Eaton, Hillsdale, Ingham, Jackson, Lenawee, Livingston Counties

Region 8 (Southwest Michigan): Barry, Berrien, Branch, Calhoun, Cass, Kalamazoo, St. Joseph, Van Buren Counties

Region 9 (Southeast Michigan): Hillsdale, Jackson, Lenawee, Livingston, Monroe, Washtenaw Counties

Region 10 (Detroit Metro): Macomb, Oakland, Wayne Counties

State of Michigan Prosperity Regions

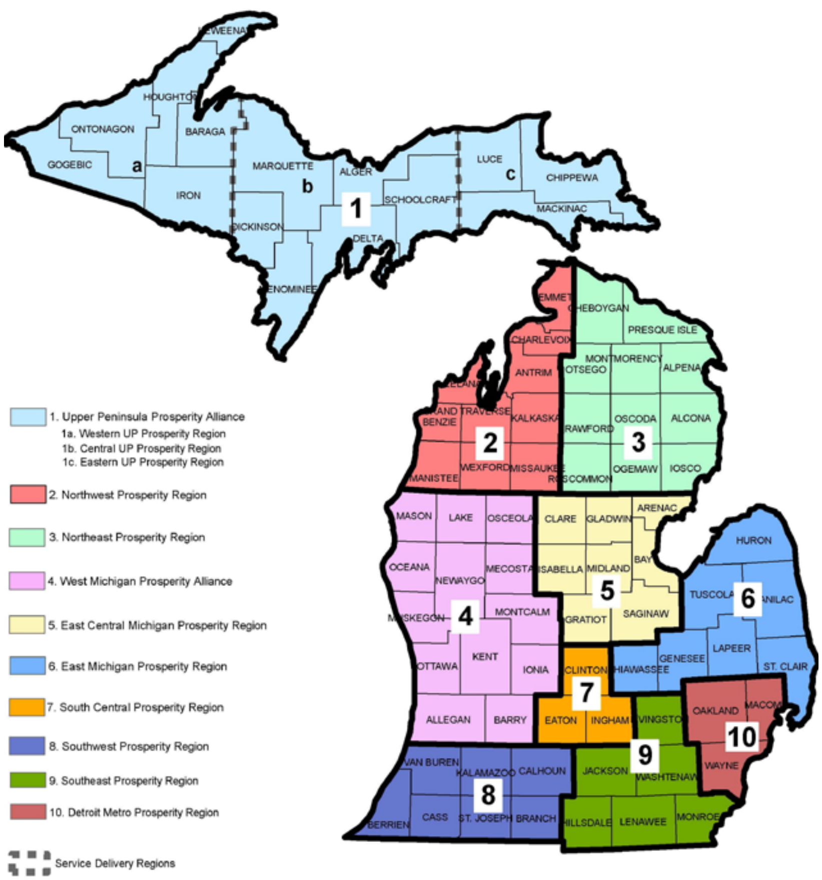


Figure 1

Modeling Tools and Methods:

5 Lakes Energy's economic modeling in this report was performed using the EPS, a free, open-source, peer-reviewed model developed by Energy Innovation Policy & Technology LLC® and RMI.

This report uses several key metrics derived from EPS: GDP and job growth, household energy costs, public health benefits, and federal investment numbers. Here's how each was calculated:

1. **GDP and Job Growth:** These figures are directly available from the EPS model outputs.
2. **Public Health Cost Savings:** The health cost savings modeling was done using emissions reduction outputs from EPS as inputs into the EPA's Co-Benefits Risk Assessment Health Impacts and Screening Tool (COBRA), which estimates the air quality and health benefits of different emissions scenarios and associated public health savings.
3. **Household Energy Costs:** To calculate this, we combined the EPS outputs for spending on residential building fuels and passenger vehicle fuels, including electricity. We then divided the total by the number of households in Michigan.
4. **Federal Investment Numbers:** These figures are derived from EPS outputs that detail subsidies for various initiatives, such as capacity construction, electricity generation, building retrofits, electric vehicles, and distributed solar.

In this report, we assess the specific impacts of the federal and state policies by comparing these key metrics— GDP, jobs, energy costs, health outcomes, and federal investments— against a business-as-usual EPS scenario where no such policies were implemented. The difference between these two scenarios highlights the impacts directly attributable to the policies, showing what would not have occurred in their absence.

Results: Statewide Impact

While this analysis primarily measures impacts on Michigan's local economies, some important indicators were not able to be modeled on the prosperity district level given their aggregate statewide effect. Since these are critical indicators of the impact of federal and state policies—and namely their combined effect—we analyzed some statewide effects.

Energy Bill Cost Savings:

- Michigan households will save $296.84 on their annual household energy costs by 2030, $713.10 annually by 2040 as a result of Michigan's new energy efficiency standards (Public Act 229), clean electricity standard (Public Act 235), and IRA clean electricity incentives.

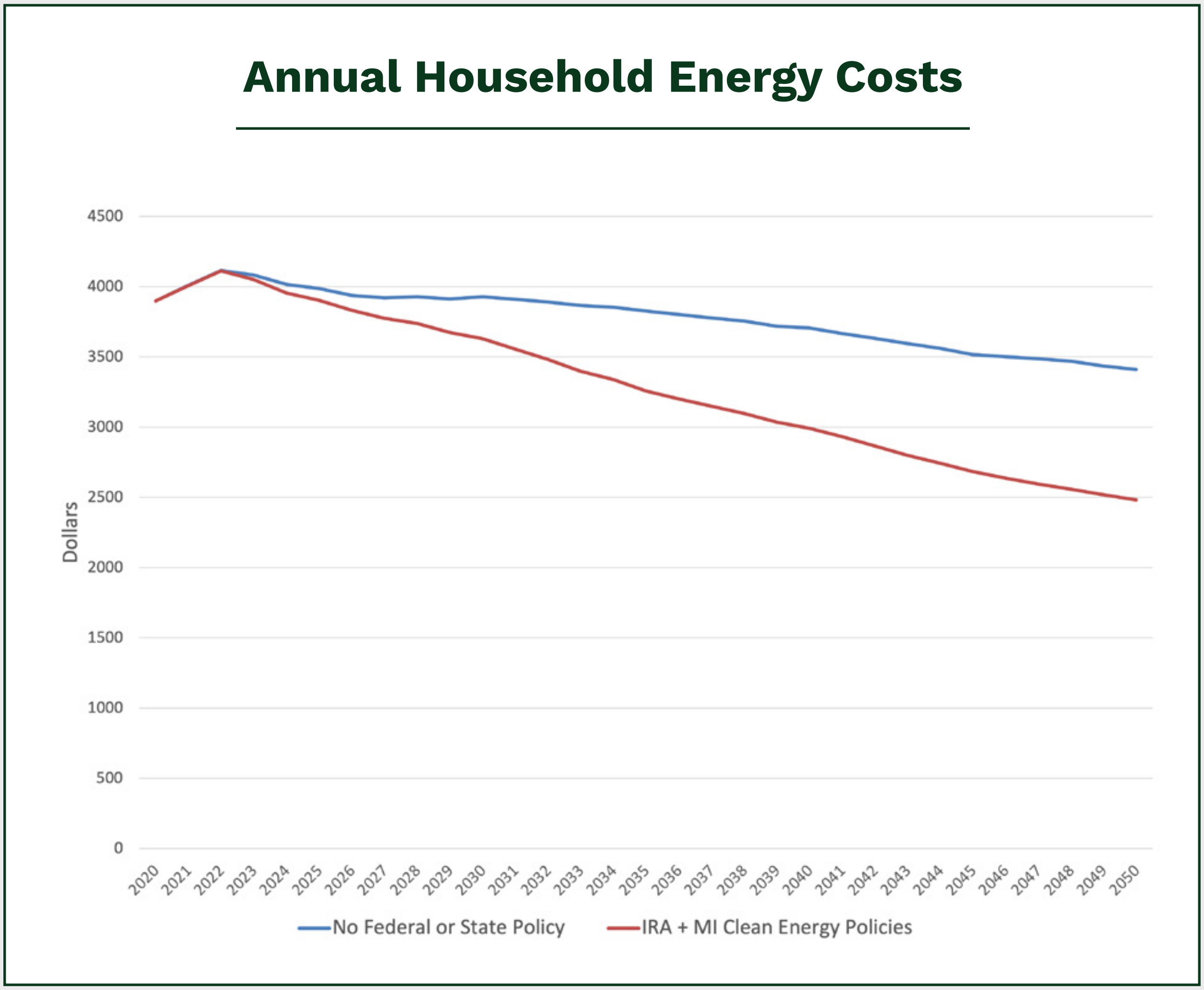


Figure 2

Greenhouse Gas Emissions Impact:

- State and federal policies will result in at least a 64.85% reduction in the state's electric power sector greenhouse gas emissions by 2030 and 87.91% by 2040.

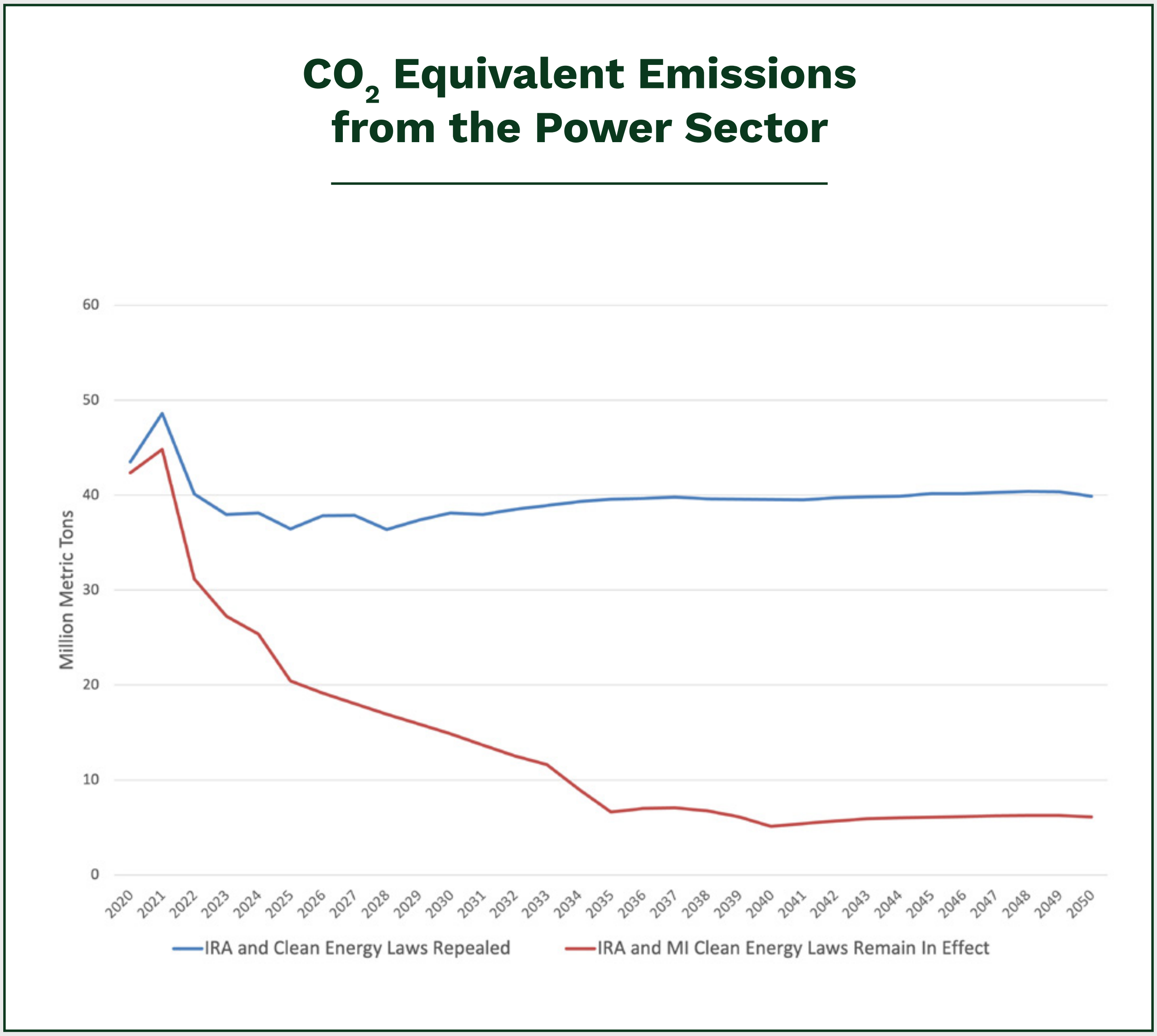


Figure 3

Ability to Meet Michigan's Clean Energy Standard:

In line with Governor Whitmer's MI Healthy Climate Plan and efforts to reduce greenhouse gas emissions, negative public health outcomes, and focus on generating energy in-state, the state set the goal to generate 50% of its electricity from renewable sources (wind, solar, storage, geothermal, biomass and hydroelectric) by 2030 and 60% of its electricity from renewable sources by 2035. As part of the legislative package, policymakers included a critical mechanism that would allow Michigan, namely farmers and landowners on a volunteer basis, to more easily and freely host renewable energy projects.

The reduction in greenhouse gas emissions (Figure 3) as a result of these policy changes underscore the pivotal role of both federal and state policies in catalyzing investments, lowering costs, and improving health outcomes across Michigan. While the IRA delivers substantial incentives, it's Michigan's proactive standards and legislative measures that secure tangible benefits for its residents. These findings highlight how Michigan's dual approach keeps the state at the forefront of the clean energy transition, with a particular focus on enhancing the quality of life. This is especially true for communities that can gain the most from fair economic growth, reduced pollution, and lower energy costs.

Results: Findings by Prosperity Region

The report breaks down the impacts of the IRA and Michigan's clean energy laws by each of Michigan's prosperity regions, focusing on the projected increases in jobs, GDP, and health-related costs in 2030 and 2040 as a result of the federal climate policies and state clean power laws.

Our analysis examines:

- **Job growth:** The number of job years added to the prosperity region's economy in 2030 and 2040 respectively.
- **Gross domestic product (GDP) growth:** The dollar amount added to the prosperity region's GDP in 2030 and 2040 respectively. GDP serves as a measure of the region's overall economic activity and an indicator of economic health.
- **Health savings:** The monetized benefit from avoided deaths, hospitalizations, lost school and work days, and other negative public health outcomes resulting from pollution.
- **Federal investment:** Anticipated IRA tax credits deployed in the state– specifically energy efficiency tax credits, rooftop solar tax credits, home energy retrofits tax credits, clean energy investment tax credits, clean energy production tax credits, and electric vehicle purchase tax credits.

Region 1: Upper Peninsula

This region includes the counties of Alger, Baraga, Chippewa, Delta, Dickinson, Gogebic, Houghton, Iron, Keweenaw, Luce, Mackinac, Marquette, Menominee, Ontonagon, and Schoolcraft.

	By 2030	By 2040
Job Growth (annual number of new jobs)	1,462	2,510
GDP Growth (annual number of new $ in GDP)	$187,859,771	$356,761,950
Federal tax credit Investment (cumulative federal investment)	$415,340,156	$802,696,824
Monetary Savings (cumulative avoided public health costs)	$33,631,666	$122,854,874

Upper Peninsula project highlight: Elevate is a nonprofit that ensures clean, affordable heat, cooling, power, and water for all by designing and implementing programs that reduce costs and ensure the benefits of renewable energy reach those that need them most.

"Our whole-home retrofit in Watersmeet, a town within the tribal land of Lac Vieux Desert Band of Lake Superior Chippewa, is a perfect example of what is possible with modern energy efficiency upgrades. We began with a house in need of serious and extensive repair, and were able to convert it into an energy efficient home with lower, more affordable energy costs. Michigan's new EWR standard will support many more projects like the one in Watersmeet across the state," said Brittany Turner, Associate Director of Tribal Programs at Elevate.

Region 2: Northwest Michigan

This region includes the counties of Antrim, Benzie, Charlevoix, Emmet, Grand Traverse, Kalkaska, Leelanau, Manistee, Missaukee, and Wexford.

	By 2030	By 2040
Job Growth (annual number of new jobs)	1,909	3,386
GDP Growth (annual number of new $ in GDP)	$246,569,065	$470,690,538
Federal tax credit Investment (cumulative federal investment)	$526,761,315	$1,029,558,930
Monetary Savings (cumulative avoided public health costs)	$95,189,941	$350,626,533

Northwest prosperity region business highlight: Harvest Solar is a Michigan-based solar energy developer focused on making agricultural, residential, and commercial customers more efficient and independent through renewable energy. The company has several projects in the Northwest region of Michigan.

“In the past, numerous agricultural and commercial projects were undersized due to statutory limitations and arbitrary caps placed on solar projects. Following the passage of PA 235, these limits have been raised, allowing us to build solar arrays more suited for these sites and more financially reasonable for our customers.There are several projects in northwest Michigan that could have built– and now can build– a larger solar array to fit the needs of their large facilities, but were limited to 150 kW at the time, including a large cherry processor and a local culinary campus,” said Luke Olinyk, President at Harvest Solar.

Region 3: Northeast Michigan

This region includes the counties of Alcona, Alpena, Arenac, Cheboygan, Crawford, Iosco, Montmorency, Ogemaw, Oscoda, Otsego, Presque Isle, and Roscommon.

	By 2030	By 2040
Job Growth (annual number of new jobs)	959	1,748
GDP Growth (annual number of new $ in GDP)	$127,802,450	$254,851,302
Federal tax credit Investment (cumulative federal investment)	$290,480,046	$561,760,064
Monetary Savings (cumulative avoided public health costs)	$107,961,978	$405,031,534

Northeast prosperity region business highlight: CBS Solar is a Michigan-based residential solar developer that has been in the renewable energy business for over 40 years. They have several projects in the Northeast prosperity region.

“The raising of Michigan’s distributed generation cap has eliminated an artificial barrier to our industry that has been stifling business and innovation for years. Before this legislation, our market was uncertain even for the next 6 months; and while the cap really should be entirely eliminated, we now foresee almost a decade of growth and business,” Allan O’Shea, President of CBS Solar.

Region 4: West Michigan

This region includes the counties of Allegan, Barry, Ionia, Kent, Lake, Mason, Mecosta, Montcalm, Muskegon, Newaygo, Oceana, Osceola, and Ottawa.

	By 2030	By 2040
Job Growth (annual number of new jobs)	10,602	17,090
GDP Growth (annual number of new $ in GDP)	$1,409,423,991	$2,391,054,542
Federal tax credit Investment (cumulative federal investment)	$3,129,407,446	$6,160,006,137
Monetary Savings (cumulative avoided public health costs)	$671,232,279	$2,554,893,947

West Michigan prosperity region business highlight: EVgo is one of the nation's largest public fast charging networks, owning and operating a charging network that includes around 900 fast charging locations in 60 metropolitan areas in 30 states.

"EVgo is excited to be one of the first companies to be selected for a preliminary award in Michigan's NEVI program, and with more than 45 fast charging stalls already operational in the state, we look forward to continuing to expand our network to meet Michigan's growing demand," said Lindsey Stegall, Senior Manager, Market Development & Public Policy at EVgo.

Region 5: East Central Michigan

This region includes the counties of Arenac, Bay, Clare, Gladwin, Gratiot, Isabella, Midland, and Saginaw.

	By 2030	By 2040
Job Growth (annual number of new jobs)	2,732	4,956
GDP Growth (annual number of new $ in GDP)	$364,684,806	$736,094,240
Federal tax credit Investment (cumulative federal investment)	$861,035,978	$1,676,693,490
Monetary Savings (cumulative avoided public health costs)	$299,825,992	$1,172,171,908

East Central prosperity region business highlight: Apex Clean Energy is an independent renewable energy developer, hosting one of the nation's largest portfolios of utility-scale generation and storage. The company developed and built the Isabella Wind Farm in Isabella County, which generates enough clean energy to power over 90,000 homes annually.

"With a robust, pro-investment policy environment, Michigan is positioned to lead our nation's transition to clean energy. The growth in this sector will drive the deployment of capital and job creation across the state, while also enabling leading Michigan companies to meet their clean energy and sustainability goals," said Chris Kunkle Senior Director of Government Affairs for Apex Clean Energy.

Region 6: East Michigan

This region includes the counties of Genesee, Huron, Lapeer, St. Clair, Sanilac, and Tuscola.

	By 2030	By 2040
Job Growth (annual number of new jobs)	3,608	6,430
GDP Growth (annual number of new $ in GDP)	$468,432,470	$905,568,594
Federal tax credit Investment (cumulative federal investment)	$1,060,206,892	$2,082,255,266
Monetary Savings (cumulative avoided public health costs)	$557,961,577	$2,201,722,744

East Michigan prosperity region business highlight: GEM Energy provides comprehensive services and technologies to improve customer business performance and reduce facility operation costs through services including solar development for commercial and industrial customers.

“Although the state's new energy storage requirements and raised distributed generation cap are bringing an increase in business for behind the meter projects, GEM primarily works in community solar, which is still not enabled by state law. Our community solar projects in Illinois employ several hundred people and bring energy savings to more; I wish to bring those same results to Michigan,” said Jason Slattery, Director of Solar at GEM Energy.

Region 7: South Central

This region includes the counties of Clinton, Eaton, Hillsdale, Ingham, Jackson, and Livingston.

	By 2030	By 2040
Job Growth (annual number of new jobs)	2,481	4,003
GDP Growth (annual number of new $ in GDP)	$296,793,115	$509,513,179
Federal tax credit Investment (cumulative federal investment)	$524,342,631	$1,038,813,578
Monetary Savings (cumulative avoided public health costs)	$248,081,173	$948,546,917

South Central prosperity region business highlight: Michigan CAT Power Systems is Michigan's premier provider of turnkey Combined Heat and Power systems with locations across the state including in Lansing.

"The energy laws have really changed the dynamic of our market," Kevin O'Connell, Advanced Energy Systems Manager at Michigan CAT. "We have seen some lag in the utility space as compliance with the new statute gets figured out, but we have also seen some expansion in the commercial and industrial space."

Region 8: Southwest

This region includes the counties of Berrien, Branch, Calhoun, Cass, Kalamazoo, St. Joseph, and Van Buren.

	By 2030	By 2040
Job Growth (annual number of new jobs)	4,316	7,294
GDP Growth (annual number of new $ in GDP)	$591,682,572	$1,104,041,476
Federal tax credit Investment (cumulative federal investment)	$1,454,673,839	$2,824,111,362
Monetary Savings (cumulative avoided public health costs)	$251,577,331	$988,726,103

Southwest prosperity region business highlight: Based in Baroda, Michigan, Lakeshore Die Cast, Inc. is a manufacturer of aluminum and zinc die castings that has been serving all industries since 1959.

"Increasing the cap on distributed generation system size has allowed me to vertically integrate my business in some really exciting ways. I have been able to expand my solar array and replace my natural gas powered melters with electric powered melters. Now I can use the electricity I generate on-site instead of buying natural gas from a utility," said Adam Schaller, Vice President at Lakeshore DieCast.

Region 9: Southeast

This region includes the counties of Monroe and Washtenaw, as well as the non-Detroit portions of Wayne County.

	By 2030	By 2040
Job Growth (annual number of new jobs)	5,060	8,383
GDP Growth (annual number of new $ in GDP)	$632,005,149	$1,155,429,644
Federal tax credit Investment (cumulative federal investment)	$1,349,084,389	$2,824,111,362
Monetary Savings (cumulative avoided public health costs)	$758,240,947	$2,710,711,798

Southeast prosperity region business highlight: Ventower Industries is a leading manufacturer of wind turbine towers, based in Monroe, Michigan, specializing in the production of utility-scale towers for the renewable energy sector.

“The manufacturing industry is still catching up from the supply chain shortages brought on by the Covid-19 pandemic; however, Michigan's new renewable portfolio standard has set in motion an uptick in demand for energy components like those made by Ventower, hastening the industry's recovery and propelling it onward,” said Ventower Vice President Scott Viciana.

Region 10: Detroit Metro

This region includes the counties of Macomb, Oakland, and Wayne, focusing on the densely populated urban and suburban areas surrounding Detroit.

	By 2030	By 2040
Job Growth (annual number of new jobs)	24,073	40,240
GDP Growth (annual number of new $ in GDP)	$2,956,361,610	$5,224,596,535
Federal tax credit Investment (cumulative federal investment)	$5,988,427,342	$11,862,700,515
Monetary Savings (cumulative avoided public health costs)	$4,272,351,284	$16,318,402,980

Detroit Metro prosperity region business highlight: Founded in 2000 and based in Detroit, MI, Walker-Miller Energy Services (WMES) is a woman & minority-owned urban energy waste reduction company focusing on empowering people and enriching communities by delivering multiple energy efficiency services.

"Many households in Detroit have historically struggled with the high cost of energy - which can often be attributed to older and inefficient homes. Legislation like Michigan's new energy waste reduction standard, bolstered by resources from the Inflation Reduction Act and other federal policy will expedite the ability for organizations like Walker-Miller to provide relief to energy burdened households across the state," said Ben Dueweke, Director: State and Local Government at Walker-Miller Energy Services.

Company Surveys

Methodology

Michigan Energy Innovation Business Council (Michigan EIBC) conducted a survey of its members and a series of one-on-one interviews with advanced and clean energy companies across Michigan's prosperity regions. Questions in both the survey and interviews were designed to glean the impact of Michigan's new clean energy legislation. Several questions also measured how Michigan's legislation complimented federal policies such as the IRA and the Infrastructure Investment and Jobs Act (IIJA).

A 33-question survey (Appendix A) was sent to all Michigan EIBC member companies in March 2024. Twenty Michigan EIBC member companies filled out the survey. Among them were two

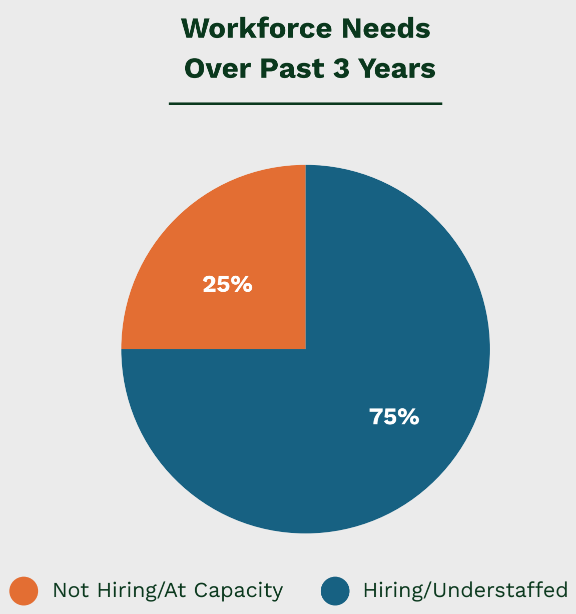


Figure 4

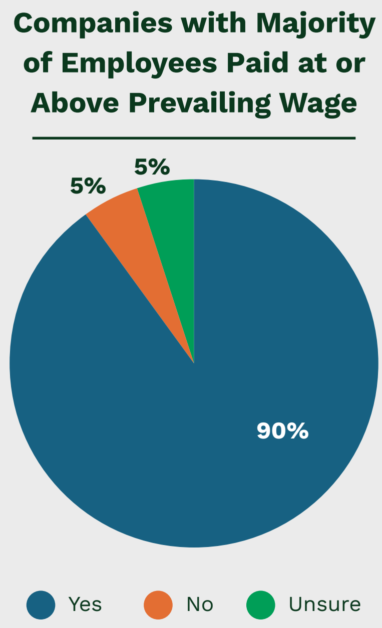


Figure 5

companies in behind-the-meter/distributed energy resource sector, six in the utility-scale generation/energy storage sector, one in financial services, three in manufacturing, four in engineering, procurement, construction, and consulting, one in transmission, two in energy efficiency/building decarbonization, and one in community solar.

Survey Results and Discussion

Workforce Needs

When survey respondents were asked to describe their previous workforce needs within the past three years, 75% of participating companies (n = 15) indicated that they were either actively hiring or understaffed (Figure 4). Nearly all of participating companies (90%, n = 18) pay a majority of their employees at or above prevailing wages (Figure 5). These data suggest that jobs in Michigan's clean energy industry are well-paying. When asked to describe their workforce needs over the next three years, 90% of companies (n = 18) indicated they would need to hire or be understaffed, indicating an existing/future increase in labor demand (Figure 6).

In addition to the noted strong wages in the industry, there is a significant opportunity for new jobs and a strong need for workforce and talent development. While 39% of respondents (n = 7; Figure 7) indicated they can attract enough talent to meet the growing demand, others highlighted a need for more workers than previously projected. Most respondents indicated a strong demand for new workers, with 44% (n = 8) unsure if they could attract enough talent to meet their needs and 17% (n = 3) believing they might not meet their hiring goals.

These data are likely generally reflective of regional labor scarcity and the broad need for increased talent attraction. Michigan policymakers have taken actions to combat these issues

Anticipated Workforce Needs Over Next 3 Years

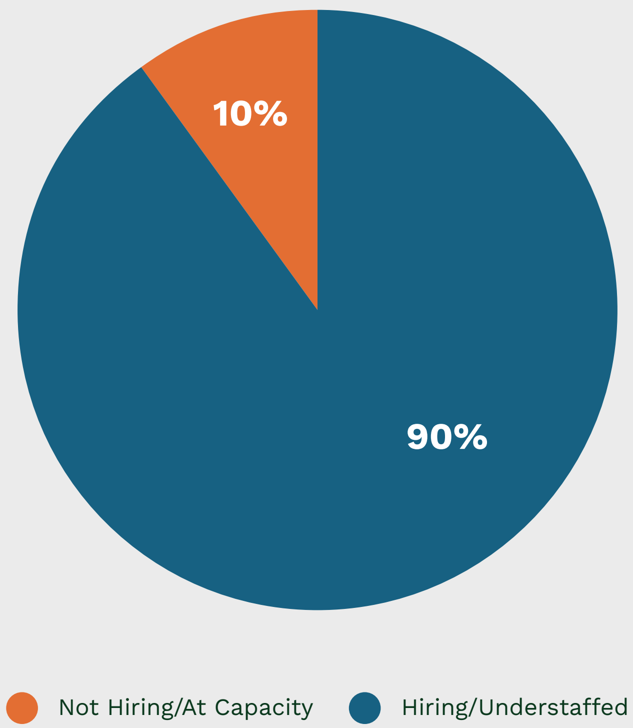


Figure 6

in recent years, such as creating the "Growing Michigan Together Council" aimed at talent attraction, but the problem of low labor supply persists. Thus, Michigan will need to continue its investment in workforce training programs that prepare workers for high-wage jobs in the growing clean energy sector.

While interest in project development is high across the entire state, three regions had the greatest percentage of desired development (Figure 11): Regions 4, 7, and 9. Each of these regions were selected as targets for business expansion by 71% (n = 10) of respondents. The region demonstrating the lowest interest in business expansion was the Detroit Metro region (Region 10 on Figure 11) but still almost half (43%) of respondents indicated plans to develop projects there.

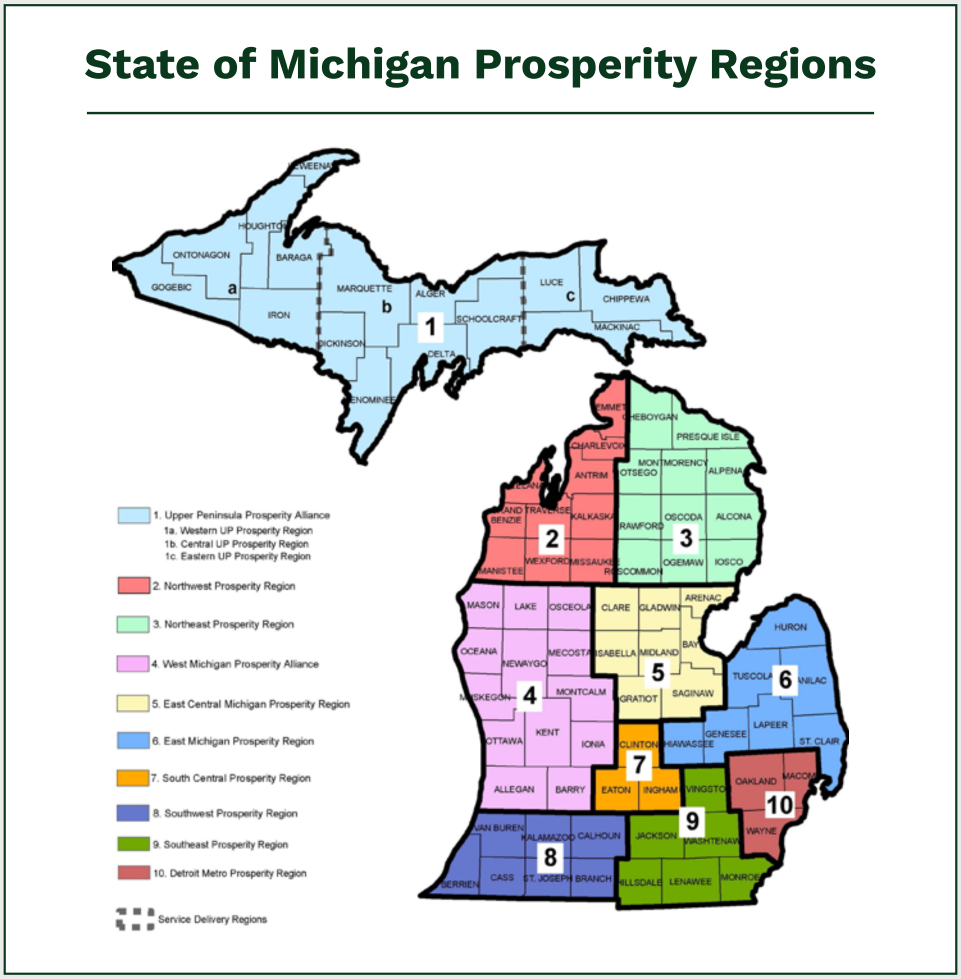


Figure 11

Barriers to Expansion

Participating companies were asked to rank barriers to business expansion by their level of impact on a scale of 0 to 5, with 0 being the least impactful barrier and 5 being the most impactful barrier. Of note, it appears that, at least among survey participants, supply chain issues are no longer a significant barrier with 44% of respondents (n = 7) ranking logistical/supply chain issues as least impactful (0 or 1; Figure 12). Similarly, access to financing is not a significant barrier for survey participants with 63% (n = 10) ranking this issue as a 0 or 1 (Figure 10). In contrast, a majority of respondents (75%, n = 12) identified workforce challenges as a moderate (2 to 3) to severe (4 to 5) barrier (Figure 14) and another 75% of respondents (n = 12) identified remaining state and local policy gaps as a moderate (2 to 3) to severe (4 to 5) barrier (Figure 15).

Among the companies that identified state and local policies as a significant barrier to expansion, most were utility-scale renewable developers and community solar companies. Utility-scale developers have faced challenges with existing local zoning restrictions in Michigan for many years. For instance, a 2021 study by Michigan State University and the University of Michigan rated Michigan wind projects as "most contentious." The passage of PA 233 of 2023 marks a turning point, establishing a state siting option that enhances the feasibility of utility-scale wind, solar, and storage projects, especially in areas where local siting was previously difficult. This new law is expected to significantly improve the prospects for renewable energy development in Michigan. In contrast, statutory changes were not made to allow for third-party community solar ownership models in Michigan and, as a result, the community solar industry does not expect to see significant opportunities for expansion in the immediate future.

Logistical/Supply Chain

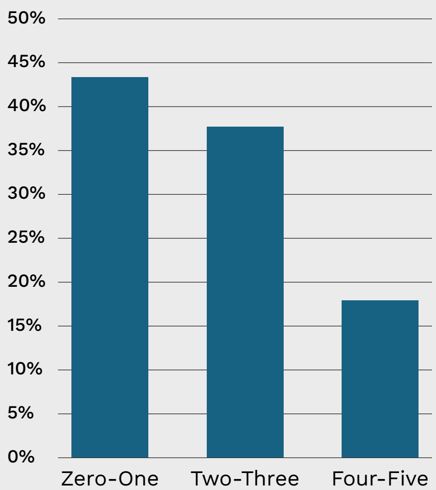


Figure 12

Access to Financing

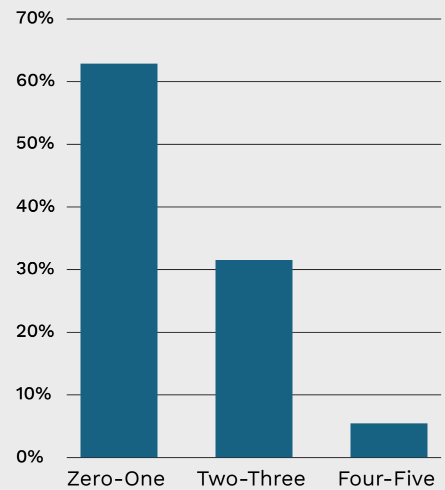


Figure 13

Workforce Challenge

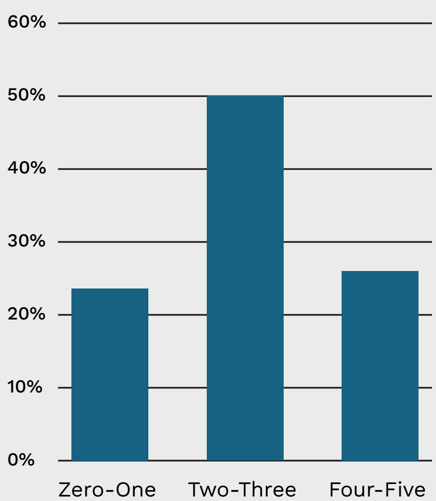


Figure 14

State/Local Policies

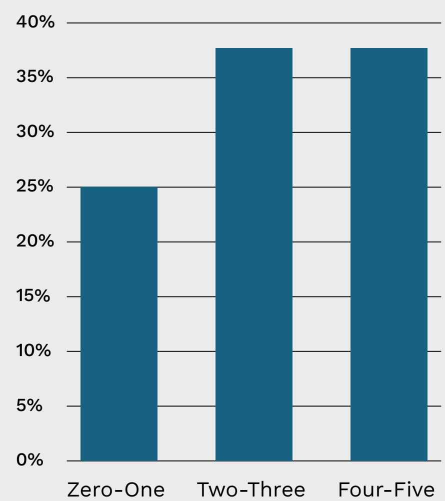


Figure 15

Policy Recommendations

Michigan's significant progress in the clean energy sector— enhanced by federal funding and a newly-aligned regulatory framework— can be further strengthened through continued and targeted actions. As Michigan advances on its trajectory of reducing greenhouse gas emissions and adapting its business landscape to meet regional economic needs, the findings in this report—both quantitative and qualitative— highlight key areas where focused efforts could yield substantial benefits. To capitalize on this momentum and address the unique challenges and opportunities within Michigan's prosperity regions, the following policy recommendations are proposed:

- **Additional state policies:** Continue advancing the growth of clean energy and decarbonizing the buildings and transportation sectors to fully implement the governor's MI Healthy Climate Plan.
- **Continued Investment:** Encourage ongoing investment in clean energy projects to leverage the full scope of economic and health benefits.
- **Monitoring and Evaluation:** Regularly assess policy impacts to ensure goals are met and to inform necessary adjustments.
- **Cumulative Impact Assessments:** Enact a policy to conduct cumulative impact assessments to evaluate the impact of retiring existing energy assets and constructing new energy projects– helping ensure that the benefits of clean energy projects reach communities across the state, particularly in areas that have historically faced disinvestment. Focus on an approach that helps to address inequities and ensures that the transition to clean energy contributes to environmental justice.
- **Reducing Energy Burdens:** Ensure that cost reductions in energy supply for utility companies translate to lower energy bills for ratepayers, especially for communities with historically higher energy burdens.
- **Workforce Development Planning:** Develop comprehensive workforce training programs that prepare workers for high-wage jobs in the growing clean energy sector, with a focus on ensuring opportunities for underrepresented groups and those transitioning from traditional energy industries.

Conclusion

This comprehensive analysis statewide and by prosperity region highlights the vast benefits that federal and state clean energy policies have brought and continue to bring to Michigan's diverse economic landscape. By strategically aligning historic federal funding with strong state action, Michigan is poised for substantial economic growth and improved health outcomes across all regions. The combined efforts of federal and state policies—plus additional efforts by the state to codify the governor's MI Healthy Climate Plan—not only ensure significant cost savings and emissions reductions but also foster job creation and economic development, securing a sustainable and prosperous future for Michigan.

June 7, 2021

Mr. John Bear, Chief Executive Office
Mid-Continent Independent System Operator, Inc.
701 City Center Drive
Carmel, IN 46032

RE: Support for MISO's Long-Range Transmission Planning Effort to Cost-Effectively Maintain System Reliability in the Face of a Changing Climate

Dear Mr. Bear:

Since taking office one of our highest priorities has been to ensure our States are prepared to address the urgent and immediate threats of climate change – as well as seize the economic and other benefits of addressing these challenges. We appreciate MISO's ongoing work around the Long-Range Transmission Planning process.

The need for this work has only become more pressing. The events in Texas and across the South earlier this year were a tragic reminder of the consequences of not being adequately prepared for the realities of a changing climate, with communities of color and low-income residents often suffering most. Absent immediate action, these harmful effects will only intensify, lending real urgency to our work to maintain system-wide reliability while decarbonizing electric generation.

At the same time, customers, communities, utilities, and states are all demanding greater amounts of carbon-free generation. A growing list of leading companies – including companies based in each of our states like American Family, Dow Chemical, Ford Motor Company, General Motors, Herman Miller, Kohler, Steelcase, Target, and Whirlpool, to name just a few – have announced aggressive carbon reduction targets. Many of our communities have also enacted bold climate goals. Our electric utilities are important partners in this effort: DTE Energy announced a goal to achieve net zero carbon emissions by 2050 (with intermediate steps of a 50% reduction by 2030 and an 80% reduction by 2040), Consumers Energy set a goal of carbon neutrality by 2040, and Xcel Energy, Alliant Energy, and Minnesota Power set goals of 100% carbon-free electricity production by 2050.

State government is also actively engaged. Each of the below signed Governors have committed to the goals of the Paris Climate Agreement to reduce greenhouse gas (GHG) emissions to 26–28 percent below 2005 levels by 2025. In addition, Illinois has a goal of 100% clean energy by

2050, Michigan has a goal of economy wide carbon neutrality by 2050, Minnesota has a goal to reduce GHG emissions 30% by 2025 and 80% by 2050, and Wisconsin has a goal of 100% carbon-free electricity by 2050.

Ensuring we have a grid that can accommodate the changes taking place in our electric sector is of critical importance, and will allow us to cost-effectively maintain the reliability of the system while making the transition to a decarbonized economy. Simply put, we cannot allow the transmission system to become a barrier to meeting our climate commitments, nor can we sacrifice system-level reliability as the number of extreme weather events driven by climate change continues to increase.

To that end, I am asking that MISO be a partner with each of us in these efforts. MISO's Long-Range Transmission Planning process is urgently needed to allow carbon-free and low-cost electricity to flow across the region – all while maintaining the reliability of the system on which we rely. To fully meet its potential, this effort must be transparent and encourage stakeholder input, optimize between transmission and non-transmission options (including electricity storage, energy efficiency, and demand response both in Michigan and across MISO's territory), and enable a "least regrets" approach to system planning.

We are counting on MISO to plan for the grid infrastructure we will need, and we stand ready to partner with you in meeting the challenges – and opportunities – demanded by the urgent realities of climate change.

Sincerely,

Gretchen Whitmer
Governor of Michigan

J.B. Pritzker
Governor of Illinois

Tim Walz
Governor of Minnesota

Tony Evers
Governor of Wisconsin

CC: Michigan Public Service Commission

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

*****

In the matter of the application of **MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC** for an Act 30 certificate of public convenience and necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan, and between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan.	)	**Case No. U-21471** **Case No. U-21472**

DIRECT TESTIMONY OF MICHAEL GOGGIN

ON BEHALF OF

THE MICHIGAN ENERGY INNOVATION BUSINESS COUNCIL,

INSTITUTE FOR ENERGY INNOVATION,

AND

CLEAN GRID ALLIANCE

TABLE OF CONTENTS

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name and job title.

A. My name is Michael Goggin, and I am a Vice President at Grid Strategies LLC, a consulting firm based in the Washington, D.C. area.

Q. For whom are you testifying?

A. I am testifying on behalf of the Clean Grid Alliance ("CGA"), Michigan Energy Innovation Business Council ("Michigan EIBC"), and Institute for Energy Innovation ("IEI"; collectively "MEIC").

Q. Have you previously testified before state utility commissions?

A. Yes. I have testified in dozens of proceedings before state utility commissions in Arizona, Colorado, Georgia, Illinois, Indiana, Iowa, Louisiana, Minnesota, Missouri, Montana, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, South Carolina, Virginia, Washington, and Wisconsin, as well as before the Federal Energy Regulatory Commission ("FERC").

Q. What is your background and educational experience?

A. I have worked on renewable energy, transmission, and electricity market issues for over 20 years. At Grid Strategies, I serve as an expert on those topics for a range of clients including state utility regulators, grid operators, and non-profit organizations. For the preceding ten years I worked at the American Wind Energy Association (now known as the American

Clean Power Association), where I provided technical analysis and advocacy regarding renewable energy, transmission, and renewable integration into electricity markets, including directing the organization's research and analysis team from 2014–2018. Prior to the American Wind Energy Association, I worked at a firm serving as a consultant to the U.S. Department of Energy, and at two environmental groups.

In the course of that work, I have co-authored more than one hundred filings to FERC; served as a technical reviewer for over a dozen national laboratory reports, academic articles, and renewable integration studies; published academic articles and conference presentations on renewable integration, transmission, and policy; and been elected to the Standards, Operating, and Planning Committees of the North American Electric Reliability Corporation ("NERC"), the entity that oversees electric reliability. I graduated with honors from Harvard University. My resume is attached as Exhibit MEIC-7 (MG-1).

Q. What is the purpose of your testimony?

A. Michigan Electric Transmission Company, LLC ("METC") is requesting Commission approval of their petition for a Certificate of Public Convenience and Necessity for the Projects, pursuant to Michigan's Electric Transmission Line Certification Act.[1] I provide facts confirming that each Project meets the statutory requirement for approval that "The quantifiable and nonquantifiable public benefits of the proposed major transmission line justify its construction."[2]

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[1] Application of Michigan Electric Transmission Company ("U-21471 Application"), Case No. U-21471 at 1 (citing 1995 PA 30, MCL 460.561 *et seq.*); Application of Michigan Electric Transmission Company ("U-21472 Application"; collectively the "Applications") at 1 (citing 1995 PA 30, MCL 460.561 *et seq.*).

[2] MCL 460.568(5)(a).

Q. Please outline your testimony.

In this testimony, I first explain the broader context of the Midcontinent Independent System Operator's ("MISO") Long Range Transmission Planning ("LRTP"), the first phase of which ("Tranche 1") identified the Projects as the optimal solution for providing customers reliable electric service at least cost. I also note that MISO's projections for renewable deployment have more than doubled since Tranche 1 was finalized, increasing the need for transmission and the benefits of the Projects.

Second, I demonstrate that the Projects will reduce electric rates in Michigan, including by reducing transmission congestion costs for ratepayers in Michigan's lower peninsula by between $1 billion and $3 billion. The Projects provide Michigan consumers with greater access to low-cost generation, including renewable energy resources, that: (1) lower wholesale electricity costs in the MISO energy market; (2) reduce MISO capacity market prices in Michigan; (3) provide lower-cost and higher-value renewable energy Power Purchase Agreements ("PPAs") to Michigan utilities; and (4) reduce the price of Renewable Energy Credits ("RECs") Michigan utilities purchase to comply with the Renewable Portfolio Standard ("RPS") requirements established by Public Act 235.

Third, I discuss how the Projects ensure adequate and reliable electric service for Michigan customers by increasing the ability to transfer power within and into Michigan.

Finally, I explain that the renewable energy delivered by Tranche 1 reduces emissions of carbon dioxide and other air pollutants by tens of millions of tons, providing public health and environmental benefits to Michigan residents.

Q. Are you sponsoring any exhibits?

A. Yes, I am sponsoring the following exhibits:

- Exhibit MEIC-7 (MG-1): Résumé of Michael Goggin
- Exhibit MEIC-8 (MG-2): MISO chart illustrating that effective transmission planning minimizes the total cost to ratepayers of generation plus transmission by building the optimal amount of transmission.
- Exhibit MEIC-9 (MG-3): NREL 80-meter wind resource assessment map of the U.S.
- Exhibit MEIC-10 (MG-4): LevelTen data showing average wind and solar PPA prices by region, with MISO prices typically significantly below those in PJM.
- Exhibit MEIC-11 (MG-5): Lawrence Berkely National Lab map of wind generation value in 2023.
- Exhibit MEIC-12 (MG-6): Lawrence Berkely National Lab chart showing factors reducing wind generation value in 2023, relative to a hypothetical flat block of power.
- Exhibit MEIC-13 (MG-7): Energy Market Price Reductions with Increasing Wind in MISO Region.
- Exhibit MEIC-14 (MG-8): Maps showing transmission expansion under alternating current (“AC”) and multi-terminal (“MT”) direct current scenarios.

II. MISO’S LRTP IDENTIFIED THE PROJECTS AS AN OPTIMAL LEAST-COST SOLUTION.

Q. Please describe the Projects.

A. The Projects include the new Helix Substation and an approximately 55-mile 345 kilovolt (“kV”) double-circuit transmission line that will run from the new Helix Substation in

Clarence Township in Calhoun County to the Michigan/Indiana state border in Gilead Township in Branch County,[3] and an approximately 39.5-mile double-circuit 345 kV transmission line between the existing Nelson Road Substation in New Haven Township, Gratiot County, to the existing Oneida Substation in Oneida Charter Township, Eaton County, Michigan.[4] The Projects are an integral part of MISO's LRTP Tranche 1. Tranche 1 includes 18 projects across the region,[5] and the Projects are the Michigan portion of project numbers 17 and 18. MISO is continuing its LRTP process with subsequent tranches of necessary regional transmission upgrades, and recently finalized its Tranche 2.1 plans.[6]

Q. How did MISO develop the LRTP Tranche 1 lines that include the Projects?

A. The Tranche 1 lines were identified through an iterative process incorporating top-down modeling by MISO to co-optimize generation and transmission expansion, as well as bottom-up input from METC and other transmission owners identifying and verifying local upgrade needs to address transmission overloads and other reliability concerns.[7] Comprehensive analysis determined that the Tranche 1 set of lines that include the Projects were the optimal solution to these needs. The Projects are the eastern end of a network of transmission expansion, encompassing Tranche 1 project numbers 12–18, connecting Iowa

[3] Direct Testimony of Charles L. Marshall on behalf of Michigan Electric Transmission Company, LLC, Case No. U-21472 ("Marshall U-21472 Direct"), p. 9.
[4] U-21471 Application at 1.
[5] MISO, *LRTP Tranche 1 Detailed Business Case* (June, 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, at 12.
[6] MISO, *LRTP Tranche 2.1 Portfolio Update* (September, 2024), available at https://cdn.misoenergy.org/20240924%20LRTP%20Workshop%20Item%2002%20Tranche%202.1%20Final%20Portfolio%20Overview649676.pdf
[7] Marshall U-21472 Direct, pp. 14, 30–31, 41–44.

to Michigan, which MISO refers to as the East-Central Corridor Projects.[8] As METC explains, "MISO found that East-Central Corridor Projects resulted in fewer unsolved contingencies than any alternatives considered. MISO studied five alternatives to the East-Central Corridor Projects. Some alternatives performed similarly on the reliability metrics but added cost or offered less flexibility in the future; others showed a reduction in performance."[9] METC also evaluated alternatives and concluded "No other option was a prudent replacement component for the East- Central Corridor Projects."[10]

Q. Is it common for transmission development to precede generation development?

A. Yes. A major difficulty in coordinating generation and transmission development is the mismatch between the relatively short amount of time required to develop a generation project versus the longer time period required to develop a transmission project.[11] Transmission development that proactively plans transmission in anticipation of changes in the generation mix has been recognized as an essential aspect of effective transmission planning,[12] and this type of proactive transmission planning is now required pursuant to FERC Order 1920. Proactive transmission planning to interconnect areas with high-quality renewable resources (*i.e.*, favorable winds, high insolation) before specific renewable projects have been built is even more important, given the even shorter time required to

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[8] MISO, MTEP21 Report Addendum: Long Range Transmission Planning Tranche 1: Executive Summary *(*"MTEP21 LRTP Addendum") (2021), available at https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf, p. 40.
[9] Marshall U-21472 Direct, p. 39.
[10] *Ibid.*, pp. 41–44.
[11] AWEA, *Grid Vision: The Electric Highway to a 21st Century Economy* (May, 2019), available at https://cleanpower.org/wp-content/uploads/2021/01/Grid-Vision-The-Electric-Highway-to-a-21st-Century-Economy.pdf.
[12] J. Pfeifenberger et al., *Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs* (October, 2021), available at https://www.brattle.com/wp-content/uploads/2021/10/2021-10-12-Brattle-GridStrategies-Transmission-Planning-Report_v2.pdf.

build a renewable energy generation facility. As METC witness Marshall explains in his testimony, "Transmission development requires more than double the time to develop than generation. While certain generation resources can be developed in 2 to 3 years, transmission infrastructure, particularly regional infrastructure such as the LRTP1 Portfolio, can require 7 to 10 years to develop."[13] As an example, proactive planning was used in developing the Competitive Renewable Energy Zone lines in Texas,[14] which were successfully completed more than a decade ago.

MISO adopted this successful model of proactive transmission planning with the Regional Generator Outlet Study[15] and the subsequent planning of the original 17 Multi-Value Projects in 2011. MISO's periodic reviews of the Multi-Value Projects show that the net benefits continue to match or exceed initial expectations,[16] which already showed highly favorable benefit-to-cost ratios. Effective transmission planning minimizes the total cost to ratepayers of generation plus transmission by accessing lower-cost generating resources and providing other benefits, like those quantified by MISO.[17] The goal of minimizing total ratepayer costs, as illustrated in the MISO chart from the 2010 Regional Generator Outlet Study shown in Exhibit MEIC-8 (MG-2), continues to be the foundational principle of MISO transmission planning including the development of Tranche 1.

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[13] Marshall U-21472 Direct, pp. 21–22.

[14] Electric Reliability Council of Texas ("ERCOT"), *Competitive Renewable Energy Zones (CREZ) Transmission Optimization Study* (April, 2008), attachment as part of ERCOT filing with the Public Utilities Commission of Texas, available at http://pbadupws.nrc.gov/docs/ML0914/ML091420467.pdf.

[15] MISO, *Regional Generation Outlet Study* (2013), available at https://puc.sd.gov/commission/dockets/electric/2013/EL13-028/appendixb3.pdf.

[16] MISO, *MTEP17 MVP Triennial Review* (September, 2017), available at https://cdn.misoenergy.org/MTEP17%20MVP%20Triennial%20Review%20Report117065.pdf.

[17] MISO, *LRTP Tranche 1 Detailed Business Case* (June, 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, at 13.

The Southwest Power Pool has similarly found large net benefits across a range of categories from its proactive transmission expansion.[18] More recent examples of proactive transmission development outside of the MISO region include the Greenlink Nevada project and the Colorado Power Pathway, and Duke Energy appears to be moving in this direction with its Multi-Value Strategic Transmission initiative.

Proactive transmission expansion is also more cost-effective because it allows selection of "right-sized" solutions to long-term needs, which realize economies of scale and use right-of-way more efficiently than the piecemeal lower-voltage solutions that would be built without proactive planning.

Q. Can you quantify these economies of scale in transmission expansion?

A. Yes. The cost estimates presented in Table 1 show that double-circuit 345-kV transmission, as proposed for the Projects, is much more cost-effective than lower-voltage solutions. The higher-capacity lines on the right and bottom part of the table are much more cost-effective on a \$/MW-mile basis, which reflects the cost of transmission capable of transporting one Megawatt ("MW") of electricity one mile. By building higher-capacity lines that meet multiple needs over a longer time horizon, proactive planning results in a lower cost for ratepayers versus multiple incremental transmission additions.

[18] Southwest Power Pool ("SPP"), The Value of Transmission Report (January, 2016), available at https://www.spp.org/documents/35297/the%20value%20of%20transmission%20report.pdf.

Table 1: Economies of scale for higher-capacity transmission[19]

	Voltage (kV)	69	115	138	161	230	345	500	765
Single Circuit	$M/mile	$1.7	$1.9	$2.0	$2.1	$2.2	$3.5	$4.4	$5.5
	MW or MVA	140	329	394	460	657	1792	2598	6625
	$/MW-mile	**$12,143**	**$5,775**	**$5,076**	**$4,565**	**$3,349**	**$1,953**	**$1,694**	**$830**
Double Circuit	$M/mile	2.5	2.8	2.9	3	3.6	5.8	NA	NA
	MW or MVA	280	658	788	920	1314	3584	NA	NA
	$/MW-mile	**$8,929**	**$4,255**	**$3,680**	**$3,261**	**$2,740**	**$1,618**	**NA**	**NA**

Q. How did MISO determine the future generation mix when designing Tranche 1?

A. MISO's Tranche 1 transmission expansion was co-optimized with generation additions and retirements modeled in what MISO refers to as Future 1.[20] Future 1 was developed using economic generator capacity expansion modeling and fine-tuned with production cost modeling.

Q. Is the change in the generation mix in Future 1 conservative?

A. Yes. MISO explains the LRTP Tranche 1 projects as follows:

> This least-regrets portfolio meets the needs of the first of MISO's three future planning scenarios, Future 1, which incorporates known and projected generation and load presented by member plans. This portfolio is

[19] Calculations based on transmission cost and capacity estimates from MISO, *Transmission Cost Estimation Guide for MTEP24* (May 2024), available at https://cdn.misoenergy.org/MISO%20Transmission%20Cost%20Estimation%20Guide%20for%20MTEP24337433.pdf. (Table 1 was prepared using the reported Power rating (MVA) capacity data in Table 3.1-5 on page 43 and the middle range of estimated costs reported in Tables 4.1-1 and 4.1-2 on pages 47–49. The Power rating (MVA) capacity data for Double Circuit lines are twice the capacity for the Single Circuit.)
[20] Marshall U-21472 Direct, p. 32.

> "least regrets" because MISO is planning for an uncertain future and has chosen to plan towards the needs that represent a current view of member plans. Those portfolio plans continue to accelerate and expand, making Future 1 the conservative, expected case and presenting reliability implications that the Tranche 1 portfolio addresses. That's why Tranche 1 is a "yes-and" set of transmission that the Tranche 2 study will build off of to continue to meet the increasing renewable penetration levels and electrification growth that the MISO system is expected to see in the future.[21]

As METC similarly explains, "Future 1 serves as a low bookend to identify a least regrets transmission plan."[22] For example, as documented in Table 2 below, Future 1 projects 31 GW of total wind in MISO in 2039, while Futures 2 and 3 project much higher 2039 wind installed capacities, at 74 and 136 GW, respectively.[23]

Early in the LRTP process, MISO also released an indicative transmission map.[24] While the transmission plan changed significantly from that early indicative map to the final version, the map does illustrate that the transmission expansion for Future 1 provides a foundation for the much greater transmission need under Futures 2 and 3. This confirms that the Tranche 1 projects will be fully utilized as the transition to clean resources accelerates, and are essential for supporting subsequent LRTP Tranches.

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[21] MTEP21 LRTP Addendum, p. 6.

[22] Marshall U-21471 Direct, pp. 32–33.

[23] MISO Futures Report, pp. 4–6 (April, 2021 (Updated December, 2021)) ("MISO Futures Report), available at https://cdn.misoenergy.org/MISO%20Futures%20Report538224.pdf.

[24] Discussion of the MISO Indicative Roadmap Projects, presented at the April 30, 2021 LRTP Workshop, available at: https://cdn.misoenergy.org/20210430%20LRTP%20Workshop%20Item%2004%20MISO%20Indicative%20Roadmap545550.pdf, slide 4.

Q. Are there other reasons why Future 1 is conservative?

A. Yes. Since Future 1 was published in April 2021,[25] demand for renewable energy resources and the need for transmission in the MISO region and Michigan in particular have dramatically increased due to all of the following:

- An uptick in electricity demand primarily due to growth in data centers and new domestic manufacturing;[26]
- The extension and expansion of renewable tax incentives in the Inflation Reduction Act in August 2022;
- New state policies that increase renewable energy demand and supply, including Michigan's passage of Public Acts 235 and 233 in November 2023.

In 2023, MISO updated its Futures to account for those developments, adding the letter "A" to Futures 1, 2, and 3 to reflect the new series of Futures. As shown in Table 1 below, the renewable deployment assumptions in MISO's more recent Future 1A is much larger than in Future 1 (which was used as the basis for LRTP Tranche 1), and renewable levels are even higher in Future 2A that forms the basis for LRTP Tranche 2.1. As a result, MISO's estimate of the need for and value of LRTP Phase 1 transmission is likely significantly understated.

[25] MISO Futures Report.

[26] For example, see J. Wilson in NERC, *Large Loads Task Force Kickoff Meeting* (October, 2024), available at https://www.nerc.com/comm/RSTC/LLTF/LLTF_Kickoff_Presentations.pdf at 75, showing a 6.1 GW increase in MISO's load forecasts between 2022 and 2024.

Table 2: Higher wind and solar capacity in MISO's updated Futures

MISO Future	Wind GW	Solar GW	Total GW
Future 1 2039 (Tranche 1 basis)[27]	31	37	68
Future 1A 2042[28] (update)	82	84	166
Future 2A 2042[29] (Tranche 2.1 basis)	162	112	274

As noted above, projections for load growth have continued to increase even after MISO updated the Futures in November 2023, increasing the need for transmission both to accommodate that load and deliver the new generation needed to serve it. Much of the expected load growth comes from data centers and industrial facilities that operate around the clock and have high load factors, the quantity of Megawatt-hours ("MWh") of energy consumed per MW of peak demand. As a result, these facilities increase the need for transmission to deliver abundant low-cost energy like that provided by wind and solar resources.

Q. How does Tranche 1 prepare Michigan and MISO for a higher renewable future?

A. Tranche 1 also provides a foundation for LRTP Tranche 2.1 and other future transmission expansion. For example, the Nelson Road and Oneida substations will each be interconnected to other substations by new 345 kV lines in Tranche 2.1, so the Nelson Road

[27] MISO Futures Report (April 2021, updated December 2021), available at https://cdn.misoenergy.org/MISO%20Futures%20Report538224.pdf, p. 4.
[28] MISO Futures Report, Series 1A (November 1, 2023), available at https://cdn.misoenergy.org/Series1A_Futures_Report630735.pdf, p. 59.
[29] *Ibid.*, p. 76.

– Oneida link built as part of Tranche 1 will be the linchpin of a network of new lines across much of lower Michigan.[30]

MISO also indicates that the transmission included in Tranche 2.1 is just a first step towards meeting Future 2A: "Key reliability and economic issues provided the foundation to develop Tranche 2.1 as a no-regrets and stand-alone first step towards the transmission required to enable Future 2A."[31] This makes the foundation provided by Tranche 1 even more important.

Q. How do the facts that Future 1 is conservative and that Tranche 1 lays the foundation for future transmission expansion affect the value of the Projects?

A. Because the need for and economic value of non-emitting generation is greater than MISO assumed in Future 1, the benefits of Tranche 1 and the Projects are greater than indicated by MISO's analysis. As explained in more detail in the next section, many of these benefits accrue because the Projects provide Michigan significantly greater access to high-quality renewable energy resources in other parts of MISO to meet long-term demand for low-cost electricity, capacity, renewable energy credits, and pollution reduction.

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[30] https://cdn.misoenergy.org/20240924%20LRTP%20Workshop%20Item%2002%20Tranche%202.1%20Final%20Portfolio%20Overview649676.pdf, p. 2.

[31] *Ibid.*, p. 8.

III. THE PROJECTS ARE NEEDED TO LOWER ELECTRICITY COSTS FOR MICHIGAN RATEPAYERS.

Q. How do the Projects reduce electricity costs for Michigan ratepayers?

A. As modeling by MISO demonstrates, the Projects allow more low-cost generation, and particularly renewable generation, to be delivered to Michigan ratepayers. MISO's cost-benefit analysis for Tranche 1 finds that MISO Zone 7, which covers almost all of Michigan's lower peninsula, will realize between $1 billion (over 20 years at a 6.9% discount rate) and $3 billion (over 40 years at a 3% discount rate) in net present value congestion and fuel cost savings.[32] As explained above, these savings will be even larger with the much higher levels of renewable energy MISO now expects in its updated Futures. Tranche 1 provides these benefits by alleviating transmission congestion. Transmission congestion occurs when higher-cost generation near a load center must be used because there is insufficient transmission to deliver lower-cost resources that are available elsewhere, and it imposes major costs on Michigan ratepayers today. MISO Independent Market Monitor ("IMM") data indicate that congestion increased consumer costs in the Midwest subregion by $2.4 billion annually on average over the last three years, with nearly half of that cost attributable to congestion inhibiting the delivery of wind generation.[33]

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[32] MISO, LRTP Tranche 1 Detailed Business Case (June, 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 57. Benefits are in year 2022 dollars, and would be even higher if current or future year dollars were used.

[33] Potomac Economics, 2023 State of the Market Report for the MISO Electricity Markets (June, 2024), available at https://www.potomaceconomics.com/wp-content/uploads/2024/06/2023-MISO-SOM_Report_Body-Final.pdf, p. 47.

Q. How do Michigan ratepayers benefit from the greater deliverability and delivery of low-cost renewable energy enabled by the Projects?

A. Tranche 1 will enable greater delivery of low-cost wind and solar resources to Michigan. The wind resources in western MISO states like Iowa, Minnesota, North Dakota, and South Dakota that can be delivered to Michigan by Tranche 1 and the Projects are some of the best in the United States, as indicated by the average wind speeds shown in Exhibit MEIC-9 (MG-3). Wind projects built in wind resource areas with high average wind speeds have high capacity factors, which is the percentage indicating the amount of electricity produced by a power plant in a typical year divided by the amount of electricity that the power plant could provide if it ran at 100% of its nameplate capacity for all 8,760 hours in that year. Lower-cost and more productive solar resources are also available in more southern and western parts of MISO.

Higher capacity factors translate directly to lower electricity costs for renewable projects on a per-unit basis, as a larger amount of electricity production from a renewable project allows the fixed costs of building and operating the project to be spread over a larger quantity of MWh. Moreover, wind and solar projects are eligible for federal Production Tax Credits ("PTCs") for each MWh they produce (though some solar projects elect to take an up-front Investment Tax Credit instead). As a result, renewable resources that operate at a higher capacity factor are able to offer lower-priced power purchase agreements ("PPAs") and RECs relative to renewable resources with lower capacity factors.

Building transmission to expand access to these high-quality renewable resources increases competition and reduces electricity costs for Michigan ratepayers through three primary mechanisms: (1) lowering the price of energy and capacity in the MISO market, (2) allowing Michigan utilities and other customers to sign lower-priced and higher-value PPAs, and (3) reducing the price of RECs by accessing more productive and lower-cost renewable resources and reducing the impact of curtailment.

Q. Can you quantify the quality of wind resources in western MISO accessed by Tranche 1?

A. As indicated in the wind resource map in Exhibit MEIC-9 (MG-3), western MISO has high-quality wind resources with high average wind speeds. Importantly, the energy available for wind energy production is proportional to the cube of wind speed, so the difference between the orange and purple areas in the wind speed map in Exhibit MEIC-8 (MG-2) is quite significant. For example, the 8.5-9 meter/second area of the map, which is the dark purple area available in parts of the Dakotas and southwestern Minnesota, has about 76% more energy available in the wind than the 7.0-7.5 meter/second reddish-orange area that represents the best wind resource available in Michigan.

Q. How does the quality of the wind resource translate to the capacity factor of wind plants that would be developed in the Resource Area?

A. Lawrence Berkeley National Laboratory's ("LBNL") annual *Land-Based Wind Market Report* includes data showing average capacity factors by state in the year 2023 for wind projects installed during the period 2017-2022. In North Dakota these wind projects averaged a 42.6% capacity factor, 42.2% in Minnesota, 41.2% in South Dakota, and 40.4% in Iowa, compared to 25.9% for Michigan wind projects.[34] Tranche 1 and the Projects will greatly increase Michigan's access to wind resources in those four western MISO states, as well as more productive wind resources within Michigan. Western MISO wind projects would have seen even higher capacity factors in 2023 if wind curtailment, which is discussed in more detail later in this section, had not reduced their output. As explained below, the transmission expansion provided by Tranche 1 will alleviate that curtailment.

Q. Are there other reasons why renewable resources in western MISO may offer a lower cost than those in Michigan?

A. Yes. Wind projects in Michigan are more likely to incur the additional expense of using taller towers to access stronger wind resources higher above the ground.[35] In western MISO, many wind projects forgo that additional expense because the wind resources at lower heights are adequate. Land also has a significantly lower average cost in North and South Dakota than in Michigan, which reduces the cost of solar and wind installations in those states.[36] Average construction labor costs are also lower in those states.[37]

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[34] Lawrence Berkeley National Lab, *Land-Based Wind Market Report Data File (*August, 2024), available at https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition_Data_File.xlsx, ("LBNL Data File") "Capacity Factor by State" tab.

[35] Lawrence Berkeley National Lab, *Land-Based Wind Market Report* (August, 2024), available at https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition.pdf, at 30

[36] U.S. Dept. Ag., National Agricultural Statistics Service, Land Values 2022 Summary, August 2022, available at https://www.nass.usda.gov/Publications/Todays_Reports/reports/land0822.pdf, p. 5.

[37] U.S. Bureau of Labor Statistics, Occupational Employment and Wages, May, 2023: 47-2061 Construction Laborers, available at https://www.bls.gov/oes/2023/may/oes472061.htm.

The Projects will also enable greater development of low-cost and highly productive renewable resources within Michigan, as discussed in more detail in the next section. Development of these renewable resource areas is constrained today by a lack of transmission capacity, which the Projects will alleviate. The next section of my testimony further explains that the renewable project siting provisions of Public Act 233 also expand the ability to develop high-quality renewable resources in Michigan.

Q. How does the PTC affect the value of wind in western MISO versus Michigan?

A. The federal PTC currently provides a $30 tax credit for each MWh produced by a wind facility.[38] Based on the average capacity factors for wind projects installed in 2017-2022 discussed above, a typical 100 MW wind project in North Dakota would generate $4.385 million more in PTCs annually than a 100 MW wind project in Michigan. PTCs are awarded for the first ten years of renewable project operations, they provide revenue that is not taxed, and the tax credit value typically increases every year because it is indexed for inflation. As a result, PTCs provide a valuable revenue stream to renewable projects, offsetting a significant share of their cost and allowing them to offer lower-priced PPAs and RECs.

Q. How do renewable PPA prices in western MISO compare to those in Michigan?

A. While I am not aware of a public state-by-state breakdown of PPA prices within MISO, the data in Exhibit MEIC-10 (MG-4) show that both wind and solar PPAs typically have

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[38] 89 FR 56924; Ernst & Young, LLP, Tax News Update; U.S. Edition, "IRS issues 2024 inflation adjustments for renewable energy production tax credits," (July 11, 2024), available at https://taxnews.ey.com/news/2024-1358-irs-issues-2024-inflation-adjustments-for-renewable-energy-production-tax-credits.

significantly lower prices in MISO than in PJM. Based on the quality of wind resources, it is likely that PJM wind PPA prices are more reflective of wind PPA prices in Michigan, while average MISO wind PPA prices are more reflective of western MISO as that is where most MISO wind development occurs. That may be true for solar as well, based more on differences between Michigan and western MISO in the cost of land, labor, and other inputs.

Q. How do current transmission constraints limit the value of western MISO renewable resources to Michigan ratepayers?

A. Transmission constraints limit renewable development by increasing congestion, curtailment, interconnection costs and delays, and other factors. As explained below, transmission congestion reduces the value of a renewable resource for utilities and other customers. Renewable curtailment also reduces the project's value and revenue, including by forgoing PTC and REC revenue. Transmission constraints also increase the interconnection costs, including network upgrade costs that are assigned to interconnecting generators.

Q. What role does transmission expansion play in enabling the development of wind resources?

A. Transmission is essential, both for allowing new wind resources to be developed and enabling wind resources to avoid congestion and curtailment that reduces their value. Increasing transmission capacity is the only viable solution for alleviating those constraints. MISO has released a map showing that virtually all of the high-quality wind resource areas in western MISO lack sufficient transmission to add even modest amounts of wind capacity.[39] The map indicates that there is essentially zero available transmission capacity to add new wind generation in western MISO, and that in many locations more than 5,000 MW of additional transmission capacity would be required to alleviate the congestion. Tranche 1 will significantly alleviate those constraints, and lay a foundation for Tranche 2.1 to further eliminate congestion that limits the ability to develop renewable resources in western MISO.

Tranche 1 and the Projects also provide access to high-quality renewable resources closer to Michigan. For example, the wind resource map in Exhibit MEIC-9 (MG-3) confirms that there are highly productive wind resources in the parts of northern Indiana and Illinois crossed by the Tranche 1 lines that connect to the Projects in Michigan. Transmission congestion and curtailment is currently reducing the value of developing wind resources there, as indicated by the map shown in Exhibit MEIC-11 (MG-5). Tranche 1 will also increase access to more productive and lower-cost solar resources from these states to Michigan's south.

Q. Can adding energy storage eliminate the need for transmission expansion?

A. No. Only transmission can move power from areas with high-quality renewable resources to electricity demand centers. Storage can complement transmission by reducing renewable

[39] MISO GI Contour Map Created using August 2017 Definitive Planning Phase Model for Central, MI, ATC, and South Regions. August 2016 model for West region (July 11, 2018), available at https://cdn.misoenergy.org/GI-Contour_Map108143.pdf.

curtailment and congestion by shifting output to time periods when transmission capacity is not fully utilized, but transmission is still needed to move energy to customers.

Q. Can you provide more detail on how transmission congestion affects consumers and the economics of renewable development?

A. The MISO wholesale energy market runs an economic optimization that calculates Locational Marginal Prices ("LMPs") for each geographical pricing node for each pricing interval (*i.e.*, every five minutes), which reflects the value provided by the marginal MWh at each point on the grid after accounting for transmission constraints. When transmission congestion prevents the delivery of renewable generation, this results in lower LMPs on the renewable-plant side of the transmission constraint and higher LMPs on the load side of the constraint. While the higher LMP harms consumers on the load side of the constraint, the lower LMP on the renewable plant side reduces the value of the renewable generation. This reduction in generation value due to transmission congestion is called basis risk.

Importantly, the local LMP clearing price applies to all MWh generated in those areas. As a result, the cost of this congestion (in the form of depressed LMPs) for renewable generators and their consumers can be much higher than just the cost of any renewable generation lost to curtailment, especially when congestion is a common occurrence.

In addition, basis risk and curtailment risk can greatly reduce the willingness of a utility to purchase the output of a renewable project, as this risk is uncertain over the life of a renewable project as it depends on unpredictable factors like market entry by competing generators. Transmission congestion can also force renewable energy development to occur in lower-quality resource areas with lower capacity factors. Finally, transmission congestion causes interconnecting renewable generators to incur greater costs for connecting to the grid, through higher network upgrade costs and the need to build longer interconnection tie lines.

Q. What data document how these current transmission challenges suppress the value of western MISO renewable resources?

A. LBNL's wind report reports that MISO has averaged 4.6% wind curtailment over the last five years.[40] MISO's modeling for LRTP Tranche 2.1 indicates that, without transmission expansion, a large share of future curtailment is expected to occur in western MISO.[41] The LBNL map shown in MEIC-11 (MG-5) illustrates how congestion and curtailment have dramatically reduced the value of wind energy in western MISO, with many wind generators in western Iowa and southwestern Minnesota realizing a total value of less than \$10/MWh.[42] As noted above, this primarily occurs because transmission congestion depresses LMPs in those wind-producing areas. Wind plants are able to offer into wholesale electricity markets at around \$0/MWh because they have no fuel cost and negligible variable operations and maintenance costs, and wind projects generating PTCs or RECs can offer in at negative prices. As a result, when wind plant output is high, LMPs are frequently very low in wind producing areas affected by transmission congestion.

[40] LBNL Data File, "Curtailment and Penetration" tab.
[41]MISO, *LRTP Tranche 2 Reliability & Economic Study Update*, (March 15, 2024), available at https://cdn.misoenergy.org/20240315%20LRTP%20Workshop%20Item%2003%20Reliability%20%20Economic%20Review632194.pdf, p. 16.
[42] LBNL Data File, "2023 Market Value by Location" tab.

LBNL's chart in MEIC-12 (MG-6) shows that congestion reduces the value of wind by 30% or $9.35/MWh on average across the MISO footprint.[43] Curtailment reduces it by an additional 1%, or $0.35/MWh. As a result, the realized value of wind generation averages $17/MWh across MISO. That impact is more pronounced in the western part of MISO, where transmission congestion alone reduces the value of most wind by $10-20/MWh, and sometimes more than $20/MWh.[44] These data also confirm that congestion has a far larger impact on wind's value than curtailment.

Q. What is the trend for interconnection network upgrade costs in MISO?

A. According to recent analysis from LBNL, interconnection costs in MISO have been "rapidly growing"[45] as demand for interconnecting renewable resources has outpaced transmission expansion. Active projects in the MISO queue now face average upgrade costs of $156/kW,[46] which is a significant share of total project capital costs for a typical wind or solar project. LBNL finds that interconnection costs are higher for wind generators, particularly in high wind resource areas like western MISO. These costs are typically recovered by the generator through a higher PPA price, directly passing these costs on to consumers.

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[43] *Ibid.*, "Value Relative to Flat Profile" tab.
[44] *Ibid.* See specifically the chart to the far right that breaks out the change in energy value due to output profile, transmission congestion, and curtailment.
[45] LBNL, "Data from MISO Show Rapidly Growing Interconnection Costs," (October 7, 2022), available at https://emp.lbl.gov/news/data-miso-show-rapidly-growing.
[46] *Ibid.*

Q. Do wind and solar projects in the MISO interconnection queue face long backlogs?

A. Yes. As LBNL has documented, many generators facing large upgrade costs withdraw from the interconnection queue.[47] A withdrawal typically triggers a restudy for all projects after that generator in the queue, which can change the interconnection costs assigned to those generators. This uncertainty results in significant shuffling of the interconnection queue, in many cases triggering additional withdrawals. Interconnection cost uncertainties also drive developers to submit more speculative interconnection applications, further exacerbating the uncertainty and shuffling.[48] MISO's interconnection queue currently contains 330,876 MW of proposed generators, including 59,420 MW of battery storage, 204,171 MW of solar and solar/battery projects, and 44,929 MW of wind and wind hybrid projects, for a total of nearly 310,000 MW of renewable and storage resources.[49] Proactive transmission expansion like LRTP is a more efficient method for planning and paying for large-scale transmission upgrades, instead of assigning interconnecting generators the cost of network upgrades that benefit many users of the grid, and will help alleviate the queue backlog by reducing the need for generators to pay for large network upgrades.

Q. Is there reason to believe LRTP Tranche 1 enables more new renewables than are assumed in MISO's benefit calculations?

A. Yes. To assess the net benefits of LRTP Tranche 1, MISO compared a reference case without Tranche 1 against a change case that includes 20,100 MW of generating resources

[47] *Ibid.*
[48] *Ibid.*
[49] MISO, Generator Interconnection Interactive Queue, available at https://www.misoenergy.org/planning/resource-utilization/GI_Queue/gi-interactive-queue/#, (accessed on November 4, 2024).

that are enabled by Tranche 1. MISO included 8.3 GW of Integrated Resource Plan ("IRP") renewable capacity in both the reference and change case, assuming that it would be built with or without Tranche 1 because it had been included in a utility IRP. However, much of this renewable capacity likely could not be built without additional transmission. IRPs provide economic modeling for planning purposes, but in most states, utilities are not required to procure the full quantity of resources indicated by the modeling results. Inclusion in an IRP can be cited by a utility as justification for subsequently procuring a resource, but it does not typically convey an obligation to procure a resource. As a result, a utility could cite challenges related to inadequate transmission, including interconnection costs and delays, congestion and curtailment risk, and other factors in deciding not to procure the quantity of renewable resources called for in its IRP. Therefore, LRTP Tranche 1 plays an important role in ensuring that the full quantity of 8.3 GW of IRP renewable capacity is actually deployed. Because MISO's LRTP analysis assumed those 8.3 GW of renewables would be built with or without LRTP, MISO's analysis understates the benefits of LRTP, including reducing congestion and curtailment that would otherwise limit renewable deployment.

MISO found that only 292 MW, or 1.5% of the region's 20,100 MW of potential renewable capacity is able to proceed without Tranche 1. That more than 98.5% of regional renewables depend on LRTP Tranche 1 also suggests a large share of renewables planned in IRPs also cannot move forward without these transmission projects. Because these renewables were found to be economic in utility IRPs, LRTP will be providing additional benefits by enabling these renewables.

Q. Are you aware of any reports that analyze or describe renewable energy's impact on electricity prices in MISO?

A. Yes. A 2012 report by Synapse Energy Economics found that adding 20 to 40 GW of wind energy and the accompanying transmission in the MISO region would save a typical household between $63 and $200 per year, as shown in Exhibit MEIC 13 (MG-7).[50] As the report explains, "Since wind energy 'fuel' is free, once built, wind power plants displace fossil-fueled generation and lower the price of marginal supply—thus lowering the energy market clearing price."[51] Adding renewable resources directly reduces wholesale electricity market prices because these fuel-free resources bid in at zero or negative prices, as noted above.

Q. Does MISO's modeling fully capture how transmission congestion impedes renewable development?

A. No. To calculate congestion and fuel cost savings from Tranche 1, MISO used the PROMOD production cost model. Quantifying congestion and fuel cost savings captures much of the impact of curtailment, but only captures a small part of the impact of congestion. Modeling production costs does not capture how transmission congestion suppresses MISO market prices and generator revenues. MISO's production cost analysis is thus understating how congestion deters renewable development by suppressing its value

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[50] Synapse Energy Economics, Inc., *The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region*, p. 3 (May 22, 2012), Available at http://cleanenergytransmission.org/wp-content/uploads/2012/05/Full-Report-The-Potential-Rate-Effects-of-Wind-Energy-and-Transmission-in-the-Midwest-ISO-Region.pdf.
[51] *Ibid.*

because, as noted above and per the data presented in MEIC-13 (MG-7), the vast majority of wind value reduction in western MISO is from congestion, not curtailment.

Q. Are there other reasons why production cost modeling provides a conservative estimate of transmission's benefits?

A. Yes. Production cost modeling does not capture transmission's higher value when other transmission lines are out of service due to forced or planned outages, as production cost modeling assumes all transmission lines are in service and does not typically model extreme weather events. For example, MISO caveats that its production cost savings calculation

> represents value under normal system intact conditions. In practice, numerous outages occur throughout the year which introduce additional congestion which is not reflected in the calculation of the economic benefits.[52]

A report I co-authored[53] catalogued the following conservative assumptions built in to typical production cost modeling:

- No change in transmission-related energy losses as a result of adding the proposed transmission project;
- No planned or unplanned transmission outages;
- No extreme contingencies, such as multiple or sustained generation and transmission outages;

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[52] MTEP21 LRTP Addendum, p. 86.
[53] The Brattle Group, Inc. and Grid Strategies LLC, *Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs* (2021), available at https://www.brattle.com/wp-content/uploads/2021/10/2021-10-12-Brattle-GridStrategies-Transmission-Planning-Report_v2.pdf, pp. 36–37.

- Only weather-normalized peak loads and monthly energy (*i.e.*, no typical heat waves, typical cold snaps, or more extreme weather conditions);
- Perfect foresight of all real-time market conditions (*i.e.*, no day-ahead and intra-day forecasting uncertainty of load and renewable generation);
- Incomplete cycling costs of conventional generation;
- Over-simplified modeling of ancillary service-related costs (*e.g.*, assuming all operating reserves are deliverable);
- Incomplete simulation of reliability must-run conditions.

MISO's production cost modeling is based on forecasted peak loads and then typical hourly energy shapes, which excludes the impact of extreme weather events.[54] The exclusion of extreme weather events from production cost modeling greatly understates the value of transmission. For example, MISO's IMM has calculated that Winter Storm Elliott "contributed to more than $350 million in congestion across just two days."[55] Separate analysis by LBNL has shown that around half of transmission's value for reducing energy costs accrues during 5-10% of hours, typically during severe weather events.[56] MISO's production cost analysis does not capture these benefits of transmission.

[54] Ameren Exhibit 4.2 in Illinois Commerce Commission docket 2024-0088, (filed February 5, 2024), available at https://www.icc.illinois.gov/docket/P2024-0088/documents/346850/files/605634.pdf, p. 6, n. 12 ("These loads reflect forecasts for annual peak load and annual energy shaped over every hour in each study year.").
[55]Potomac Economics, *2023 State of the Market Report for the MISO Electricity Markets* (June, 2024), available at https://www.potomaceconomics.com/wp-content/uploads/2024/06/2023-MISO-SOM_Report_Body-Final.pdf, p. 48.
[56] LBNL, "The Latest Market Data Show that the Potential Savings of New Electric Transmission was Higher Last Year than at Any Point in the Last Decade," (Feb. 7, 2023), available at https://emp.lbl.gov/news/latest-market-data-show-potential.

Q. Are there other reasons why MISO's calculated production cost savings for Tranche 1 are conservative?

A. Yes. MISO's production cost modeling for transmission planning does not account for the value of renewable PTCs, with MISO noting "the associated tax revenue received by the applicable resources are not reflected in the [Adjusted Production Cost] savings value shown for the transmission portfolio."[57] The value of PTCs directly reduces the cost of generating energy, and when transmission expansion allows more renewable generation by enabling more renewable development and reducing curtailment, the value of additional PTCs flows to ratepayers. MISO's calculated production cost benefits are thus highly conservative, as Tranche 1 primarily increases access to highly productive renewable resources that generate a large quantity of PTCs.

Finally, MISO's production cost modeling does not account for the fact that transmission expansion that reduces energy market prices also reduces the price of operating reserves and other ancillary services.

Q. Can you please summarize the main conclusion of this section?

A. The Projects reduce electricity prices in Michigan, including by facilitating access to western MISO renewable resources that offer a lower cost than resources available in Michigan. The Projects are essential for interconnecting these resources and delivering

[57] MISO LRTP Tranche 2 Business Case Metrics Methodology Whitepaper (October 1, 2024), available at https://cdn.misoenergy.org/LRTP%20Tranche%202%20Business%20Case%20Metrics%20Methodology%20Whitepaper633738.pdf, p. 17.

their output to Michigan ratepayers without their value to the overall system and to Michigan ratepayers in particular being degraded by transmission congestion.

IV. THE PROJECTS ARE NEEDED TO DELIVER RENEWABLE RESOURCES TO COST-EFFECTIVELY MEET THE MICHIGAN RPS.

Q. What are the requirements of the Michigan Renewable Portfolio Standard?

A. Michigan has a renewable portfolio standard ("RPS") that requires utilities to obtain a certain share of their generation from renewable resources. Michigan enacted Public Act 235 in November 2023, expanding the renewable energy requirements substantially and adding a clean energy standard. Renewable energy requirements are now 50% by 2030 and 60% by 2035.[58] Clean energy requirements are 80% by 2035 and 100% by 2040.[59]

Q. What quantity of renewable resources are needed to meet the demand of Michigan utilities?

A. Michigan's RPS and utility IRPs are driving significant demand for new renewable resources.[60] LBNL's calculation of state RPS demand shows Act 235's RPS driving 58 TWh of renewable demand and the clean energy standard driving an additional 50 TWh of clean energy demand by 2040.[61] For reference, producing 108 TWh of renewable energy per year would require over 41,000 MW of renewable capacity operating at an average capacity factor of 30%.

[58] MCL 460.1028(1).
[59] MCL 460.1051(1).
[60] Marshall U-21472 Direct, pp. 22–25.
[61] LBNL, RPS and CES Demand Projections (August 2024), available at https://emp.lbl.gov/sites/default/files/2024-08/RPS%20and%20CES%20Demand%20Projections_August%202024.xlsx

The Michigan utility IRPs reviewed by Witness Marshall include 11,700 MW of wind and 17,385 MW of solar in their preferred plans. Many of those IRPs were completed before the increase in the Michigan RPS and recent increases in electricity demand projections, so their actual demand for renewables will likely be even higher.

Q. What constraints does Public Act 235 impose on out-of-state renewable resources used for RPS compliance?

A. For an out-of-state renewable resource to be eligible for RPS compliance, the utility must "include[] the capacity from the renewable energy system toward meeting its resource adequacy obligations to the applicable regional transmission organization."[62] Under MISO capacity market rules, resources outside of a zone can typically only count towards a utility's resource adequacy obligation if they can be imported under the Capacity Import Limit ("CIL") that MISO calculates for each zone. As discussed in the next section of my testimony, the Projects and Tranche 1 significantly increase the Capacity Import Limit into Zone 7, and thus the quantity of renewable resources in other states that are eligible for RPS compliance.

[62] MCL 460.1029(1)(b).

Q. Do the Projects increase access to renewable resources in Michigan?

A. Yes. MISO's modeling indicates that a significant quantity of the resources enabled by Tranche 1 are located in Michigan.[63] METC confirms that MISO found LRTP Tranche 1 enables 1.4 GW of new generation within [Local Resource Zone ("LRZ")] 7."[64]

The MISO interconnection queue confirms there is market interest in developing new renewable and storage resources in the areas accessed by the Projects. The MISO queue contains a 300 MW wind project[65] and two battery storage projects that have proposed to interconnect at the Nelson Road substation. Another 925 MW of solar projects have proposed to interconnect in the area that will be traversed by the Nelson Road-Oneida transmission line. There are more than 650 MW of operating wind projects within 25 miles of the northern terminus of the line at the Nelson Road substation, including the 150 MW Gratiot Farms wind project, 168.6 MW Polaris project, 132 MW Beebe project, and 200 MW Heartland Farms project,[66] confirming the area has economically viable wind resources that are suitable for additional development.

However, MISO's Points of Interconnection tool shows that transmission constraints currently limit the ability to add new generation in that area.[67] The tool indicates that a hypothetical 200 MW interconnection request at the Nelson Road substation would overload 11 existing transmission facilities, eight of which have 0 MW of spare capacity

[63] MISO, *LRTP Tranche 1 Detailed Business Case* (June 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 19.
[64] Marshall U-21472 Direct, p. 37.
[65] MISO queue number J3640
[66] U.S. EIA, *U.S. Energy Atlas: Electricity Energy Infrastructure and Resources*, available at https://atlas.eia.gov/apps/eiA.:electricity/explore.
[67] MISO POI analysis tool, available at https://giqueue.misoenergy.org/PoiAnalysis/index.html.

available. As a result, these queue generators would likely face significant interconnection costs or not be able to interconnect at all if the Projects are not built.

Similarly, MISO's queue indicates 1,640 MW of solar projects, 200 MW of batteries, and 499 MW of solar-battery hybrids have proposed to interconnect in Branch and Calhoun counties, the Michigan counties crossed by the proposed Helix-Hiple transmission line.

Q. Are there other benefits from expanding development of renewable energy resources in Michigan?

A. Yes. Renewable development in Michigan creates jobs for residents, increases local tax revenue, and boosts economic activity in the state. Developing Michigan renewable resources in addition to renewable resources in other states also results in a more diverse portfolio of renewable resources across MISO. As discussed in the next section of my testimony, by accessing a more geographically diverse portfolio of renewable resources, transmission increases the value of renewable energy towards meeting peak demand and offsets variability in the output of local resources.

Q. What does MISO's queue indicate about the need to increase access to out-of-state renewable resources?

A. Currently only 2,137 MW of proposed wind projects in the MISO queue are located in Michigan,[68] less than the 11,700 MW of planned wind additions called for in Michigan

[68] MISO, Generator Interconnection Interactive Queue, available at https://www.misoenergy.org/planning/resource-utilization/GI_Queue/gi-interactive-queue/#, (accessed on November 4, 2024).

utility IRPs.[69] By allowing the development and interconnection of additional low-cost renewable resources in Michigan, the Projects should spur more projects to enter the MISO queue. Public Act 233's renewable siting provisions should also enable more in-state renewable resources to enter the queue. However, expanding access to out-of-state resources will still be essential for meeting the Michigan RPS and achieving the economically optimal resource mix identified in utility plans.

Q. How do the Projects affect the price of RECs and their cost to Michigan ratepayers?

A. The Projects are designed to interconnect and deliver low-cost renewable generation from within Michigan and from other states. As noted above, lower-cost renewable resources are able to cover their costs with lower PPA and REC prices, doubly benefiting Michigan ratepayers. More productive renewable resources also generate more RECs that can be used for RPS compliance. Finally, alleviating renewable curtailment not only improves the economics of renewable generation, but also increases REC production.

The additional renewable energy resources built because of the Projects will increase the supply of renewable energy and RECs that can be used for compliance with the Michigan RPS. Increasing the supply of RECs will make the market for RECs more competitive and reduce REC prices, providing a lower cost of compliance for Michigan ratepayers.

[69] Marshall U-21472 Direct, p. 23.

Q. Do any of Public Act 235's provisions besides the RPS increase the need for the Projects?

A. Yes. In addition to its renewable requirements, Public Act 235 requires 80% of electricity come from clean energy resources by 2035, and 100% by 2040.[70] As a result, emitting resources' generation, capacity, and other reliability services contributions must be replaced by non-emitting resources. Tranche 1's transmission upgrades play an essential role in ensuring that those resources can reliably retire and that replacement resources' output can be delivered to Michigan customers.

Public Act 235 also establishes a statewide energy storage target of 2,500 MW.[71] The Projects' transmission expansion will facilitate the interconnection of these storage resources.

V. THE PROJECTS INCREASE ELECTRIC RELIABILITY AND RESILIENCE IN MICHIGAN IN A LEAST-COST MANNER.

Q. How do the Projects improve reliability and resilience for Michigan ratepayers?

A. The Projects and Tranche 1 strengthen the transmission network in Michigan and across MISO, resolve overloads of existing lines and other reliability concerns that would emerge due to load growth and changes in the generation mix, improve the voltage profile,[72] and, as noted above, significantly increase Michigan's capacity import limit. As explained in detail in the MISO Transmission Expansion Plan ("MTEP") LRTP Addendum,[73] the

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[70] Michigan Public Service Commission, "2023 Energy Legislation," https://www.michigan.gov/mpsc/commission/workgroups/2023-energy-legislation; see also MCL 460.1051(1).

[71] *Ibid.*; see also MCL 460.1101.

[72] MTEP21 LRTP Addendum, pp. 41–43.

[73] *Ibid.*, p. 40 ("The Iowa to Michigan projects addresses 600 thermal violations associated with 77 unique monitored facilities (Figure 6-13).").

Tranche 1 East-Central Corridor Projects running from Iowa to Michigan "will mitigate 600 transmission thermal violations on 77 monitored facilities, including 28 in Michigan."[74] MISO calculates that Tranche 1 will provide Michigan ratepayers with $624 million in benefits by increasing the import capacity of Zone 7,[75] which covers the MISO portion of Michigan's lower peninsula, by 1,292 MW.[76] METC quantifies that LRZ 7 currently has a CIL that ranges from 4,400 MW to 4,893 MW depending on the season, while MISO's estimated limit under the prior annual capacity construct was 3,367 MW. Increasing that limit by nearly 1,300 MW significantly increases Michigan ratepayers' access to lower-cost capacity, energy, and renewable resources. METC writes that it "confirmed MISO's analysis to ensure that the LRTP1 Portfolio substantially increased the LRZ 7 CIL (e.g., increases for summer peak day: 39%; winter peak day: 59%)."[77]

MISO's cost-benefit analysis also quantifies that Tranche 1 provides $74 million in net present value savings for Zone 7 by avoiding incremental transmission upgrades or replacement that would have been needed in the future to maintain reliability.[78]

Q. Is there a history of high and volatile MISO capacity market prices in Michigan?

A. Yes. In the capacity auction for Planning Year 2020-2021, prices in Zone 7 reached $257.53/MW-day.[79] This price reached the cost of new entry ("CONE"), indicating a

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[74] Marshall U-21472 Direct, p. 39.

[75] MISO, *LRTP Tranche 1 Detailed Business Case* (June, 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 29.

[76] Marshall U-21472 Direct, p. 11.

[77] Marshall U-21472 Direct, p. 30.

[78] MISO, *LRTP Tranche 1 Detailed Business Case* (June, 2022), available at https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, pp. 57–58.

[79] See MISO Planning Resource Auction Results for Planning Year 2024/25 (Corrections reposted on April 26, 2024), available at https://cdn.misoenergy.org/2024%20PRA%20Results%20Posting%2020240425632665.pdf, p. 25.

shortfall of capacity that caused the price of capacity to increase to the maximum set by MISO. METC notes that "Reaching CONE has a significant economic impact. It is estimated the cost to LRZ 7 during the 2020/2021 [Planning Reserve Auction] PRA, due to insufficient access to resources resulting in CONE pricing, was $911 million."[80] Future price spikes could be even more harmful, as CONE for Zone 7 has now increased to $359/MW-day.[81] Moreover, under MISO's ongoing market design changes annual capacity prices could reach four times CONE if the market is short in all four seasons.[82]

Expanding transmission ties to the rest of MISO to protect against high capacity market prices is particularly important for Michigan, given that the state is geographically isolated as a peninsula. The ability to access additional supply is also valuable for ensuring the capacity market is competitive.

Q. Is MISO's resource adequacy analysis conservative?

A. Yes. The resource adequacy analysis did not fully account for the benefit of the Projects expanding access to PJM, the Southwest Power Pool ("SPP"), and other external markets, though MISO's loss of load risk analysis did include two regional scenarios in which severe weather affects a large part of MISO. In the severe weather scenarios, MISO assumed that it was importing from PJM and exporting 7,500 MW to SPP in Scenario 1, and importing

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[80] Marshall U-21472 Direct, p. 27.

[81] MISO Resource Adequacy Subcommittee (RASC) "MISO Cost of New Entry (CONE) and Net CONE Calculation for Planning Year 2025/2026 (September 23, 2024), available at https://cdn.misoenergy.org/20240923%20RASC%20Item%2003%20CONE%20and%20Net%20CONE%20Update649247.pdf, p. 11.

[82] MISO RASC "Reliability-Based Demand Curve(s)" (August 22-23, 2023), available at https://cdn.misoenergy.org/20230822-23%20RASC%20Item%2006a%20Reliability%20Based%20Demand%20Curves%20Presentation%20(RASC-2019-8)629946.pdf, p. 28.

from SPP in Scenario 2.[83] This loss of load analysis showed $246-$1,618 million in net present value benefits for Zone 7, with the range based on estimates for the value of lost load of $3,500–$23,000/MWh.

Expanding ties to these markets can save also consumers billions by reducing the overall need for generating capacity in MISO. I have previously analyzed net load (load minus renewable output) and conventional generator correlated outage patterns between MISO and its neighbors, and found large benefits due to diversity as to when the RTOs experience peak loads.[84]

Expanded ties with the PJM grid, and particularly its 765 kV network, through LRTP Tranche 1 and 2 are extremely valuable. I have previously quantified the benefits of expanding ties between MISO and PJM.[85] The U.S. Department of Energy's congestion study also found the MISO-PJM seam had the largest need in the country for expanded transfer capacity,[86] and modeling in its just-released National Transmission Planning Study confirms that MISO's internal transmission constraints and interfaces with SPP and PJM have the largest need for expansion in both the Alternating Current and Direct Current optimized solutions. As shown in MEIC-14, MG-8, the study's Alternating Current

[83] MISO, LRTP Tranche 1 Detailed Business Case, (June 2022), https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 35.
[84] Grid Strategies, LLC, "Quantifying a Minimum Interregional Transfer Capability Requirement," (May, 2023), available at https://gridstrategiesllc.com/wp-content/uploads/2023/05/GS_Interregional-Transfer-Requirement-Analysis-final54.pdf, p. 4.
[85] Grid Strategies, LLC, "Billions in Benefits: A path for expanding transmission between MISO and PJM," (November, 2023), available at https://acore.org/wp-content/uploads/2023/11/ACORE-Billions-in-Benefits-A-Path-for-Expanding-Transmission-Between-MISO-and-PJM.pdf
[86] U.S. Dept. of Energy, "National Transmission Needs Study" (October, 2023), available at https://www.energy.gov/sites/default/files/2023-12/National%20Transmission%20Needs%20Study%20-%20Final_2023.12.1.pdf, p. x.

scenario expanded transmission ties from MISO Central and MISO North to PJM by 13 GW and to SPP by 11 GW, and the multi-terminal Direct Current scenario expanded those ties with SPP by 30 GW.[87] The multi-terminal scenario also built a link of 22 GW between MISO North and the PJM footprint in northern Illinois and Indiana and southwestern Michigan, 17 GW from that part of PJM's footprint into MISO Central, and then 25 GW from MISO Central into the rest of PJM, in addition to 4 GW between MISO North and MISO Central. By confirming the need to resolve transmission constraints within MISO and between MISO and PJM, multiple studies have validated a need for transmission expansion that closely resembles what is proposed in the Projects and LRTP Tranche 1 and 2.1.

LRTP Tranche 1 likely also enables increased transfer capacity with SPP and Associated Electric Cooperative Incorporated ("AECI") by expanding transmission capacity into Missouri and South Dakota. This can provide MISO with greater access to SPP resources, including its abundant wind resources, when severe weather is affecting MISO.

Q. Do the Projects provide other reliability benefits that were not quantified by MISO?

A. Yes. MISO notes one benefit that was not quantified in its analysis:

> as the grid moves to a higher penetration of renewables and seasonal load curve flattens, outage scheduling becomes more challenging. Additional transmission improves system utilization and allows more opportunity for scheduling transmission outages with less risk of causing operational issues or rescheduling of outages.[88]

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[87] U.S. Department of Energy, Grid Deployment Office, "The National Transmission Planning Study," (2024), available at https://www.energy.gov/sites/default/files/2024-10/NationalTransmissionPlanningStudy-ExecutiveSummary.pdf, p. 21.

[88] MISO MTEP LRTP Addendum, p. 86.

METC similarly notes that "The Project supports reliable energy delivery under a variety of conditions through an increasingly interdependent system which adds operational flexibility and geographic diversity."[89]

Q. How do Tranche 1 and the Projects facilitate the reliable integration of high levels of renewable generation?

A. Transmission is essential for realizing the benefits of geographic diversity in wind and solar output profiles, as mentioned above. The primarily east-west paths expanded by Tranche 1 tap into diversity created by the typical movement of weather systems from west to east, and the daily movement of the sun from east to west. Tranche 1 also taps into geographic diversity with neighboring grid operators, including in renewable output but also in demand and conventional generator correlated outages, increasing resilience.[90]

Q. What are these diversity benefits?

A. A foundational principle of the power system is that a networked aggregation of many customers and sources of supply greatly reduces cost and risk because changes in individual customers' demand or outages of individual generators are not perfectly correlated. As discussed above, diversity benefits reduce the cost of building the power system, as less power plant capacity is needed to reliably meet peak demand if diverse resources are available. MISO and PJM have each documented how transmission enables them to take advantage of diversity in load patterns across their large footprints, saving

[89] Marshall U-21472 Direct, p. 49.
[90] MISO MTEP LRTP Addendum, p. 85.

billions of dollars per year.[91] Diversity benefits also reduce the cost of operating the power system, as lower variability reduces the need for flexible resources to quickly change their level of output.

As variable renewable resources like wind and solar make up a larger share of our generation mix, these diversity benefits grow even larger. Even a relatively small amount of geographic distance between them is enough for the output profiles of two wind plants[92] or two solar plants[93] to be less than perfectly correlated, as local weather phenomena no longer affect both plants simultaneously. As a result, a diverse portfolio of renewable resources has more constant output, ensuring a higher level of output is available during times of peak demand. The value of transmission for cost-effective decarbonization through accessing diverse renewable resources is confirmed by a number of regional[94] and national studies.[95]

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[91] MISO, "About MISO," available at https://www.misoenergy.org/about/miso-strategy-and-value-proposition/miso-value-proposition/; PJM Interconnection, "Value Proposition" (2019), available at https://www.pjm.com/about-pjm/~/media/about-pjm/pjm-value-proposition.ashx.

[92] Hannele Holttinen, et al., *Design and Operation of Power Systems with Large Amounts of Wind Power: Final summary report, IEA WIND Task 25, Phase three 2012–2014*, p. 22 (2016), available at: https://iea-wind.org/wp-content/uploads/2021/08/T268.pdf; Clara M. St. Martin, Julie K. Lindquist & Mark A. Handschy, *Variability of Interconnected Wind Plants: Correlation Length and its Dependence on Variability Time Scale*, Environmental Research Letters, 10(4), (April 2015), available at: http://iopscience.iop.org/article/10.1088/1748-9326/10/4/044004

[93] Andrew Mills & Ryan Wiser, *Implications of Wide-Area geographic Diversity of Short-Term Variability of Solar Power*, Lawrence Berkeley National Laboratory (September 2010), available at: https://www.osti.gov/servlets/purl/1196768.

[94] Christopher T.M. Clack, Michael Goggin, Aditya Choukulkar, Brianna Cote & Sarah McKee, Consumer, *Employment, and Environmental Benefits of Electricity Transmission Expansion in the Eastern U.S.*, (October 2020), available at: https://cleanenergygrid.org/wp-content/uploads/2020/11/Consumer-Employment-and-Environmental-Benefits-of-Transmission-Expansion-in-the-Eastern-U.S.pdf.

[95] For example, see https://ieeexplore.ieee.org/document/9548789; https://www.nrel.gov/analysis/100-percent-clean-electricity-by-2035-study.html.

Q. How does Tranche 1 ensure the value of renewable generation remains high?

A. As MISO reaches higher levels of renewable energy use, an increasingly important benefit of transmission will be increasing the value of renewable energy by allowing regional power flows to cancel out local fluctuations in renewable output, and inter-regional power flows to cancel out regional variability. Increasing the geographic diversity of wind and solar resources will increase the value of their energy and capacity by reducing their variability and increasing their capacity value.

DOE's National Transmission Planning Study compellingly illustrated this phenomenon with maps showing that when one region experiences a weather-driven lull in wind or solar output or a spike in electricity demand, neighboring areas often do not.[96] As a result, transmission can tap into these interregional diversity benefits in wind and solar output and electricity demand patterns, saving ratepayers by reducing the need for generating capacity in both regions.

The decline in solar capacity value at higher solar penetrations primarily occurs because late afternoon solar output pushes peak net load later into the evening, when solar generation declines. The western MISO solar resource areas accessed by LRTP Tranche 1 are around 700 miles west of Michigan, so during much of the year the sun sets around an hour later there. As a result, during most of the year western MISO solar resources are still

[96] U.S. Department of Energy, Grid Deployment Office "The National Transmission Planning Study, Chapter 2: Long-Term U.S. Transmission Planning Scenarios," (2024), available at https://www.energy.gov/sites/default/files/2024-10/NationalTransmissionPlanningStudy-Chapter2.pdf, pp. 51–53.

producing large amounts of power when Michigan is experiencing peak net load in the late afternoon and early evening.

Q. Does inter-regional transmission help ensure reliability and resilience during severe weather events?

A. Inter-regional transmission is particularly valuable during severe weather events. Extreme weather is typically most severe in a limited geographic area and weather systems move over time, so importing from a neighboring region that is less affected by the severe weather is a highly effective solution.[97] For example, SPP, MISO, and PJM saw large diversity in the timing of their peak needs during Winter Storms Elliott[98] and Uri and recent polar vortex and bomb cyclone events, but those regions experienced costly price spikes because there was insufficient transmission to fully meet their needs.[99] As noted above, MISO ratepayers incurred $350 million in congestion costs during Winter Storm Elliott, and LBNL analysis confirms that severe weather events account for about half of the total benefit of transmission lines, even though these extreme weather events are not typically included in production cost or other transmission benefit analyses. A recent report for the Energy Systems Integration Group confirmed the value of transmission for accessing diverse loads and resources during severe weather events.[100]

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97 Grid Strategies, LLC, "Transmission makes the power system resilient to extreme weather" (July, 2021), available at https://acore.org/wp-content/uploads/2021/07/GS_Resilient-Transmission_proof.pdf.

98 Grid Strategies, LLC, "The value of transmission during winter storm Elliott," (February, 2023), available at https://acore.org/wp-content/uploads/2023/02/The-Value-of-Transmission-During-Winter-Storm-Elliott-ACORE.pdf.

99 Grid Strategies, LLC, "Transmission makes the power system resilient to extreme weather," (July, 2021), available at https://acore.org/wp-content/uploads/2021/07/GS_Resilient-Transmission_proof.pdf.

100 Energy Systems Integration Group (ESIG) Transmission Resilience Task Force, "Interregional Transmission for Resilience using regional diversity to prioritize additional interrregional transmission," (June, 2024), available at https://www.esig.energy/wp-content/uploads/2024/06/ESIG-Interregional-Transmission-Resilience-methodology-report-2024.pdf, pp. 31–36.

NERC's recent Interregional Transfer Capability Study concluded Michigan has a significant need for expanded transmission import capacity. It found that if severe weather events that occurred in 2011, 2020, and 2021 re-occurred in the future with expected changes in electricity supply and demand, Michigan could face a generation shortfall of 5,715 MW to 6,410 MW.[101] As a result, the report recommends expanding transmission capacity to MISO west by at least 2,000 MW and to PJM west by at least 1,000 MW,[102] and potentially expanding total ties to those regions by more than 4,000 MW.[103] The transmission expansion provided by Tranche 1 and 2.1 will help protect Michigan customers against the devastation from rolling blackouts that Texas residents experienced during Winter Storm Uri in 2021.

Q. Does transmission increase the competitiveness of electricity markets?

A. Yes, both during normal operations and extreme weather events. The Projects protect against the potential for generators to exercise market power in both the MISO energy and capacity markets, largely by increasing import capacity into MISO Zone 7. The energy market competitiveness benefits are more pronounced during extreme events. There is likely to be greater opportunity for profiting from economic withholding of generation when an electricity market is on the steep right side of the generation supply curve, as occurs during periods of high demand and short supply. Generator outages and transmission congestion also tend to be high during extreme events, which further creates

[101] NERC, *Interregional Transfer Capability Study Final Report*, https://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/ITCS_Filing_Fall2024_signed.pdf, p. 105.
[102] *Ibid.,* p. xvii.
[103] *Ibid.,* p. 106.

an opportunity for local exercise of market power. By reducing congestion and increasing the supply of generation from more distant sources, transmission helps ensure that power markets remain competitive.

Q. Does transmission help to hedge against uncertainty and protect consumers from risk?

A. Yes. Transmission is an important mechanism to protect consumers against unpredictable volatility in the price of fuels used to produce electricity. Transmission can alleviate the negative impact of fuel price fluctuations on consumers by making it possible to buy power from other resources. As utilities Xcel and ITC noted in an approved application to build a transmission line in Minnesota, "[A] robust regional transmission system is also key to enabling access to a diverse mix of generation resources, which in turn allows customers to access the least expensive power available at any given time."[104] Renewable generation itself also provides significant hedging value against fuel price fluctuations,[105] so the hedging benefit of transmission is even larger for transmission that connects new renewable generation, such as the Projects.

MISO's Tranche 1 net benefits analysis included a gas price sensitivity, which shows production cost savings more than doubling in a scenario in which natural gas prices are

[104] Northern States Power Company and ITC Midwest LLC, *Application to the Minnesota Public Utilities Commission for a Certificate of Need for the Huntley-Wilmarth 345 kV Transmission Line Project*, MPUC Docket No. E-002, (January 2018), *available at* https://www.huntleywilmarth.com/staticfiles/microsites/hw/HW-Certificate-of-Need-Application.pdf, p. 8.
[105] LBNL, *Revisiting the Long-Term Hedge Value of Wind Power in an Era of Low Natural Gas Prices*, (March 2013), available at https://www.osti.gov/servlets/purl/1171998, p. i.

20% higher than the baseline forecast, with savings increasing from $19.9 billion to $45.1 billion over 40 years at a 6.9% discount rate.[106]

Going forward, a robust transmission grid can provide valuable protection against a variety of uncertainties in the electricity market,[107] including fluctuations in fossil fuel prices and uncertainty regarding electricity demand growth. As a result, transmission should be viewed as a valuable hedge against uncertainty and future price fluctuations for all consumers.

VI. THE PROJECTS REDUCE POLLUTION

Q. How do the Projects affect air pollution in Michigan?

A. By delivering more low-cost non-emitting energy to Michigan and the broader MISO market, the Projects displace higher-cost emitting generators in Michigan and in nearby states whose pollution also negatively affects Michigan residents.

Q. Did MISO quantify the economic value of emissions reductions from transmission expansion?

A. MISO quantified the economic value from Tranche 1 generated by reductions in greenhouse gas emissions, but not the value of reducing emissions of other air pollutants including sulfur dioxide ("SO_2"), nitrogen oxides ("NO_x"), and particulate matter. These

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[106] https://cdn.misoenergy.org/LRTP%20Tranche%201%20Detailed%20Business%20Case625789.pdf, p. 85.

[107] B. Hobbs et al., *Large-Scale Stochastic Programming to Cooptimize Networks and Generation in the Face of Long-Run Uncertainties: What Lines Should We Build Now?* (June 2015), available at https://www.ferc.gov/sites/default/files/2020-08/T4-A-2-HOBBS.pdf.

pollutants cause environmental degradation, including smog and acid rain, and contribute to cardiopulmonary health problems including asthma, bronchitis, heart attacks, and even death.[108] Particulate matter in particular has large negative public health impacts, which have been economically quantified.[109]

Q. Has the economic value of greenhouse gas emissions reductions increased since MISO completed its analysis?

A. Yes. Recent updates to the federal Social Cost of Carbon increased it to $190/metric tonne in 2020 with an escalator of $40/tonne each decade,[110] which results in a $198/tonne cost for 2022. This is more than four times higher than the $47.80/metric tonne that MISO used as the high estimate of the cost of carbon for 2022 by averaging the Social Cost of Carbon ($57.76 in 2022) and the 45Q tax credit value ($37.85/tonne in 2022). This is also drastically higher than the $12.55/metric tonne Minnesota PUC estimate that MISO used as its low estimate for 2022. Using the updated federal Social Cost of Carbon instead of the $12.55–$47.80/tonne range that MISO used would increase MISO's estimate of decarbonization benefit from a net present value from $3.5–$17.4 billion to over $70 billion.

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[108] U.S. Environmental Protection Agency (EPA), *Regulatory Impact Analysis for the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Projects* (August, 2018), available at https://www.epa.gov/sites/production/files/2018-08/documents/utilities_ria_proposed_ace_2018-08.pdf, pp. 4–18.

[109] Illinois Power Agency (IPA) Fiscal Year 2021 Annual Report (February 15, 2022), available at https://ipa.illinois.gov/content/dam/soi/en/web/ipa/documents/illinois-power-agency-fy-2021-annual-report-(15-feb-2022).pdf, pp. 30–31.

[110] U.S. Environmental Protection Agency (EPA), Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, (November, 2023), available at https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf, p. 4.

Q. Did you conduct your own analysis of the emissions benefits of LRTP Tranche 1?

A. Yes. I used the U.S. Environmental Protection Agency's ("EPA's") Avoided Emissions and Generation Tool ("AVERT") to calculate the emissions reductions that would be provided by the 20,100 MW of incremental renewable generation enabled by LRTP Tranche 1. The AVERT tool was built by the EPA to quantify the impact of renewable energy and other measures on air pollution emissions.[111] This U.S. government tool has been widely used for emissions benefit analysis. The tool statistically estimates which power plants in a region experience reduced emissions of SO_2, fine particulate matter (under 2.5 micrometer, ("$PM_{2.5}$")), NO_x, volatile organic compounds ("VOCs"), ammonia ("NH_3"), and carbon dioxide ("CO_2") due to the deployment of renewable energy or energy efficiency. AVERT's "Midwest" region, which roughly approximates the footprint of MISO, was used for this analysis.

The AVERT tool indicates that delivering 20,100 MW of additional renewable generation to the Midwest region, would annually displace over 37 million short tons of carbon dioxide, more than 50 million pounds of SO_2, 41 million pounds of NO_x, 4.6 million pounds of $PM_{2.5}$, over 1.2 million pounds of VOCs, and nearly 1.5 million pounds of NH_3. These MISO-wide results, as well as results for the displacement of air emissions from power plants in Michigan, are summarized in Table 3 below.

[111] U.S. EPA, *AVoided Emissions and geneRation Tool (AVERT)*, accessed November 6, 2024, https://www.epa.gov/avert/avert-web-edition.

Table 3: Air pollution reductions from the 20,100 MW of renewable resources enabled by LRTP Tranche 1, calculated using EPA AVERT tool

	MISO	Michigan
SO_2 (lb)	50,495,820	3,839,680
NO_X (lb)	41,082,860	3,794,120
CO_2 (tons)	37,342,320	4,341,840
$PM_{2.5}$ (lb)	4,568,040	348,520
VOCs (lb)	1,242,880	166,260
NH_3 (lb)	1,450,420	160,120

Q. In summary, what is your recommendation to the Commission?

A. Based on the quantifiable and nonquantifiable public benefits of the proposed Projects, I respectfully recommend that the Commission find that METC's petition for a Certificate of Public Convenience and Necessity, pursuant to Michigan's Electric Transmission Line Certification Act, demonstrates that "[t]he quantifiable and nonquantifiable public benefits of the proposed major transmission line justify its construction."

Q. Does this conclude your testimony?

A. Yes.

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

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In the matter of the application of **MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC** for an Act 30 certificate of public convenience and necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan, and between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan.	)	**Case No. U-21471** **Case No. U-21472**

EXHIBITS OF MICHAEL GOGGIN

ON BEHALF OF

THE MICHIGAN ENERGY INNOVATION BUSINESS COUNCIL,

INSTITUTE FOR ENERGY INNOVATION,

AND

CLEAN GRID ALLIANCE

Michael Goggin

Education:

Harvard University class of 2004, B.A. *cum laude* in Social Studies
- Wrote thesis "Is it Time for a Change? Science, Policy, and Climate Change"

Experience:

Grid Strategies — Vice President — February 2018-present
- Serve as an expert consultant on electricity transmission, grid integration, reliability, market, and public policy issues for environmental and clean energy industry clients
- Have testified before FERC and in dozens of state regulatory commission cases
- Wrote blueprint for electricity market reforms
- Directed analysis of transmission's value for decarbonization and job creation
- Co-authored report on need for FERC transmission policy reform
- Crafted vision for modernizing the grid for renewable energy
- Co-authored other reports cited in the "Solving the Climate Crisis" Action Plan from the Majority Staff of the House Select Committee on the Climate Crisis

AWEA — Senior Director of Research, other titles — February 2008-February 2018
- Led team responsible for all American Wind Energy Association analysis
- Served as primary technical and economic expert for market design, transmission, grid integration, carbon policy, and other topics
- Authored regulatory filings at state (IRP and transmission siting cases), regional (ISO transmission and market design), and federal levels (FERC transmission, interconnection standard, grid integration, and market design cases; EPA carbon policy)
- Directed economic and power sector modeling to inform AWEA's policy strategy and support advocacy positions
- Communicated with the press and policy makers about wind energy
- Authored reports to promote AWEA's policy agenda, rebut misconceptions about wind energy, and explain complex energy topics to lay audiences
- Other titles included Electric Industry Analyst, Senior Analyst, Manager of Transmission Policy, Director of Research

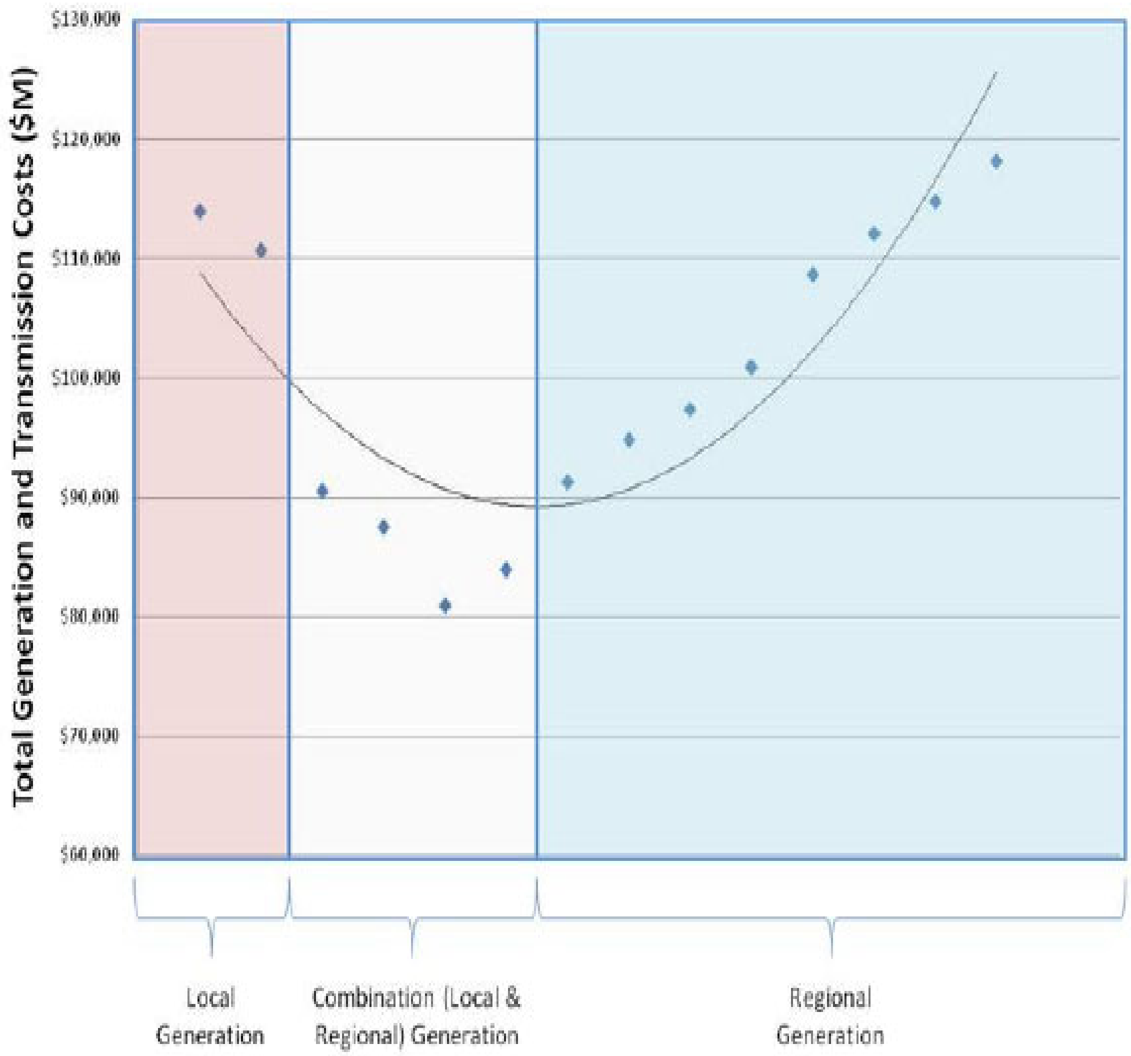
Sentech, Inc. — Research Analyst — October 2005-February 2008
- Conducted economic analyses of solar, wind, geothermal, and energy storage technologies for U.S. Department of Energy officials
- Provided analytical support for DOE's renewable energy R&D funding decisions

Union of Concerned Scientists — Clean Energy Intern — May 2005-October 2005
- Worked with the legislative and field staff to promote the inclusion of pro-renewable energy measures in the Energy Policy Act of 2005

State Public Interest Research Groups — Policy Analyst — August 2004-May 2005
- Analyzed and advocated for clean energy policies at the state and federal level

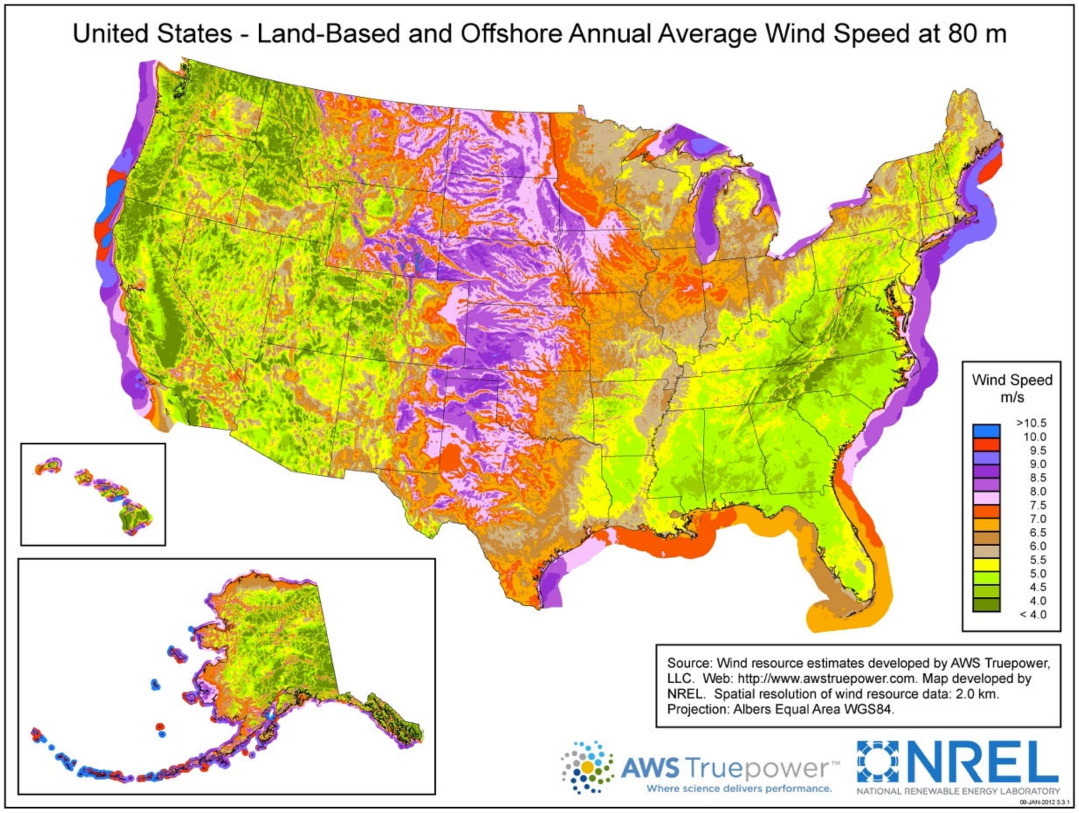
Other publications available at https://gridstrategiesllc.com/reports/

MISO chart illustrating that effective transmission planning minimizes the total cost to ratepayers of generation plus transmission by building the optimal amount of transmission.[1] The red area on the left of the chart represents an underinvestment in transmission that results in higher generation costs and therefore total costs to customers. The blue area on the right shows a theoretical overinvestment in transmission. The goal of transmission planning should be to minimize the total cost of generation plus transmission, as occurs in the white area in the middle of the chart.



[1] Midcontinent Indep. Sys. Operator, *Regional Generation Outlet Study*, Nov. 19, 2010, at p. 3, available at https://puc.sd.gov/commission/dockets/electric/2013/EL13-028/appendixb3.pdf.

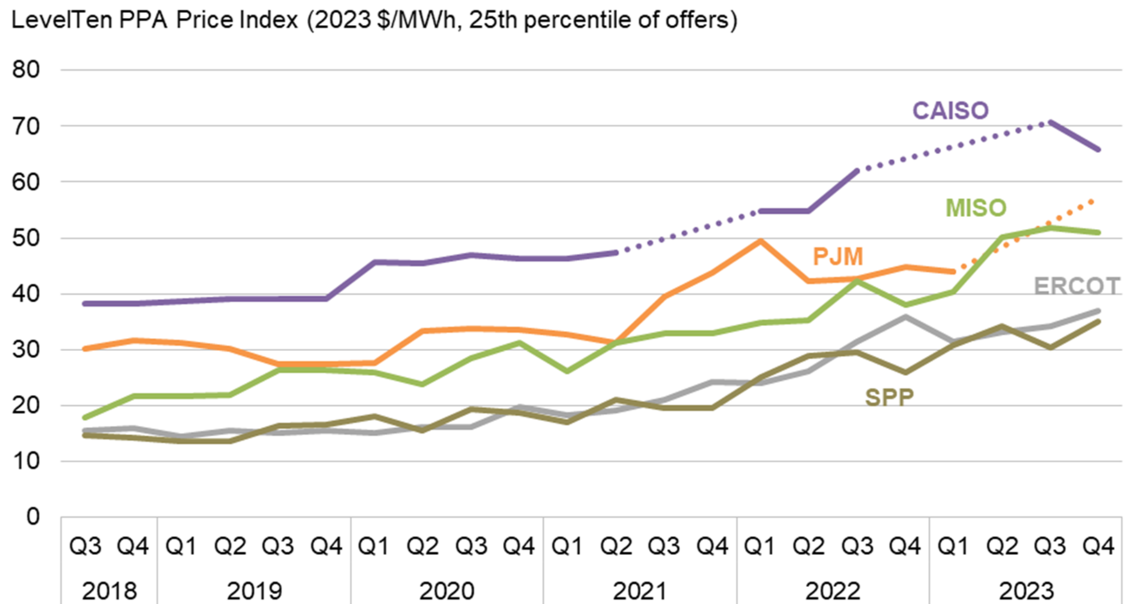
National Renewable Energy Laboratory (NREL) 80-meter wind resource assessment map of the U.S.[2]



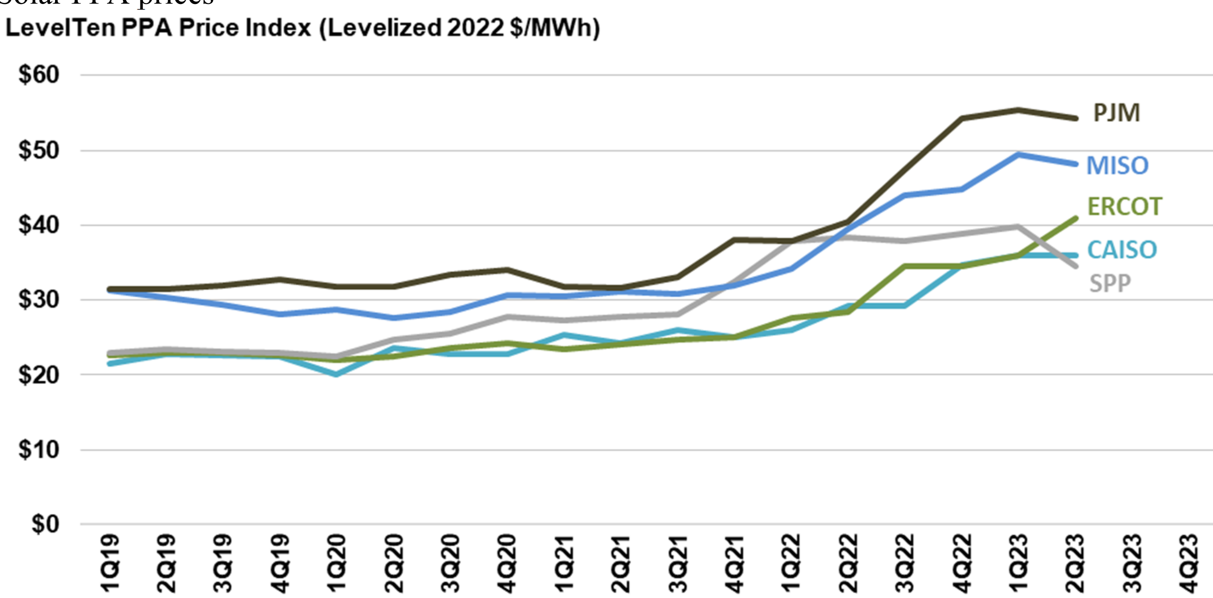
[2] National Renewable Energy Laboratory (NREL) and AWS Truepower: 80-meter wind resource assessment map of the U.S. Poster presented at WINDPOWER 2010; *available at* https://www.nrel.gov/docs/fy10osti/48036.pdf, (2010).

LevelTen data showing average wind and solar PPA prices by region, with MISO prices typically significantly below those in PJM.

Wind PPA prices[3]



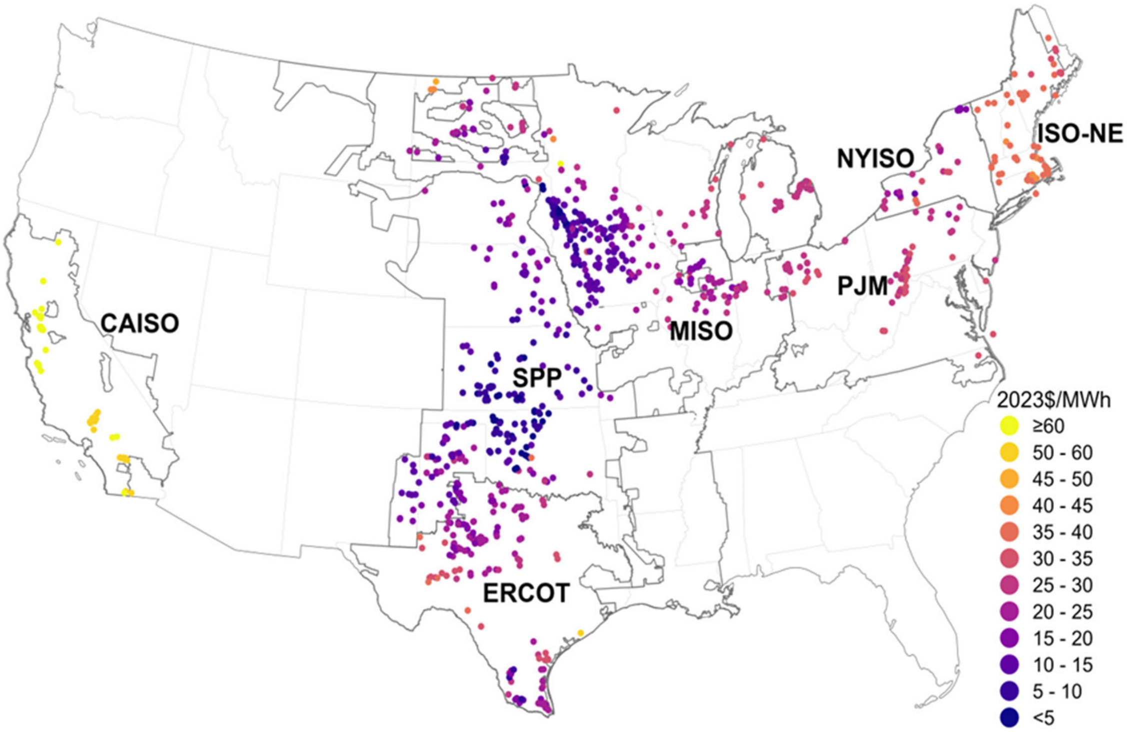
Solar PPA prices[4]



[3] Lawrence Berkeley National Lab, *Land-Based Wind Market Report Data File,* "Level10 Wind PPA Prices" tab, August, 2024, available at https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition_Data_File.xlsx.

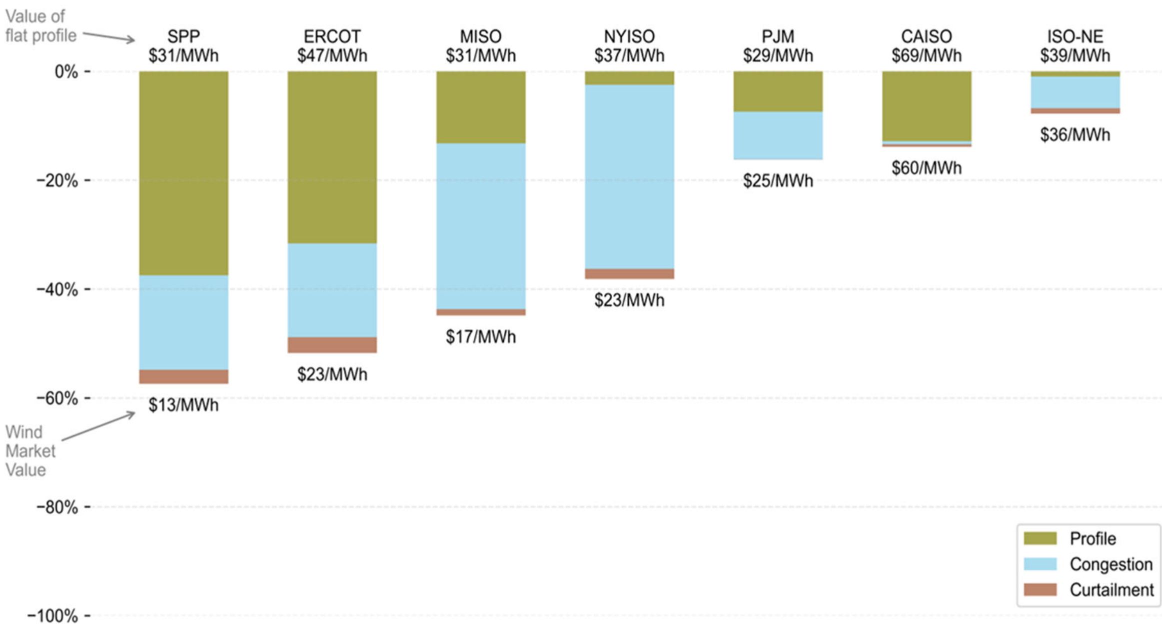
[4] Lawrence Berkeley National Lab, *Utility-Scale Solar Data Update*, "LevelTen Solar PPA Prices" tab, October, 2023, available at https://emp.lbl.gov/sites/default/files/emp-files/2023_utility-scale_solar_data_update.xlsx.

Lawrence Berkeley National Lab (LBNL) map of wind generation value in 2023[5]



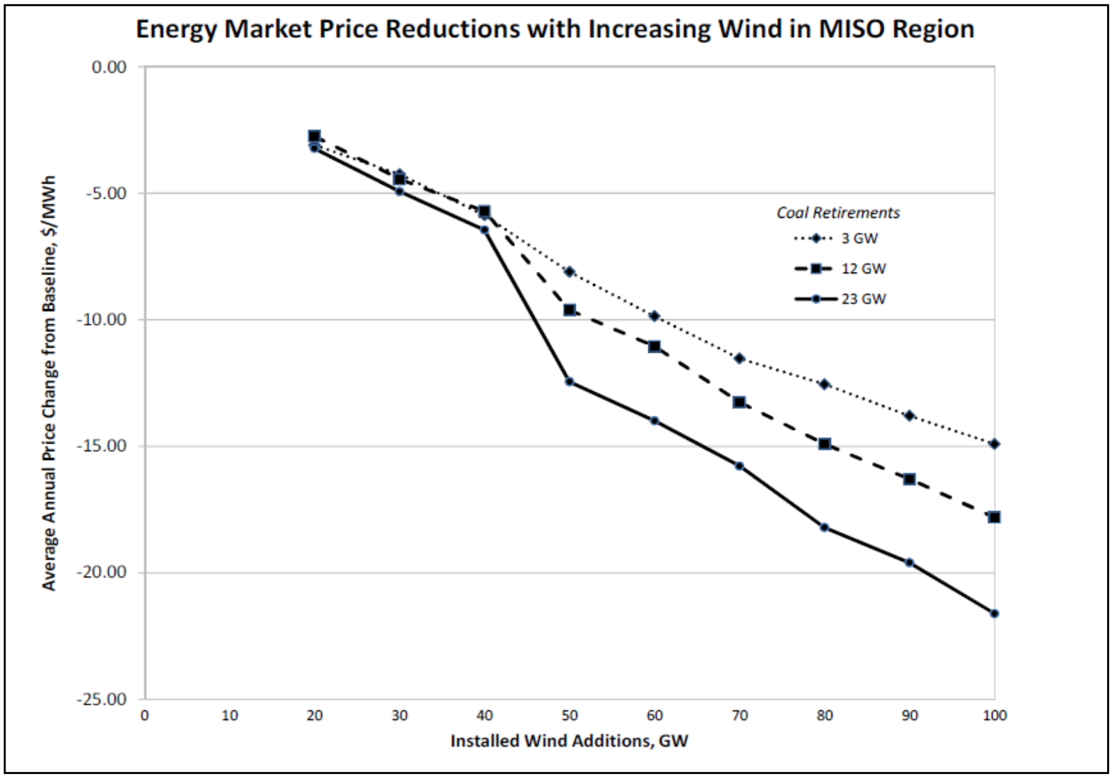
[5] Lawrence Berkeley National Lab, Land-Based Wind Market Report Data File, "2023 Market Value by Location" tab, August, 2024, available at: https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition_Data_File.xlsx.

Lawrence Berkeley National lab chart showing factors reducing wind generation value in 2023, relative to a hypothetical flat block of power.[6]



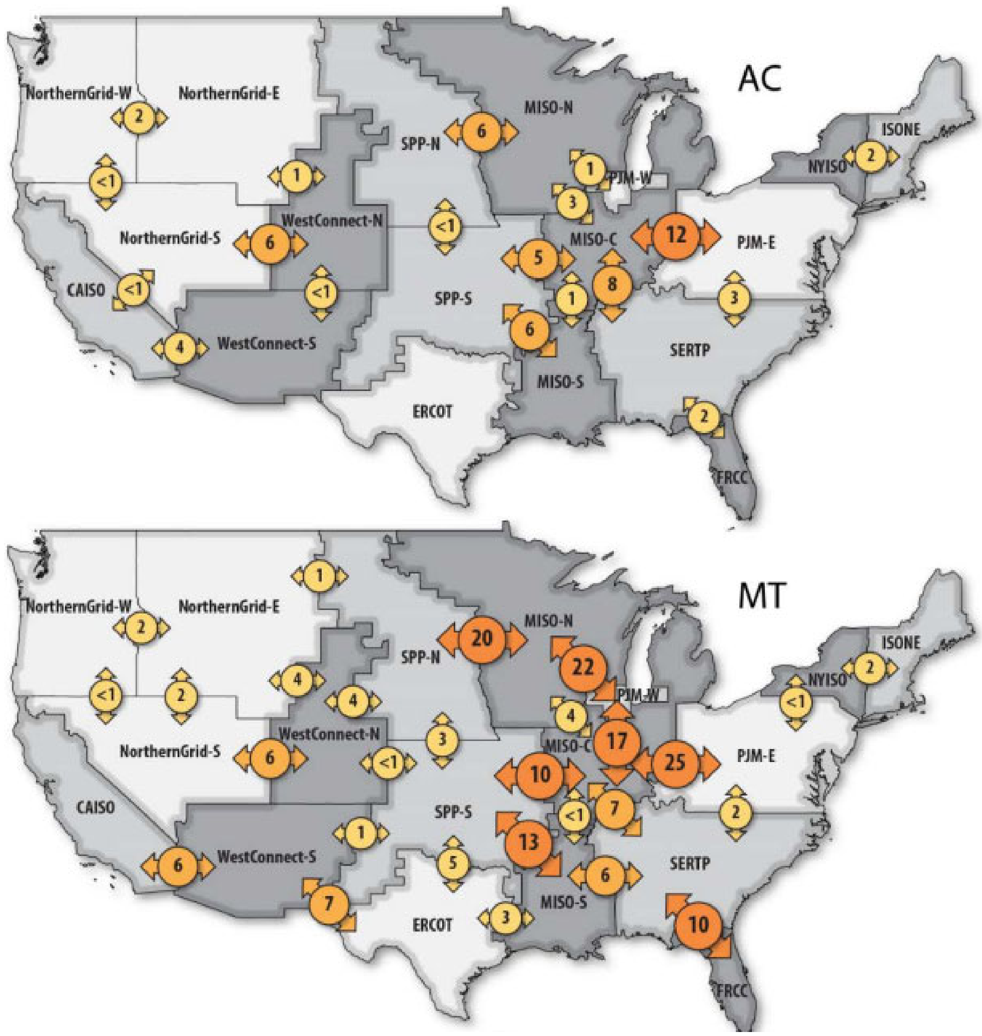
[6] Lawrence Berkeley National Lab, *Land-Based Wind Market Report Data File,* "Value Relative to Flat Profile" tab, August, 2024, available at https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition_Data_File.xlsx.

Energy Market Price Reductions with Increasing Wind in MISO Region.[7]



[7] B. Fagan et al.,*The Potential Rate Effects of Wind Energy and Transmission in the Midwest ISO Region*, at p. 4 (May 22, 2012), *available at* https://cleanenergygrid.org/wp-content/uploads/2012/05/Full-Report-The-Potential-Rate-Effects-of-Wind-Energy-and-Transmission-in-the-Midwest-ISO-Region.pdf

Maps showing transmission expansion under alternating current ("AC") and multi-terminal ("MT") direct current scenarios[8]



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8 U.S. Department of Energy, Grid Deployment Office. The National Transmission Planning Study. Washington, D.C.: U.S. Department of Energy. https://www.energy.gov/gdo/national-transmission-planning-study, at p. 21. (2024).

STATE OF MICHIGAN

BEFORE THE MICHIGAN PUBLIC SERVICE COMMISSION

*****

In the matter of the application of MICHIGAN ELECTRIC TRANSMISSION COMPANY, LLC for an Act 30 certificate of public convenience and necessity for the construction of a major transmission line between Oneida Substation in Eaton County and Nelson Road Substation in Gratiot County, Michigan, and between the Indiana/Michigan state border at Gilead Township in Branch County and the new Helix Substation in Calhoun County, Michigan.	)	**Case No. U-21471** **Case No. U-21472**

PROOF OF SERVICE

STATE OF SOUTH CAROLINA)
) ss.
COUNTY OF BERKELEY)

Summer R. Dukes, the undersigned, being first duly sworn, deposes and says that she is a Paralegal at Potomac Law Group PLLC and that on the 4th day of December, 2024 she served the Direct Testimony and Exhibits of Natalie Lyijynen and the Direct Testimony and Exhibits of Michael Goggin on behalf of the Michigan Energy Innovation Business Council, the Institute for Energy Innovation, and Clean Grid Alliance, via email, upon those individuals listed on the attached Service List via email.

Summer Dukes Digitally signed by Summer Dukes Date: 2024.12.04 17:45:01 -05'00'

Summer R. Dukes

Administrative Law Judge Honorable Christopher S. Saunders saundersc4@michigan.gov **Ronald S. Bewersdorff, Trustee of the Ronald S. Bewersdorff Revocable Trust; Brenda Birchman; Daniel and Lori May; Kenneth May; Josip Zokvic, Trustee of the Josip Zokvic Trust** Clifford A. Knaggs Betsy L. Reeve Rhonda Kunkel caknaggs@kblawpc.com betsy@kblawpc.com rhonda@kblawpc.com **Danielle Wohlscheid; Anthony Wohlschied; Diane Wohlscheid; Charles Wohlscheid; Valerie Wohlschied-Brennan; Robert Brennan; Lynn and Stephen Colby; Gordon and Vossie Diemer; Joseph and Jennifer Haddix; Karol and Eugene Sanborn; Dr. James and Dr. Judi Sikarskie; Lawrence and Coreen Strzalka** Frederick M. Baker, Jr. Valerie Wohlschied-Brennan Jim Dauphinais Brian Andrews Matthew Klekar fmbjrpllc@outlook.com vwohlscheid@hotmail.com jdauphinais@consultbai.com bandrews@consultbai.com mklekar@consultbai.com **Michigan Electric Transmission Company, LLC** Courtney F. Kissel Olivia R.C.A. Flower Kyle M. Asher Hannah E. Buzolits Lisa Agrimonti Haley Waller Pits Richard J. Aaron Breann Jurek ckissel@dykema.com oflower@dykema.com kasher@dykema.com hbuzolits@dykema.com lagrimonti@fredlaw.com hwallerpitts@fredlaw.com raaron@dykema.com kadarkwa@itctransco.com bjurek@fredlaw.com mpscfilings@dykema.com	**Michigan Public Service Commission Staff** Amit T. Singh Michael J. Orris Monica M. Stephens Heather M.S. Durian Megan Mix Singha9@michigan.gov orrism@michigan.gov stephensm11@michigan.gov durianh@michigan.gov mixm@michigan.gov **Michigan Energy Innovation Business Council Institute for Energy Innovation Clean Grid Alliance** Laura A. Chappelle Timothy J. Lundgren Justin K. Ooms Elizabeth Wheeler Laura Sherman Natalie Lyijynen lchappelle@potomaclaw.com tlundgren@potomaclaw.com jooms@potomaclaw.com ewheeler@cleangridalliance.org laura@mieibc.org natalie@mieibc.org **Citizens Utility Board of Michigan (CUB) Sierra Club (SC)** Christopher M. Bzdok John Liskey Breanna Thomas Natasha Fowles Douglas B. Jester Julielyn Gibbons Eli K. Gold chris@tropospherelegal.com john@liskeypllc.com breanna@tropospherelegal.com natasha@tropospherelegal.com djester@5lakesenergy.com jgibbons@5lakesenergy.com egold@5lakesenergy.com **Branch Solar, LLC** Katherine G. Boothroyd Daniel P. Ettinger Ashley G. Chrysler kboothroyd@wnj.com dettinger@wnj.com achrysler@wnj.com

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