APPENDIX O: HIBBARD RETIREMENT STUDY

Minnesota Power (or the "Company") submits to the Minnesota Public Utilities Commission ("Commission") this Retirement Study (or "Study") for a dispatchable renewable resource as part of its 2025-2039 Integrated Resource Plan ("2025 IRP"). This Study evaluates the considerations for early retirement of the Hibbard Renewable Energy Center ("HREC") and states the plan to continue operation of HREC. Information in this Study is presented in the following sections:

- Part A: Introduction to Hibbard Retirement Study
- Part B: Perspectives on Hibbard Renewable Energy Center Retirement
- Part C: Conclusions

A. Introduction to Hibbard Retirement Study

This Study is part of the Company's 2025 IRP, which provides in-depth evaluation of multiple resource futures that includes a comparison between the Company's Preferred Resource Plan (the "2025 Plan") and a retirement scenario for HREC. The Study itself discusses the factors relevant to HREC retirement and brings together additional data and analyses in the broader 2025 IRP that are pertinent to studying a retirement of the HREC facility.

HREC is a dispatchable and renewable energy and capacity source that uses biomass to produce energy. It has the capability to provide renewable energy when wind and solar energy are unavailable. In the region, it also provides the only outlet north of the Twin Cities for unmerchantable roundwood affected by emerald ash borer, spruce budworm, and other pests. HREC is a valuable generation asset for customers that provides renewable energy when it is needed by the system. Its dispatchable operational characteristics results in delivering higher levels of accredited system capacity, contributing to meeting Minnesota Power's reliability criteria for the power supply, and is used to relieve local transmission reliability issues in the Duluth area – all important attributes when there is declining dispatchable capacity on the broader system at the same time customers are requesting more energy from Minnesota Power. For these reasons, along with the additional findings in this Retirement Study, Minnesota Power recommends in the 2025 Plan to continue operating HREC.

In addition to HREC's contributions to the system as a dispatchable renewable energy resource, HREC operations provide economic benefits to the local community and the state. In a typical year, HREC provides direct, full-time employment to 24 highly skilled Minnesotans and generates tax revenue of approximately $0.6 million for county and local entities, and approximately $1.1 million for the state of Minnesota. Further, planned capital improvements through 2028 will provide additional employment, labor income, and associated economic impacts in St. Louis County. The economic impacts of HREC operations and planned capital investments are discussed further below and in more detail in a study entitled "*The Economic Impact of Hibbard Renewable Energy Center on St. Louis County, Minnesota,"* conducted by the Bureau of Business and Economic Research ("BBER") at the University of Minnesota Duluth's Labovitz School of Business and Economics included as Appendix O, Attachment 1 (the "BBER Study"). The BBER Study complies with the Commission's Order approving the Company's 2021 Integrated Resource Plan (the "2021 IRP Order"),[1] requiring that Minnesota Power evaluate the

[1] *In the Matter of Minnesota Power's 2021-2035 Integrated Resource Plan,* Docket No. E-015/RP-21-33, Order Approving Plan and Setting Additional Requirements (Jan. 9, 2023).

economic impacts of the potential closure of HREC. Specifically, Order Point 11.b. of the 2021 IRP Order required the following:

> *11. In its next resource plan, Minnesota Power must work with stakeholders, including but not limited to parties to the current proceeding, to include a stakeholder report, consistent with the following:*
>
> > *b. Stakeholders will provide input on a societal cost benefit analysis of Boswell Unit 4 and Hibbard Renewable Energy Center, considering impacts on host communities, workforce, economics, health, system reliability, the environment, and customer costs.*

As it relates to Order Point 11.b., this Study discusses the impacts of early retirement of HREC and provides the BBER Study, included as Appendix O, Attachment 1. The 2025 IRP also includes information in compliance with Order Point 11.b. in the Engagement Report and Societal Cost-Benefit Analysis provided as Appendix N to the 2025 IRP.

While the 2021 IRP Order did not explicitly require a retirement study for HREC, a retirement study is appropriate as part of this 2025 IRP so that a complete evaluation of the resource is performed to inform the 2025 Plan, similar to the baseload retirement analysis of the Boswell Energy Facility ("BEC") in the 2021 Integrated Resource Plan ("IRP").

Further, in January 2023, the Minnesota Legislature enacted the Carbon-Free Standard ("CFS") in Minn. Stat. § 216B.1691, which requires electric utilities to generate or procure electricity from a carbon-free energy technology that is equivalent to at least 80 percent, 90 percent, and 100 percent of its electric retail sales to retail customers in Minnesota by the end of the years 2030, 2035, and 2040, respectively. A key point of debate within the implementation of the law is whether energy from wood biomass facilities, such as HREC, should qualify as carbon-free along with its renewable designation. During the second phase of the Commission's investigation into implementing the CFS,[2] questions arose regarding whether the term "carbon-free" included calculations based on a cumulative life-cycle or alternative waste management analysis. Biomass energy for example – which emits carbon dioxide at the point of combustion – is carbon neutral over the life-cycle in which an equivalent amount of vegetation grows back. To clarify these questions, the Commission issued an Order to establish a record development proceeding to determine whether biomass, renewable natural gas, and solid waste should be eligible as fully or partially carbon-free generation resources based on a fuel life-cycle analysis.[3] Minnesota Power discusses compliance with the CFS in further detail in Appendix I to the 2025 IRP. The Commission indicated it expects to render its decision in this matter by December 31, 2025. While determinations regarding biomass facilities carbon emissions are pending, this Study addresses other factors impacting consideration of early retirement of HREC.

As described later in this Study, the Company's 2025 Plan ultimately supports continuing operation of HREC. In assessing potential early retirement of HREC, the Company evaluated the following scenarios:

1. Retire HREC as early as feasible: no earlier than end of 2032;[4] and

[2] *In the Matter of an Investigation into Implementing Changes to the Renewable Energy Standard and the Newly Created Carbon Free Standard under Minn. Stat. § 216B.1691,* Docket No. E-999/CI-23-151.
[3] *In the Matter of a Commission Investigation into a Fuel Life-Cycle Analysis Framework for Utility Compliance with Minnesota's Carbon-Free Standard,* Docket No. E-999/CI-24-352, Order Initiating New Docket and Clarifying "Environmental Justice Area" (Nov. 7, 2024).
[4] The retirement occurs at the end of the year. For example, a 2032 retirement refers to the unit being retired on December 31, 2032.

2. Continue HREC operations.

These scenarios were chosen for further evaluation in the IRP because they reflect the earliest feasible retirement date for HREC and assess the impacts of continued operations. A key factor of the feasibility baseline retirement date is implementation of local transmission system upgrades necessary to ensure continued safe and reliable service for customers that meets all applicable federal and state standards, along with time to build replacement dispatchable capacity and renewable energy, and community and economic impacts caused by retirement.

This Study further discusses these considerations, the role HREC plays in Minnesota Power's generation portfolio, and the value to our customers and to the community of continued operation of HREC as a dispatchable renewable energy resource.

Hibbard Renewable Energy Center Overview

Originally built in 1931, the HREC is located in Duluth, Minnesota. The facility is depicted in Figure 1 below. HREC consists of Unit 3 ("HREC3") and Unit 4 ("HREC4"), operating as dispatchable energy resource for Minnesota Power's system. HREC can burn wood and wood wastes, coal, and natural gas. Use of wood and wood waste fuels make much of the energy generated by HREC a qualified renewable energy product used to meet the Minnesota Renewable Energy Standard. HREC units have been providing a portion of the Company's regulated services and spinning reserves since 2004. HREC is capable of and originally designed for baseload operation and currently supports baseload energy generation as a peaking facility for customers, currently capable of generating 60 MW. As a dispatchable generator, HREC also contributes to supporting the reliability of the electric grid in the Duluth area by mitigating potential overloads on the Duluth-area transformers during peak periods.

Figure 1. Hibbard Renewable Energy Center, Duluth, Minnesota

Since 2004, capital investments have been completed to ensure reliable energy production at HREC. The boilers continue to provide steam that drives turbine generators based on customer energy needs. The Company operates HREC for renewable energy and other ancillary services, along with being available to mitigate regional and local reliability needs. HREC is also positioned with infrastructure to provide steam sales to the Duluth Mill (Sofidel) if additional steam is needed for operations in the future.

Recently, HREC has been dispatched by MISO more frequently due to higher power prices and the Company's procurement of competitive biomass, which resulted in the facility producing energy at the higher range of a typical peaking resource. Furthermore, HREC has seen an increase in being dispatched to mitigate local reliability issues. As discussed later in this Study, there are upgrades needed to strengthen the local transmission system prior to any retirement. Hibbard not only has an important role operating as a peaking renewable resource but also provides critical reliability support under certain system conditions.

HREC boilers are fitted with pollution control technology that provide continued particulate emissions control during the operational life of the facility. The pollution control equipment achieves 99 percent control of particulate matter. HREC has increased the percentage of biomass to approximately 90 percent of fuel supply and reduced the percentage of coal fueling for the boilers to maintain industrial boiler classification under the industrial boiler maximum-achievable control technology ("MACT") rule. Capital improvements in recent years have focused on refurbishing the existing boilers to improve their reliability, wood handling, and ash handling systems to manage the increased wood burn. As discussed further in Appendix E, significant technology investments were not required at HREC for either the initial 2016 Boiler MACT Rule nor the subsequent 2020 and 2022 updated rulemakings.

While there is presently no formal retirement date set for HREC 3 and HREC4 or the HREC common facilities, HREC will be fully depreciated by 2029. Currently, the remaining balance on these units totals approximately $23 million, excluding decommissioning costs. Current operations and maintenance ("O&M") practices have continued with routine maintenance inspections performed and corrective actions implemented as needed to keep the units reliable. Capital investments are continuously reviewed and prioritized across the generating fleet, including HREC, with a goal of maintaining current capacity in a manner that maintains reliability and availability throughout the current resource planning period. For example, the Company expects planned capital improvements through 2028 will include spending on new equipment and equipment refurbishment as well as a planned roof replacement project in 2026. Minnesota Power plans to spend capital prudently at HREC to maintain the reliability of the facility for continued operations over the foreseeable planning horizon.

***Study Objectives and* Scope**

The objective of this Retirement Study is to evaluate operations scenarios and factors impacting early retirement of the HREC facility. The scope of this evaluation consists not only of power supply planning scenario creation and other important considerations but also considers local transmission upgrades needed and regional transmission planning in coordination with the Midcontinent Independent System Operator ("MISO"). This Retirement Study and its conclusions will also support the inputs for the resource plan evaluation and decisions presented in the overall 2025 IRP, including the regional economic benefits identified in the BBER Study provided as Appendix O, Attachment 1.

General Approach

The general analytical approach to evaluating potential scenarios for the early retirement of HREC is through the use of EnCompass modeling as part of the IRP, in addition to evaluating other significant considerations, such as ensuring local and regional transmission system reliability, incorporating input from stakeholders, customer impacts, and considering socioeconomic impacts of retirement of this dispatchable generation resource. This overall evaluation in the IRP, as described in IRP Appendix J, Assumptions and Outlooks, and this Study also enables consideration of a variety of nuanced cost factors including: (1) the remaining value of the asset being retired; (2) the cost of physical decommissioning and restoration of the site; (3)

the replacement cost of additional generating supply; (4) the cost of transmission upgrades required to maintain grid reliability; and (5) the avoided environmental costs or carbon regulation and environmental externality costs. Likewise, it is important to assess the effect of these factors on customer power supply costs, as well as the time it will take to build replacement generation and/or new transmission to maintain customer reliability.

Consistent with Minnesota Power's 2021 IRP, the Company has used EnCompass as the modeling tool to assess various scenarios in this 2025 IRP. However, as noted above, other factors, not all of which are quantifiable in firm costs or specific to HREC, must also be considered in creating the retirement scenarios. While this Retirement Study addresses HREC and the 2025 IRP addresses the broader fleet and resource planning overall, it is important to underscore Minnesota Power's significant contributions to reducing greenhouse gas emissions in the state as the Company is transforming the way it energizes communities and businesses through its *Energy**Forward*** resource strategy. Under its *Energy**Forward*** strategy, the Company is now delivering between 50 and 60 percent renewable energy to customers, making Minnesota Power a leader among the utilities in its region. In the 2025 IRP, Minnesota Power has committed to achieving 80 percent renewable energy for its customers by 2030, and 90 percent renewable energy by 2035, in compliance with the CFS milestones. This background underscores Minnesota Power's overall renewable transformation goals and achievements.

As part of its overall evaluation, the Company also engaged with MISO regarding potential retirement of HREC as allowed under the MISO tariff and as discussed in detail in Appendix F, Part 7, and referenced below. Because Minnesota Power is a member of MISO, any generating unit closure on the Minnesota Power system will be required to utilize the MISO Attachment Y (unit closure) process to enable retirement from the bulk electric grid, which is therefore a vital consideration in the Company's approach to retirement.

Further, the Company engaged the BBER at the University of Minnesota Duluth's Labovitz School of Business and Economics to conduct an analysis and provide a report on the broader economic effects of HREC's operations. The BBER Study shows the effects of HREC's ongoing operations and its planned capital improvement projects on St. Louis County, Minnesota as well as the economic consequences of a potential closure of the plant. The BBER Study is provided as Appendix O, Attachment 1.

Finally, Minnesota Power initiated a stakeholder process to learn priorities and considerations from a diverse group of stakeholders, which informed the overall IRP and provided input on a potential societal cost-benefit analysis of the HREC. This process and insights are described later in this Study and in the Engagement Report and Societal Cost-Benefit Analysis provided as Appendix N to the 2025 IRP.

Evaluation Framework

As noted above, identifying the appropriate timing for any future retirement of a firm dispatchable asset is a complex evaluation that includes consideration of the utility's current and future power supply needs along with energy demand growth outlooks, impacts to the reliability of the transmission system, and the time it will take to implement transmission system reliability and replacement energy solutions for the retired units. In evaluating early retirement of HREC, Minnesota Power considered impacts from the following four areas, which factor into creation of retirement scenarios for evaluation:

1. Minnesota Power's system and regional reliability;
2. Community and socioeconomic impacts;
3. Customer cost considerations; and

4. Environmental considerations.

The remainder of this Study provides an in-depth evaluation of each of the four primary areas on early retirement. The Study then addresses the feasibility of the identified early retirement scenario (2032 retirement) and uses the EnCompass model to show the impact to the 2025 Plan when HREC is retired. Lastly, the Company summarizes the insights derived from this Study. Based on a wide variety of considerations presented in this Study and in the IRP, the Company recommends that the Commission approve continued operation of HREC.

B. Perspectives on Hibbard Renewable Energy Center Retirement

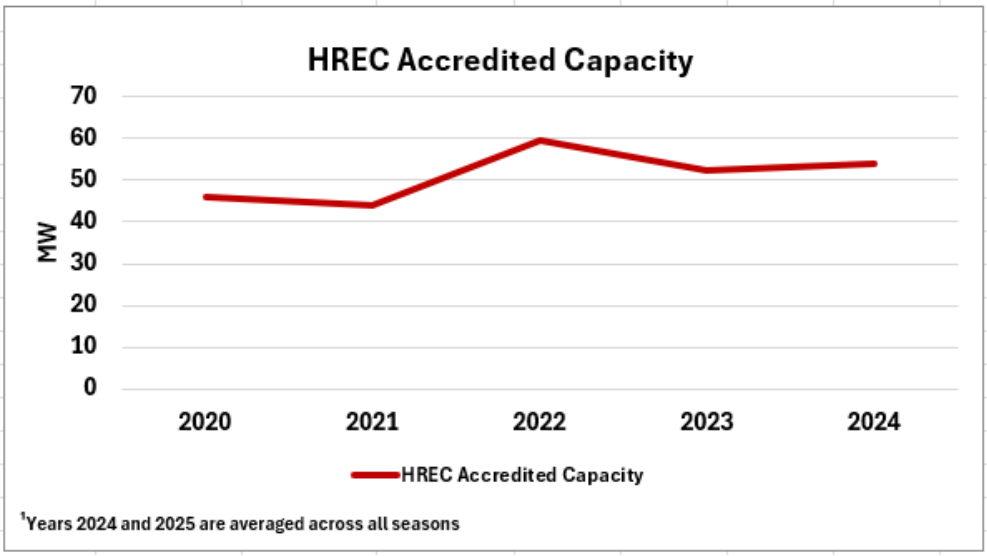
In the following sections of this Study, the Company explains its approach to creating the retirement scenarios for HREC and evaluating each perspective described above: (1) system and regional reliability considerations for retirement of dispatchable generation at HREC; (2) community and socioeconomic impacts of HREC retirement; (3) customer impacts of retirement approaches; and (4) environmental considerations.

Minnesota Power System and Regional Reliability Perspectives

Minnesota Power has the obligation to ensure adequate resources to safely and reliably serve its customers. This requires assessment of the Company's broader load-serving needs and available resources, which is undertaken in the 2025 IRP, of which this Retirement Study is a part. With respect to generation retirements, it is necessary to determine the effect of losing the HREC generation capacity on the Company's ability to serve its customers and its load. This includes consideration of not only the Company's generation capabilities, but also the needs of the local and regional transmission system.

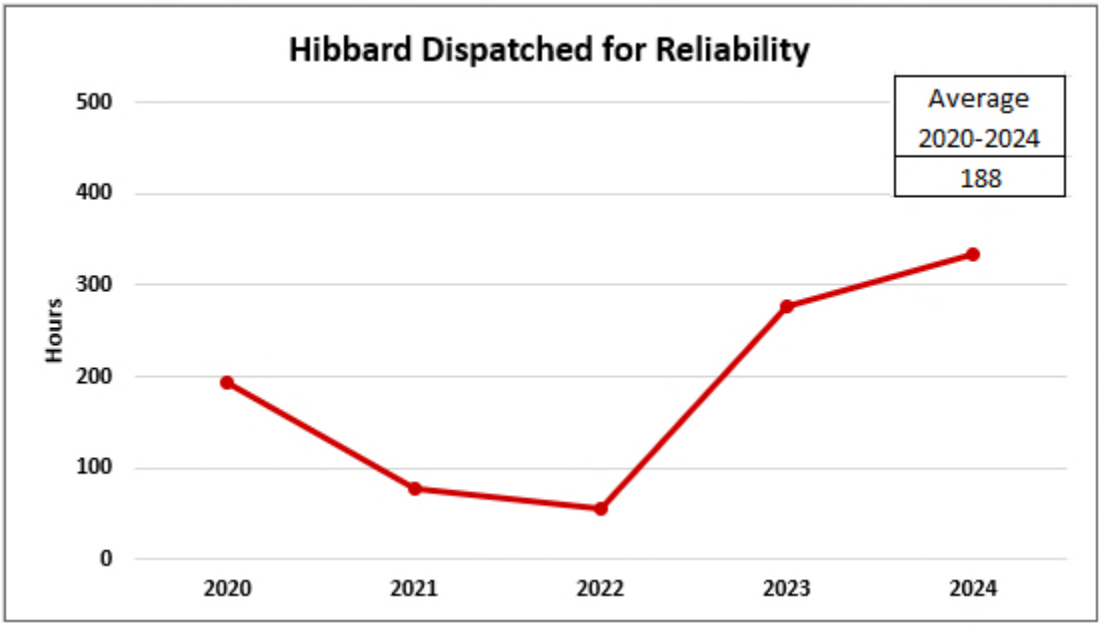
As shown in Figure 2 below, HREC has a significant and increasing role in Minnesota Power's resources to support reliability. From 2020 to 2024, the accredited capacity increased from 45 MW to 54 MW, an indication that the HREC is able to contribute more reliably to meeting electricity demand during critical periods. As a renewable resource with dispatchable capabilities, unlike intermittent resources, HREC can be called upon when needed, providing a reliable source to meet customer demand, manage variability from other resources, and help ensure grid reliability. Retiring HREC would create a loss of capacity and energy that Minnesota Power would need to address. Figure 2 outlines the MISO accredited capacity of HREC over the last 5 years.

Figure 2. Hibbard Accredited Capacity



Removing HREC would leave the system more vulnerable to fluctuations, highlighting the importance of having sufficient and flexible generating capacity like HREC. Factors that will impact the decision about when and how to replace HREC as a dispatchable resource must consider the type and timing of replacement energy and capacity and the potential impacts to system reliability of each alternative. Considerations include the timing of new resources, potential extreme market pricing, future changes in regulations, exacerbated capacity needs, and higher demand. Additionally, some alternative solutions would be inadequate on their own to support reliability. For example, while energy storage can manage the intermittency of renewables and can provide some capacity, the duration and sustained output of 4-hour, 8-hour, and 100-hour batteries compared to continuous operations of resources like HREC would be a limitation. From 2020 to 2024, HREC was dispatched on average 188 hours a year for reliability. Figure 3 below shows the yearly number of hours HREC was dispatched for reliability. These are hours where HREC is dispatched out of necessity for reasons such as the unavailability of other generation resources or system reliability. The upward trend of the utilization of HREC for reliability is striking, basically doubling in recent years as the system calls for additional dispatchable firm generation.

Figure 3. Hours HREC Ran for Reliability Annually



The reliability criteria developed by Minnesota Power emphasizes stability and dependability of the system throughout transformation of the power supply to lower or zero emitting carbon resources. The HREC Retirement Study reiterates the need for consistent alternatives to maintain reliability and to uphold Minnesota Power's commitment to a seamless transition while maintaining reliable energy service for customers. Generation access and the MISO market are discussed further below.

Turning to impacts to the transmission system, electric utilities in Minnesota serve retail service areas that are spread throughout the state, and a utility's service area is sometimes non-contiguous. Electric utilities in Minnesota and the upper Midwest (investor owned, cooperatives, and municipal utilities) have worked together for many years to develop a transmission network that will serve our respective native load customers. As a result, electric utilities in Minnesota and the region have highly interconnected transmission facilities that do not necessarily follow the patchwork of retail service area boundaries. This cooperation benefits customers by providing the transmission infrastructure needed to serve our loads at a lower cost than if the Company and neighboring utilities each independently constructed facilities to reach their respective service area loads.

It is also important to consider that Minnesota Power is a member of MISO, which operates the combined transmission system of transmission owners in its footprint, including Minnesota Power, and manages the dispatch of Minnesota Power's generation fleet. Because Minnesota Power operates under the MISO tariff, certain activity, such as the proposed shutdown of dispatchable generation, is governed by provisions of the MISO tariff, as discussed in more detail below and in Appendix F, Part 7.

For the 2025 IRP, the Company evaluated the potential impact of HREC retirement on the local and regional transmission system to identify the potential for significant reliability concerns. While the Company conducts its own evaluation and is particularly responsible for identifying local transmission reliability concerns, the full impact of a unit shutdown on the transmission system would be determined through extensive engineering coordination with MISO and other regional

counterparties in the event of any formal shutdown decision. Because HREC is a dispatchable generator, it contributes to supporting the reliability of the electric grid in the Duluth, Minnesota area. The retirement of HREC would remove one of the primary options within Minnesota Power's direct control for relieving heavy loading on the Duluth-area 230/115 kV transformers, which are the main source of power delivery to the Duluth area from the regional 230 kV network. As such, it is important to identify not only regional transmission impacts of HREC retirement, but the local transmission upgrades that would be necessary to meet local reliability needs in the event of HREC shutdown. These considerations are discussed further below and in Appendix F, Part 7.

An additional question pertaining to the impacts of the potential retirement of HREC on Minnesota Power's and the regional system is related to replacement generation. Specifically, the timing of when replacement energy can be operational by, the cost, and will it have similar operational characteristics as Hibbard (i.e., dispatchable and renewable). In the 2025 IRP, Minnesota Power studied the cost impact to the Base Plan and Growth Plan with HREC removed. The results of that analysis are discussed later in the Retirement Study.

It is also important to consider the potential benefits of site re-use. If HREC is shut down and repurposed, use of the existing infrastructure should be thoroughly evaluated and utilized, if possible, in order to ensure efficient and cost-effective use of the system. Notably, the current infrastructure holds significant value for replacement generation as an existing interconnection with the transmission system. Future replacement generation could utilize the existing infrastructure or interconnection. Finally, reinvestment in communities that have hosted utility generation for decades to help facilitate a just transition was a key insight gained through the formal stakeholder process.

Ultimately, in the event of HREC retirement, the evaluations indicate local transmission investment and/or dispatchable generation will be needed to serve Minnesota Power's customers and system reliability needs. These solutions will likely require several years to implement once a retirement decision is made, with the earliest feasible retirement of HREC in 2032.

Generation Access

MISO Market

Minnesota Power's generation is dispatched according to MISO market price signals, which has allowed the Company to optimize the value of its various generation resources. While the Company retains primary responsibility to serve its customers, and in fact each utility must do so for the MISO marketplace to function properly, the MISO market, including the Day-Ahead, Real-Time, and Ancillary Services, has allowed Minnesota Power to make economic use of the wholesale power market. Additional benefits include increased purchase and sale opportunities, more transparent pricing, a reserve sharing pool, and the ability to purchase the energy needed based on customer demand. With the progression of resource transformation from a fleet of dispatchable baseload resources to higher levels of intermittent resources and natural gas dispatchable resources, the dynamics of the markets are changing resulting in more volatile energy prices. There is an increasing need for dispatchable generation to fill gaps when wind and solar generation is unavailable, which is the role HREC has in the power supply, while being renewable itself. As Minnesota Power evaluates potential impacts due to the early retirement of HREC's dispatchable generation, the Company has identified that HREC provides fuel diversity when gas prices are high, local, and reliable energy with little congestion risk, and flexible generation when needed.

Cost is also a key consideration. The prices at which a utility can expect to sell and purchase energy in the MISO market depend heavily on whether the sale or purchase is during on- or off-peak periods or when wind/solar generating. Thus, if Minnesota Power needs additional power or

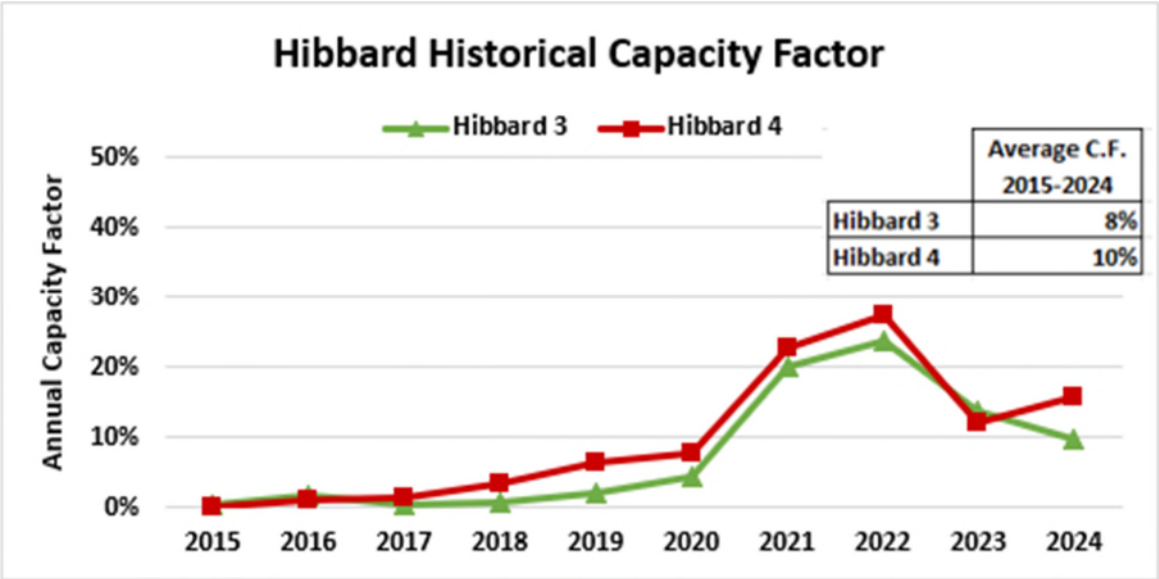
has surplus to sell in the MISO market, the price can vary significantly depending on when the energy is needed or available. With the addition of wind and solar generation, market prices now follow the variable renewable generation patterns. When the wind energy availability is higher, market prices are lower, and Minnesota Power typically has surplus energy due to its large wind portfolio. When the wind and solar energy availability is lower, the market prices are higher, and typically Minnesota Power either has to rely on its dispatchable generation fleet or purchase energy. It is in the latter case, when renewables are unavailable, that HREC energy is most valuable for customers.

These patterns are relevant to consider in the analysis of potential retirement of HREC, in multiple respects. As Minnesota Power moves further toward 90 percent renewable resources as recommended in the 2025 Plan, with higher quantities of variable wind and solar generation patterns and absent of having HREC, the Company is more likely to be a buyer than a seller in the MISO market, resulting in the Company being more at the mercy of market variability and pricing it cannot control. Finally, the MISO market can only function properly when each participating utility prepares for sufficient capacity and energy to serve its customers under most circumstances. Over-reliance on the MISO market would not only create greater pricing risk for customers, but it can also put the Company (and other utilities) at risk of insufficient access to capacity and energy necessary to provide reliable electric service. Reliability is a key component of the 2025 IRP as demonstrated with Minnesota Power introducing reliability criteria into the evaluation.

Current market outlooks are showing a need for more dispatchable generation as coal generation is retired and replaced with mostly wind and solar to date. This is resulting in MISO projecting a potential capacity shortfall as soon as Planning Year 2025-2026, according to the 2024 Organization of MISO States ("OMS")-MISO Survey.[5] In MISO, there is a need to maintain dispatchable capacity, while continuing to add new capacity to meet growing customer demand and replace retired generation. Minnesota Power is seeing the impact of the changing market dynamics on the dispatch of its own generation fleet. Figure 4 below shows a trend in increasing operations of HREC as a dispatchable resource. The more volatile market prices are supporting operating HREC at higher levels, which over the period 2015-2024 has shown an increase in capacity factor from less than 5 percent to over 20 percent as recently as 2022. Dispatchable resources, such as HREC, are needed in this region to serve Minnesota Power customers, which is supported by historical market operations.

[5] 2024 OMS-MISO Survey Results, (June 20, 2024), available at https://cdn.misoenergy.org/OMS%20MISO%20Survey%20Results%20Workshop%20Presentation628355.pdf

Figure 4. Hibbard Renewable Energy Center Historical Capacity Factor



Local and Regional Transmission Reliability

Transmission Planning Considerations

As a transmission-owning member of MISO, while Minnesota Power owns and maintains transmission assets, MISO operates the combined system, including Minnesota Power's assets, in conjunction with the transmission systems of more than 50 transmission owners. Furthermore, MISO establishes: (1) the process and rules for wholesale customers to access the transmission system on a non-discriminatory basis; (2) the annual transmission planning process for reviewing, expanding and upgrading the regional transmission system (i.e., MISO Transmission Expansion Planning ("MTEP")); and (3) the policies and procedures that provide for the allocation of costs incurred to construct certain transmission upgrades and the distribution of revenues associated with those costs. Access to the jointly-developed, multi-owned transmission grid is available under the MISO tariff, which dictates how revenues and expenses must be accounted for within the transmission system. However, each utility must also play its part in overall local and regional transmission planning.

Minnesota Power shares the responsibility of ensuring a reliable transmission system for its customers and the region, and the following section discusses transmission planning activities that would ensure a reliable system for its customers. As the generation mix has changed under the *Energy**Forward*** strategy and continues to change through the addition of more renewable energy and the potential retirement of traditional dispatchable generation like HREC – as well as across the MISO footprint – the transition must be thoughtful in order to ensure that the transmission system continues to be reliable and safe for customers.

Minnesota Power Transmission Planning Activities

When considering retirement of HREC, Minnesota Power must factor in any potentially resulting reliability concerns regarding operation of the transmission system. That is, if retirement of HREC causes concerns with the reliable operation of the transmission system, those considerations must be recognized and addressed, including allowing for the length of time anticipated to place needed improvements in service prior to retirement of the generating facility.

HREC is a dispatchable generator which contributes to supporting the reliability of the electric grid in the Duluth, Minnesota area. The retirement of HREC would remove one of the primary options within Minnesota Power's direct control for relieving heavy loading on the Duluth-area 230/115 kV transformers. These transformers provide the main source of power delivery into the local Duluth area transmission system from the regional 230 kV network. Without HREC, there are very limited options for relieving heavy loading on these three transformers as power is delivered from the higher voltage 230 kV network to the local area during peak load periods. If two of these three transformers are offline, the remaining transformer is responsible for delivering most of the power needed for serving load on the Duluth 115 kV network. When Duluth-area loads are at or near peak levels, this condition would cause the remaining transformer to overload.

Without having the necessary transmission solutions in place to maintain reliability of the system if HREC were to shut down, there will be reliability risks and uncertainties that are unacceptable under transmission planning and operating regulatory standards and customer expectations. As such, it is necessary to ensure timely implementation of reliability solutions in coordination with the HREC retirement to avoid impacting the reliable operation of the transmission system.

In coordination with MISO, and to ensure both regional and local reliability is not compromised by shutdown of HREC, Minnesota Power has conducted several steady-state planning studies to contribute to Minnesota Power's understanding of the system impacts of a potential HREC retirement. Historically, HREC has supported the reliability of the Duluth electric grid by providing power and support on the 115 kV level so that less support is needed from the higher voltage 230 kV network tied in at the substations serving the local area. Through various studies, the Duluth-area 230/115 kV transformer loading and HREC generation status have been monitored to build Minnesota Power's understanding of a HREC retirement. The transmission system analysis of HREC retirement is provided in Appendix F, Part 7.

The discussion of the studies in Appendix F, Part 7 begins with regional impacts evaluated through the MISO Generator Retirement Study process (i.e., Attachment Y-2 Study) and then discusses Minnesota Power's complementary "Hibbard Retirement Targeted Investigation" assessing the local impact of potential HREC retirement to the Duluth-area transmission system. These studies are summarized below:

- MISO Generator Retirement (Attachment Y-2) Study**:** In January 2024, Minnesota Power submitted an Attachment Y-2 Study request to MISO for a transmission system reliability assessment of a HREC retirement. Mirroring the standard MISO generator retirement study (Attachment Y) process, the Attachment Y-2 Study was an information-only study of various scenarios to identify reliability issues due to the potential retirement of the HREC units. The HREC Attachment Y-2 Study is also discussed in Appendix F, Part 7. Some of the constraints identified by MISO in the Attachment Y-2 were similar to Duluth-area 230/115 kV transformer constraints Minnesota Power had observed in previous planning studies and real-time operations. While MISO's methodology for Attachment Y studies allows for redispatching remaining online generators out of economic merit order to address these constraints, the approach represents a short-term solution. Additional targeted analysis of the local area is necessary to identify the appropriate long-term solution for the underlying issues leading to these constraints. To gain a deeper understanding of transmission impacts from HREC retirement with a greater focus on long-term solution development, Minnesota Power conducted a targeted power flow study of the local Duluth-area network impacts.

- Hibbard Retirement Targeted Investigation**:** The "Hibbard Retirement Targeted Investigation" targets specific contingencies that have historically been stressful for the Duluth-area 230 kV and 115 kV transmission system using models that simulate more locally stressed power flow scenarios than those in standard model sets but are similar to those experienced under real operating conditions. This study showed that there is a long-term need for more 230/115 kV transformer capacity in the Duluth area with or without the availability of HREC, but that retaining HREC on the local 115 kV network provides important near-term relief for these heavily-loaded transformers. If HREC were to be retired, this long-term (ten years or more) planning horizon need for more transformer capacity would become an immediate need within the next one to five years, and there would be a risk of reliability issues related to overloading these transformers in real-time operations during peak load periods. These findings align with Minnesota Power's experiences in real-time operations, where HREC is called upon occasionally during outages of the Duluth-area 230/115 kV transformers.

In sum, regional reliability requirements, along with Minnesota Power's and MISO's capacity needs, present key considerations and fundamental requirements for any early retirement plan for HREC. MISO market factors, including the ongoing move to renewable, intermittent generation, along with the tightening energy markets, each provide opportunities and challenges for the early retirement of dispatchable resources.

Community and Socioeconomic Perspectives

Resource planning decisions can have real-life socioeconomic impacts on communities that "host" generation plants, which should also be considered in deciding whether to retire a generation resource. In this case, the Company used two reports, one evaluating the economic and social impacts of retirement of HREC (the BBER Study, provided as Appendix O, Attachment 1) and the other evaluating the Company's 2025 Plan on communities, surrounding areas, and the state (the Socioeconomic Impacts Assessment, provided as Appendix M). Additionally, as part of planning for its IRP, Minnesota Power worked with Great Plains Institute ("GPI") as the facilitators of an engagement process that elicited input on key impacts of resource planning on communities, among other impacts. This process is described in more detail in Appendix N.

Economic Impacts of Hibbard Renewable Energy Center on St. Louis County, Minnesota

As noted above, Minnesota Power engaged the BBER at the University of Minnesota Duluth's Labovitz School of Business and Economics to conduct a study to better understand the broader economic effects of HREC's operations as well as the economic consequences of a potential closure of the plant. The BBER Study used IMPLAN economic modeling software and was based on inputs provided by the Company, including operational data for 2022-2023 and projected capital investments for the five-year period 2024-2028.[6]

As discussed in the BBER Study, the economic impact analysis tracks the initial economic activity through multiple rounds of industry and consumer spending to show the multiplier or ripple effects through a local economy. The initial activity (HREC operations) is considered the direct effect, the resulting increase in industry spending is the indirect effect, and the resulting increase in consumer spending is the induced effect. Results are measured in employment, output, labor income, and value-added spending (Gross Domestic Product). Spending within the study area also provides significant tax impacts to the local, county, state, and federal governments. Further,

[6] For data not provided by the Company, the UMD research team relied on IMPLAN estimates and secondary data sources as inputs.

planned capital improvement projects over the next five years support additional employment and labor income as well as value added spending in St. Louis County.

Examples of the economic impacts discussed in the BBER Study include the following:

- Based on current operations, HREC provides direct, full-time employment to 24 Minnesotans, and including indirect and induced effects, supports a total of 62 jobs in the region.
- Including indirect and induced effects, each year HREC operations generate a total of $5.0 million in labor income, $7.8 million in value added (Gross Domestic Product), and $26.1 million in economic output (meaning the total value of all goods and services produced by HREC operations).
- In a typical year, HREC generates tax revenue of approximately $0.6 million for county and local entities, and approximately $1.1 million for the state of Minnesota. In total, including local, county, state, and federal tax revenue, HREC generates $2.9 million annually.
- Planned capital improvement projects for period 2024-2028 are predicted to support 157 jobs, $12.1 million in wages and benefits (labor income), $16.6 million in value added spending, and $28.6 million in total economic output.

Closure of HREC would result in the disappearance of these economic contributions to St. Louis County and the state of Minnesota. Additionally, St. Louis County would miss out on the cumulative economic output associated with planned capital investments, as well as any tax revenue associated with HREC projects. These economic impacts, considered in conjunction with the other factors and modeling results discussed in this Retirement Study and in the IRP, support continuing operations of HREC.

The BBER Study, provided as Appendix O, Attachment 1, provides additional detail related to the effects of HREC's ongoing operations and planned capital improvement projects on St. Louis County, as well as the economic consequences of potential retirement of the plant.

Community Input

As part of planning for its 2025 IRP, Minnesota Power worked with GPI as the facilitators of an extensive engagement process that elicited input on key impacts of resource planning on communities, among other impacts. As it relates to potential retirement of HREC specifically, the engagement process elicited information related to a potential societal cost benefit analysis ("SCBA") of HREC, considering impacts on host communities, workforce, economics, health, system reliability, the environment, and customer costs. The engagement process, along with this Retirement Study, complies with the Commission's Order in the Company's 2021 IRP, requiring that Minnesota Power evaluate the economic impacts of the potential closure of HREC. More information on the engagement process and the SCBA conducted for HREC can be found in Appendix N.

Customer Cost Considerations

The estimation of customer impacts is a further integral part of the planning process. In addition to the non-cost factors discussed throughout the IRP and this Retirement Study, Minnesota Power continues to identify and implement prudent power supply projects through its resource planning process, by comparing power supply alternatives to identify the most reasonable cost solution to meet customer load requirements. Responsible planning in turn leads to reasonably priced and reliable electric service. Power supply cost trends are tracked and analyzed through the planning process to give insight into the range of customer impacts that can

be expected under the scenarios evaluated. This evaluation of unit retirement also considers the remaining asset value, and any decommissioning costs associated with the facility, which need to be factored into a holistic analysis of early retirement and available alternatives.

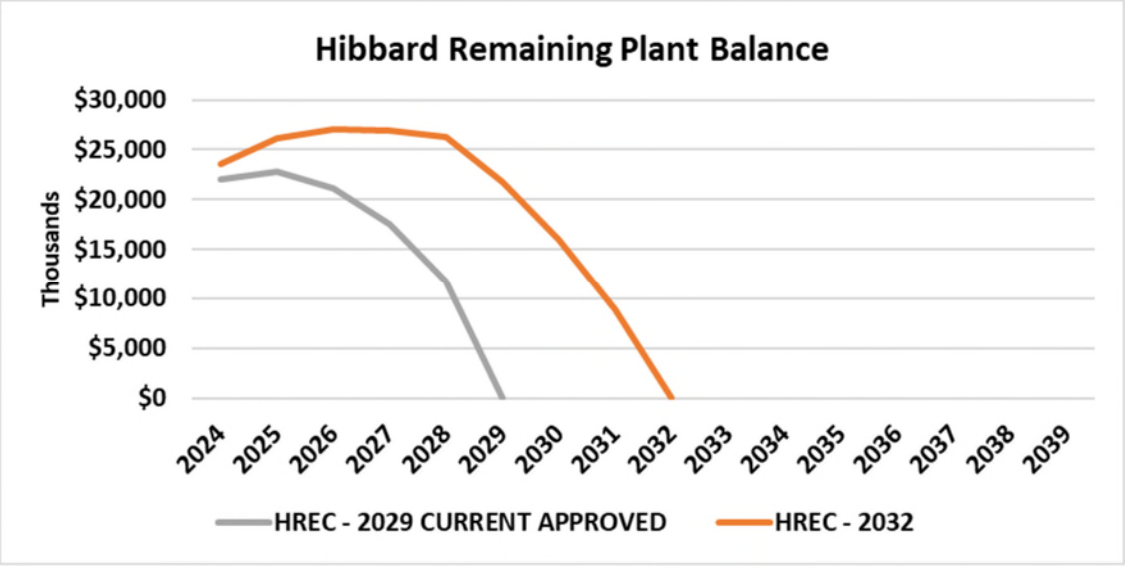
During the 2025 IRP engagement process, participants likewise expressed a significant interest in the competitiveness of rates for all customers, particularly Minnesota Power's large industrial customers. In addition, stakeholders expressed significant concern for the reliability of power for customers, including any need to curtail industrial customers. Stakeholders also expressed concerns with the affordability of customer rates due to increased use of renewable energy.

The costs of retiring HREC are discussed later in this section. The EnCompass model was used to study the impact of retiring HREC in the Base Plan and Growth Plan. This Study also provides an overview of remaining costs of HREC and associated cost factors and impacts to the power supply in the IRP analysis identified below.

Hibbard Renewable Energy Center Depreciation Schedule

HREC3 and HREC4 are currently scheduled to be fully depreciated by 2029. The remaining depreciable life for HREC is shorter than the estimated operational life through 2035 that was used in the Company's 2021 IRP analysis. At this time, the remaining balance on these units totals approximately $23 million (excluding decommissioning costs). Depending on the actual retirement date, undepreciated capital amounts could remain for these units, as indicated in Figure 5 below. Decommissioning cost for HREC are currently estimated at approximately $10 million.

Figure 5. Hibbard Remaining Plant Balance



At the time of HREC retirement in 2032, the Company's avoided annual fixed O&M would be an estimated $7 million per year.

EnCompass Analysis

The remaining plant balances and fixed O&M data described above are factored into the IRP analysis that informed the Company's 2025 Plan. These data points were included in the revenue requirements used in the EnCompass modeling, along with ongoing capital and fuel costs for HREC3 and HREC4.

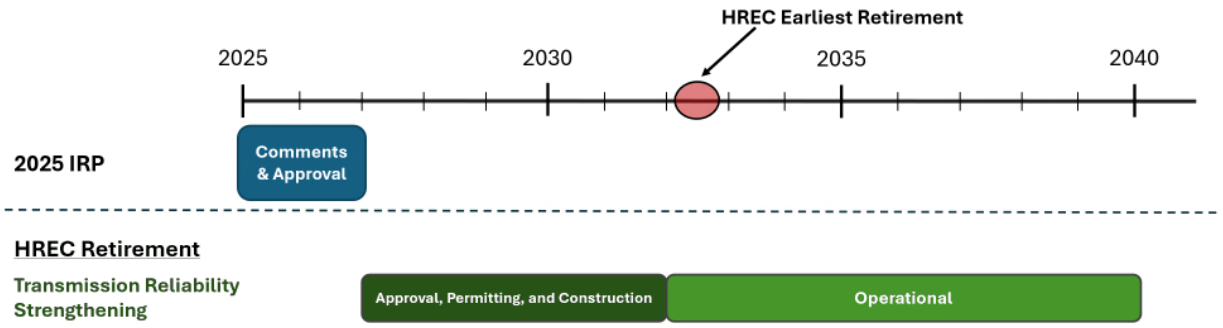
Minnesota Power used the EnCompass model to determine if a shutdown of a generation resource is part of the lowest cost plan. To conduct this analysis, the Base Plan and Growth Plan was contrasted with a Hibbard retirement scenario. Impacts to the power supply were evaluated and showed an overall increase in total planning cost when HREC is retired. In the short-term, regional reliability and transmission needs were identified as the largest limiting factors for retirement of HREC, followed by community impacts and the potential costs of retiring and replacing HREC capacity and energy.

Consistent with these factors, the Company evaluated the scenarios presented below for the early retirement of HREC:

1. 2025 Plans (Base Plan and Growth Plan): HREC continue operations; and
2. Retirement of HREC: Both units retire end of 2032.

Figure 6 below also provides an illustrative depiction of the estimated time needed to implement improvements to the transmission system to accommodate early retirement of HREC.

Figure 6. Approximate Timeline for Construction of Grid Strengthening Projects Required to Accommodate HREC Retirement



Capacity Position Impacts with HREC Retirement

Table 1 below shows the Load and Capability ("L&C") capacity position for the summer season for the Base Plan and Growth Plan recommended in 2025 IRP, and the impact to these capacity positions with HREC retired. HREC accredited capacity is approximately 50 MW. The period between 2025-2035 shows a generally short capacity position, which gets worse with the retirement of HREC. This demonstrates the importance of HREC's capacity during a period of potential significant demand growth, uncertainty of the impact to the capacity position with MISO's transition to Direct Loss of Load ("DLOL"), and when MISO is communicating potential for capacity shortfalls regionally. The importance of Table 1 and Figure 6 is to align the complex timeline in retiring HREC, adding replacement capacity and energy, while strengthening the system. The outcome is that the earliest retirement date the Company could consider in the IRP analysis is the end of 2032, although depending on when new replacement energy and capacity can be constructed and operational, retirement could be delayed beyond 2032.

Table 1. 2025 Summer Base and Growth Plan L&C with Hibbard Retired[7]

	Base Plan (MW)	Base Plan W/O Hibbard (MW)	Growth Plan (MW)	Growth Plan W/O Hibbard (MW)
2025	16	(38)	16	(38)
2026	(89)	(143)	(89)	(143)
2027	82	30	82	30
2028	(32)	(83)	(102)	(153)
2029	32	(20)	(225)	(277)
2030	2	(50)	309	257
2031	(13)	(64)	163	111
2032	(30)	(82)	(15)	(66)
2033	(40)	(92)	(73)	(124)
2034	(41)	(93)	(29)	(81)
2035	181	129	149	98
2036	178	127	147	95
2037	254	202	145	93
2038	251	199	298	247
2039	245	193	288	236

In Table 2 below, the revenue requirements, carbon regulation, and externalities costs that were included in the EnCompass model are summarized and compared against the HREC retirement scenario. When retiring both units in 2032, costs increased by approximately $104 million in the base demand scenario and by approximately $76 million in the growth scenario.

Table 2. Hibbard 15-Year Net Present Value Cost Summary of Retirement

15-Year NPV Revenue Requirements ($M)				
	Base Plan		Growth Plan	
	Preferred Plan	Hibbard Retirement	Preferred Plan	Hibbard Retirement
Power Supply	$7,870	$7,850	$11,155	$11,128
CO_2 Regulation	$539	$553	$708	$722
Environmental Cost	$7,639	$7,748	$8,816	$8,906
Total	$16,047	$16,151	$20,679	$20,755

[7] From 2025 through 2027, the L&C is based on MISO's current seasonal accredited capacity ("SAC") methodology. For 2028 forward, the L&C is based on MISO's DLOL methodology.

Environmental Regulations and Policy

As noted in this Study and discussed in the 2025 IRP, Minnesota Power is a leader in environmental stewardship, planning to exceed its carbon emissions reduction goals that the state has implemented in carrying out its mission to have a lower carbon-intensive future. Through its *Energy**Forward*** strategy, Minnesota Power's commitment to adding carbon-minimizing resources has resulted in the removal of tons of carbon from its generation portfolio. Minnesota Power is proud that its generation portfolio now consists of between 50 and 60 percent renewable energy. Additionally, the actions Minnesota Power has proposed in the 2025 Plan will result in 95 percent reduction in CO_2 emissions (from 2005 levels) by 2035 through implementation of its *Energy**Forward*** strategy.

HREC meets or exceeds all currently applicable environmental standards. HREC has mechanical dust collectors ("MDCs") followed by electrostatic precipitators ("ESPs") installed after each boiler to control particulate matter emissions. In addition, the units have been outfitted with cinder reinjection systems which function to reduce the carryover of ash and unburned particles that would otherwise increase the workload of the MDCs and ESPs. The ESPs and MDCs combined are estimated to have an overall control efficiency of 99 percent for particulate matter emissions. The ESPs also reduce emissions of lead, mercury, and other metals through particulate control. Other efforts to minimize environmental impacts include boiler combustion tuning and routine system maintenance.

Environmental Regulation

The Company complies with all federal and state environmental laws applicable to HREC and monitors the status of proposed regulations. At this time, no additional major capital investments are anticipated to keep HREC in compliance with existing environmental regulations. An overview of applicable regulations and facility compliance strategies are discussed in Appendix E.

Environmental Impacts on Retirement Planning for Hibbard Renewable Energy Center

Environmental regulations and policy goals factor into all aspects of resource planning, including plans for early retirement of the HREC units. One important consideration is that no significant controls or retrofits are anticipated for HREC, barring new regulations.

HREC also provides an important environmental function enabling the beneficial use of wood and wood waste for energy production. Approximately 90 percent of all ash produced at HREC is used as a soil nutrient on area farmlands, reducing the amount of ash being landfilled.[5] HREC provides an important outlet for unmerchantable roundwood affected by emerald ash borer, spruce budworm, and other pests, as it is one of the only biomass facilities north of the Twin Cities within an Emerald Ash Borer quarantine zone, allowing it to receive infested wood for combustion without a compliance agreement. This public service allows for beneficial use of otherwise unmerchantable roundwood.

Retiring HREC early may, nonetheless, avoid certain state planning environmental and regulation costs that would otherwise be incurred going forward from the date of retirement. However, savings related to avoided environmental effects as a result of early retirement may not result in lower rates for customers.[8] In other words, if the retirement of a generation resource is

[8] The Minnesota environmental costs of several pollutants and carbon regulation costs are added onto generation included within the power supply that emit these pollutants. These costs are removed when generation is retired but are netted with the costs of emissions from replacement energy, which is called an "Environmental Costs" impact. Thus, environmental or regulatory costs that are avoided factor into retirement decisions for resources in Minnesota Power's system.

part of a least-cost resource plan that factors in avoided environmental costs, it may nevertheless result in higher rates for customers. Likewise, the nature of replacement resources, and their associated environmental costs (or avoided environmental costs) will further affect customer rates. Moreover, while direct emissions from HREC may decrease if retired, there could be a net increase in emissions if HREC is retired depending on the replacement generation type selected to provide the same energy, capacity, and dispatchable capabilities as HREC provides today. With HREC being a renewable resource and net-carbon free,[9] the environmental cost increases in Minnesota Power's power supply at retirement – as shown above in the EnCompass model analysis discussed in section 3 – Customer Cost Considerations.

Ultimately, the consideration of environmental impacts – from both a societal and revenue requirements perspective – requires a multi-faceted, complex analysis of sometimes competing factors. The factors in this Study pertaining to HREC are likewise part of the Company's broader resource planning analysis in the IRP.

C. Conclusions

This HREC Retirement Study evaluates the impacts of the potential closure of HREC. Based on this information, Minnesota Power developed insights into potential resource planning decisions related to HREC. The results of this Study informed the recommendation to continue to operate HREC. Minnesota Power will continue to monitor and seek clarity on the impacts of MISO resource adequacy reform (i.e., DLOL), the timeline to add new gas generation to the power supply, the trajectory for customer demand growth, and the timeline for upgrades to strengthen the network to facilitate a retirement – and how these outcomes impact HREC's operations.

Furthermore, by providing information on socioeconomic impacts of potential HREC retirement, this Study provides information associated with the Commission's 2021 IRP Order. Additional information in compliance with the Commission's 2021 IRP Order is provided in the Engagement Report and Societal Cost-Benefit Analysis provided as Appendix N.

[9] The Company's position is that biomass can be a net carbon free resource when considering the life-cycle analysis of the fuel supply. The Commission has initiated proceedings to address compliance with the CFS based on a life cycle analysis in Docket No. E-999/CI-24-352.

The Economic Impact of the Hibbard Renewable Energy Center on St. Louis County, Minnesota

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BUREAU OF BUSINESS AND ECONOMIC RESEARCH

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Executive Summary

The M. L. Hibbard Renewable Energy Center (HREC), operated by Minnesota Power in Duluth, Minnesota, is a renewable energy facility that uses waste wood biomass to generate electric power. Originally constructed in 1931, HREC produces roughly 114,000 megawatts (MW) of electricity annually, of which about 14,000 MW are used to operate the power plant itself. The remaining electricity produced is sold to the grid, the electric power system, where it is used to power homes and businesses in and around Duluth.

In January 2023, the Minnesota House of Representatives passed a bill mandating that all utilities in the state generate 100% of their electricity from carbon-free sources by 2040. A key point of debate within the implementation of the law is whether energy from wood biomass facilities, such as HREC, should qualify as carbon-free. In response, the Minnesota Public Utilities Commission requested that Minnesota Power evaluate the economic impacts of the potential closure of HREC.

To better understand the broader economic effects of HREC's operations, Minnesota Power engaged the Bureau of Business and Economic Research (BBER) at the University of Minnesota Duluth's Labovitz School of Business and Economics (LSBE) to conduct an economic impact analysis of the facility. This study shows the effects of HREC's ongoing operations and its planned capital improvement projects on St. Louis County, Minnesota as well as the economic consequences of a potential closure of the plant.

According to Minnesota Power, HREC generates roughly $18.2 million in annual revenue for the company in a typical year of operations. The facility also employs 24 workers who earn approximately $2.5 million in wages and benefits.

Each year, HREC spends roughly $9.2 million on intermediate goods and services like energy, materials, and professional services. These expenditures contribute to a ripple effect across the economy, as local industries and households benefit from the indirect and induced spending generated by HREC's activities.

Using the IMPLAN economic modeling software, the BBER estimated the economic impacts of HREC's operations. In total, the facility supports a total of 62 jobs in St. Louis County, contributes $5 million in labor income, adds $7.8 million in value added (Gross Domestic Product) to the county's economy, and produces an overall economic output of $26.1 million. County industries benefiting the most from HREC's activities include durable goods wholesale, waste management, industrial machinery repair, and local government enterprises. Furthermore, HREC's presence generates significant tax revenue, estimated at $2.9 million annually, which supports county, state, and federal governments.

Minnesota Power has proposed nearly $28 million in capital improvement projects for HREC in the years of 2024 to 2028. In total, these projects are estimated to provide $12.1 million in wages and benefits, $16.6 million in value added spending, and an additional $28.6 million in output to the county's economy, for the five-year period. Additionally, the capital improvements are anticipated to support an average of 31 jobs annually during the period.

The potential closure of HREC would result in substantial economic losses for St. Louis County, including the loss of $5 million annually in labor income, $7.8 million in value added, $26.1 million in annual economic output, and $2.9 million in tax revenue. The projected capital investments totaling over $28 million would also be forfeited.

★ ★ ★

Economic Impacts of Hibbard Renewable Energy Center on St. Louis County, Minnesota

I. Project Description

Minnesota Power is a utility company based in Duluth, Minnesota, and is owned by ALLETE, Inc., a publicly held energy company. Minnesota Power provides energy to roughly 150,000 residential customers, 14 municipalities, and several large industrial customers. As of November 2024, more than 50% of the company's electricity was produced from renewable energy sources. One source of renewable energy for the company is the M. L. Hibbard Renewable Energy Center (HREC) located in Duluth, Minnesota.

Originally built in 1931 as the Hibbard Steam Electric Generating Station, HREC burns wood waste, or biomass—such as left over scraps from loggers and wood manufacturing plants—as a feedstock to produce electricity for Duluth and the surrounding region. Boilers burn the wood at temperatures reaching 700 degrees Fahrenheit to create steam, which turns two giant turbines to generate electricity. Approximately 90% of the ash produced as a biproduct from burning biomass at HREC is used as a soil nutrient on area farmlands, reducing the amount of ash being landfilled.

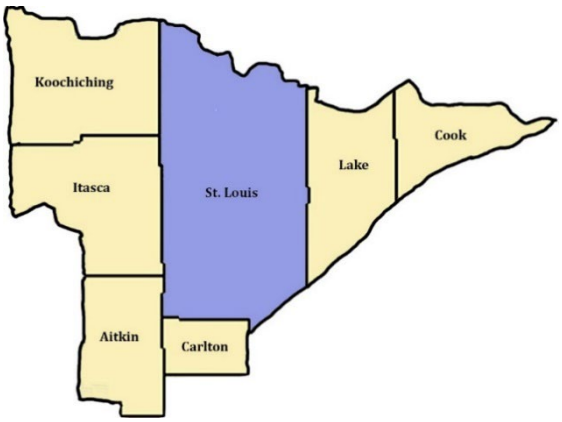
In January 2023, the Minnesota House of Representatives passed a landmark bill requiring all state utilities to produce 100% of their electricity from carbon-free sources by 2040. The Minnesota Public Utilities Commission (PUC), a governor-appointed board that regulates utility providers, is currently considering whether energy produced by sources like waste-to-energy incinerators and wood biomass burning plants (such as HREC) should be considered carbon-free under that law.

To help inform their decision, the Minnesota Public Utilities Commission has requested that Minnesota Power study the economic impacts of a potential closure of HREC.

Minnesota Power contacted the Bureau of Business and Economic Research (BBER) at the University of Minnesota Duluth's Labovitz School of Business and Economics to estimate the economic impact of HREC on St. Louis County (Figure 1). This study includes the impacts from the facility's current operations and planned capital improvement projects. It also examines the potential negative economic impacts on the county if the facility were to close.

The research team used the IMPLAN input-output modeling data and software for modeling economic impacts. The data used was the most recent IMPLAN data available, which is for the year 2022.

Figure 1. St. Louis County, Minnesota



SOURCE: WIKIPEDIA, BBER

II. Inputs and Assumptions

The following section describes the inputs required for modeling the impacts of the Hibbard Renewable Energy Center (HREC). Data was provided by Minnesota Power, and the research team worked under the assumption that the company provided good-faith estimates. In instances where data were not provided by the company, the research team relied on IMPLAN estimates and secondary data sources as inputs.

Current Operations

In 2022 and 2023, HREC produced an average of 114,248 megawatts (MW) of electricity annually, of which about 14,000 MW were used to operate the power plant itself. The remaining electricity produced (101,119 MW) was sold to the grid to power homes and businesses. According to the company's revenue estimates, HREC generates roughly $18.2 million in annual revenue for the company in a typical year of operations. The facility also employs 24 workers who earn approximately $2.5 million in wages and benefits.

Table 1. Hibbard Renewable Energy Center Operational Inputs (Typical Year)

Modeling Inputs	*Value for a Typical Year of Operations (Based on 2022-23 average)*
Gross electric power generation (MW)	114,248
Sellable electric power generation (MW)	101,119
Projected revenue, in 2024 ($)	18.2 million
Intermediate Inputs ($)	9.2 million
Wages and Benefits ($)	2.5 million
Employment	24

SOURCE: MINNESOTA POWER, IMPLAN

Estimated spending on intermediate inputs—goods and services such as energy, materials, and professional services that are used in the facility's production—equaled approximately $9.2 million. Table 2 below includes the 10 commodities that represent the largest share of the biomass electric power generation industry's intermediate inputs. In total, 119 unique commodities were used to create the spending pattern.

Table 2. IMPLAN Commodities Used in Modeling Hibbard Renewable Energy Center Operations

Description
Wholesale – other durable goods
Waste management and remediation services
Office administration services
Commercial and industrial machinery and equipment repair and maintenance
Wholesale – machinery, equipment, and supplies
Water, sewage, and other systems
Power boilers and heat exchangers
Electronic and precision equipment repair and maintenance
Architectural, engineering, and related services
Commercial and industrial machinery and equipment rental and leasing
Plus 109 other commodities

SOURCE: IMPLAN

To model the economic impact of HREC for a typical year of operations, the research team used a tool in IMPLAN called an "Industry Impact Analysis." Industry impact analysis is used to analyze the economic impact of some industry activity when more detailed information about the industry or company—such as employment, wages, intermediate inputs, and other key metrics—is known.

Capital Improvement Projects

Minnesota Power plans to dedicate nearly $28 million to various capital improvement projects for HREC during the five-year period from 2024 to 2028. Projected annual spending for each of the five years along with the IMPLAN sectors used in modeling are shown in Table 3, below. Check marks indicate if the company expects there will be spending for that sector in that year.

Table 3. Hibbard Renewable Energy Center Capital Improvement Projects (2024-2028)

	2024	*2025*	*2026*	*2027*	*2028*	*Total*
Projected capital spending (in millions)	$5.0	$6.4	$5.4	$5.2	$5.9	$27.9
Wholesale machinery, equipment, and supplies	✓	✓	✓	✓	✓	
Commercial/industrial machinery and equipment repair, maint.	✓	✓	✓	✓	✓	
Architectural, engineering, and related services	✓	✓	✓	✓	✓	
Maintenance and repair construction of nonresidential structures			✓			

SOURCE: MINNESOTA POWER, IMPLAN

According to the company, all the planned projects will require engineering services, the procurement of new equipment (i.e., wholesale machinery, equipment, and supplies sector), and the labor to install the equipment (i.e., commercial/industrial repair and maintenance). In addition, the maintenance and repair construction noted in 2026 is related to a planned roof replacement project.

III. Findings

The inputs described in the previous section were used to model the economic impacts—direct, indirect, and induced—of the M. L. Hibbard Renewable Energy Center's (HREC) operations and proposed capital improvement projects on St. Louis County, Minnesota.

Economic impact analysis tracks an initial economic activity (like HREC's operations) through multiple rounds of industry and consumer spending to show the multiplier or ripple effects through a local economy. The initial activity is considered the direct effect, the resulting increase in industry spending is the indirect effect, and the resulting increase in consumer spending is the induced effect. Results are measured in employment, output, labor income, and value added. All results are shown in millions of dollars for the year 2024.

Current Operations

Table 3 shows the estimated economic impacts of HREC on St. Louis County from a typical year of operations. Employment represents the number of jobs that the facility supports both directly and through indirect and induced effects. As shown in the table, 62 jobs are supported in the study area by the facility's operations.[1]

Table 3. Hibbard Renewable Energy Center Operations Economic Impact, Typical Year (in Millions of Dollars)

Impact Type	*Employment*	*Labor Income*	*Value Added*	*Output*
Direct Effect	24	$2.5	$3.8	$18.2
Indirect Effect	23	$1.7	$2.6	$5.4
Induced Effect	15	$0.8	$1.5	$2.5
Total Effect	62	$5.0	$7.8	$26.1
Multiplier	2.58	2.00	2.05	1.43

*Totals may not sum due to rounding
SOURCE: IMPLAN

Labor income is the total of all employee compensation. This includes wages, benefits, and payroll taxes for full- and part-time workers. In a typical year of operations, HREC contributes roughly $5 million in labor income (wages and benefits) to St. Louis County's economy.

Value added refers to the contribution to the gross domestic product made by an individual producer, industry, or sector. In this case, HREC. Value added includes employee compensation, proprietor income, and other property income and taxes. In a typical year of operations, HREC contributes roughly $7.8 million in additional value added to the study area's economy.

Output is the total value of all goods and services produced by a business (in this case, all spending generated from HREC's operations). According to the results of modeling, HREC supports $26.1 million in additional output to the economy in a typical year of operations.

The last row in the table shows the multipliers associated with each effect. A multiplier indicates how much additional spending is added to the study area's economy for each dollar in direct spending. For example, an employment multiplier of 2.58 indicates that for every one job created by HREC in St. Louis County, another 1.58 jobs are added in other supporting industries.

The industries that see the largest economic impacts in the study area because of HREC's operations—

[1] For more details on the data sources and assumptions used by IMPLAN's input-output model, see Appendix B.

beyond the electric power generation industry itself—include durable goods wholesalers, waste management and remediation, commercial and industrial machinery and equipment repair and maintenance, and machinery, equipment, and supplies wholesalers. Other impacted industries include local government enterprises, owner-occupied dwellings, and hospitals.

Closure of HREC would result in a loss of $5.0 million in employee income, $7.8 million in value added spending, and $26.1 million in total output in St. Louis County.

Spending within the study area also provides significant tax impacts to the local, county, state, and federal governments. Table 4 below outlines the projected tax impacts created because of HREC's operations.

Table 4. Hibbard Renewable Energy Center Operations Tax Impact, Typical Year (in Millions of Dollars)

Impact Type	*County and Local*	*State*	*Federal*	*Total*
Direct Effect	$0.5	$0.8	$0.6	$1.8
Indirect Effect	$0.06	$0.2	$0.4	$0.6
Induced Effect	$0.06	$0.1	$0.2	$0.4
Total Effect	$0.6	$1.1	$1.2	$2.9

*Totals may not sum due to rounding
SOURCE: IMPLAN

As the table shows, in a typical year of operations, HREC generates tax revenue of $0.6 million for county and local entities, $1.1 million to the state of Minnesota, and $1.2 million to the federal government. Overall, the modeling indicates that HREC generates approximately $2.9 million in total tax revenue. Closure of the facility would result in a decrease in tax revenue of $2.9 million for local, state, and federal agencies.

Capital Improvement Projects

Over the next five years, HREC's proposed capital improvement projects are predicted to support $12.1 million in wages and benefits (labor income), $16.6 million in value added spending, $28.6 million in total output, and 31 jobs annually.[2] Closure of HREC would mean that the economic impacts from these capital improvement projects—totaling $28.6 million over five years—would not be felt in the county.

Table 5. Hibbard Renewable Energy Center Capital Spending, Total Effects by Year (in Millions of Dollars)

Total Effects	*Employment*	*Labor Income*	*Value Added*	*Output*
2024	27	$2.1	$2.9	$5.0
2025	36	$2.8	$3.8	$6.5
2026	32	$2.5	$3.4	$6.0
2027	29	$2.2	$3.1	$5.2
2028	33	$2.5	$3.4	$5.9
Total	31	$12.1	$16.6	$28.6

*Totals may not sum due to rounding
*Employment total is an annual average
SOURCE: IMPLAN

[2] It should be noted that while the dollar values shown in the "Total" row at the bottom of Table 5 (i.e., labor income, value added, and output) represent the sum of economic impacts for the full project, employment totals represent the average number of workers employed by the project per year. This is because many of the jobs supported by the capital improvement projects continue each year.

IV. Conclusions

The economic impact analysis conducted by the Bureau of Business and Economic Research estimated the contributions of the M. L. Hibbard Renewable Energy Center (HREC) to the economy of St. Louis County, Minnesota. According to the results of our analysis, HREC supports 62 jobs in the region, directly employing 24 individuals with $2.5 million in wages and benefits annually.

Including indirect and induced effects, the facility generates a total of $5.0 million in labor income, $7.8 million in value added (Gross Domestic Product), and $26.1 million in economic output each year. Additionally, HREC contributes $2.9 million in tax revenue annually, benefiting county, state, and federal governments.

The ripple effects of HREC's annual $9.2 million in spending on intermediate goods and services support key industries such as durable goods wholesale, waste management, and industrial machinery repair.

Planned capital improvement projects are estimated to support 157 jobs and $12.1 million in labor income for the five-year period. The projects are also expected to produce $16.6 million in value added spending and $28.5 million in total output. The output multiplier of 1.55 indicates that for every dollar spent on capital improvement projects, another $0.55 is spent in the study area by households and supporting industries.

If HREC were to close, its economic contributions would disappear entirely. This would mean an annual loss of $5.0 million in employee compensation, $26.1 million in total output, and $2.9 million in tax revenue. Over the next five years, St. Louis County would miss out on a cumulative $28.5 million in economic output, as well as any tax revenue associated with HREC's projects.

NOTE - Readers are encouraged to remember the UMD Labovitz School's BBER was asked to supply an economic impact analysis only. Any subsequent policy recommendations should be based on the big picture of total impact.

Appendix A. Definitions Used in this Report

Biomass: Organic matter used as a fuel, especially in a power station for the generation of electricity

Carbon-free: Energy produced from resources that generate no carbon emissions

Direct effect: Initial new spending in the study area resulting from the project

Economic impacts: The effects of an event on the economy in a specified area, ranging from a single neighborhood to the entire globe. It usually measures changes in business revenue, business profits, personal wages, and/or jobs.

Employee compensation: In IMPLAN, employee compensation is the sum of all wages and salary income plus benefits.

Employment: Estimates (from U.S. Department of Commerce secondary data) are in terms of jobs, not in terms of full-time equivalent employees. Therefore, these jobs may be temporary, part-time, or short-term.

Grid: A network of cables or pipes for distributing power, especially high-voltage transmission lines for electricity

Indirect effect: The additional inter-industry spending from the direct impact

Induced effect: The impact of additional household expenditures resulting from the direct and indirect impact

Input-output modeling: A type of applied economic analysis that tracks the interdependence among various producing and consuming sectors of an economy. More particularly, it measures the relationship between a given set of demands for final goods and services and the inputs required to satisfy those demands.

Intermediate Inputs: Purchases of non-durable goods and services that are used to produce other goods and services rather than for final consumption

Labor income: All forms of employment income, including employee compensation (wages and benefits) and proprietor income

Margins: The value of wholesale and retail trade services provided in delivering commodities from producers' establishments to purchasers. Margin is calculated as sales receipts less the cost of the goods sold. It consists of the trade margin plus sales taxes and excise taxes that are collected by the trade establishment. (BEA)

Megawatt: A unit of power equal to one million watts, especially as a measure of the output of a power station

Multipliers: Total production requirements within the study area for every unit of production sold to final demand. Total production will vary depending on whether induced effects are included and the method of inclusion. Multipliers may be constructed for output, employment, and every component of value added.

Output: The value of local production required to sustain activities

Proprietor Income: Income from sole proprietorships, partnerships, and tax-exempt cooperatives

Renewable energy: Energy from a source that is not depleted when used, such as wind or solar power

Value Added: A measure of the impacting industry’s contribution to the local community; it includes wages, rents, interest, and profits

Appendix B. Input-Output Modeling

Data Sources

This study uses the IMPLAN Group's input-output modeling data and software (IMPLAN version 3.1). The IMPLAN database contains county, state, zip code, and federal economic statistics, which are specialized by region, not estimated from national averages. Using classic input-output analysis in combination with region-specific Social Accounting Matrices and Multiplier Models, IMPLAN provides a highly accurate and adaptable model for its users. IMPLAN data files use the following federal government data sources:

- U.S. Bureau of Economic Analysis Benchmark Input-Output Accounts of the U.S.
- U.S. Bureau of Economic Analysis Output Estimates
- U.S. Bureau of Economic Analysis Regional Economic Information Systems (REIS) Program
- U.S. Bureau of Labor Statistics Covered Employment and Wages (CEW) Program
- U.S. Bureau of Labor Statistics Consumer Expenditure Survey
- U.S. Census Bureau County Business Patterns
- U.S. Census Bureau Decennial Census and Population Surveys
- U.S. Census Bureau Economic Censuses and Surveys
- U.S. Department of Agriculture Census

IMPLAN data files consist of the following components: employment, industry output, value added, institutional demands, national structural matrices, and inter-institutional transfers. Economic impacts are made up of direct, indirect, and induced impacts. The data used was the most recent IMPLAN data available, which is for the year 2022. All data are reported in 2024 dollars.

Economic impacts are made up of direct, indirect, and induced impacts. The following are suggested assumptions for accepting the impact model: IMPLAN input/output is a production-based model, and employment numbers (from U.S. Department of Commerce secondary data) treat both full- and part-time individuals as being employed.

Regional data for the impact models for value added, employment, and output are supplied by IMPLAN for this impact. Employment assumptions were provided to the model to enable construction of the impact model. From these data, social accounts, production, absorption, and byproducts information were generated from the national level data and was incorporated into the model. All region study definitions and impact model assumptions were agreed on before work with the models began.

Modeling Assumptions

The following are suggested assumptions for accepting the impact model:[3]

Backward-Linkages: IMPLAN is a backward-linkage model, meaning that it measures the increased demand on industries that produce intermediate inputs as a result of increases in production. However, if an industry increases production, there will also be an increased supply of output for other industries to use in their production. Models that measure this type of relationship are called forward-linkage models. To highlight this concept, consider the example of a new sawmill beginning its operations in a state. The increased production as a result of the sawmill's operations will increase the demand for lumber, creating an increase in activity in the logging industry, as well as other supporting industries such as electric transmission and distribution. IMPLAN's results will include those impacts but will exclude effects on any wood product manufacturers located nearby that might be impacted by the newly available supply of lumber.

Employment: IMPLAN input-output is a production-based model, and employment numbers (from U.S. Department of Commerce secondary data) treat both full- and part-time individuals as being employed.

Fixed prices and no supply constraints: IMPLAN is a fixed-price model. This means that the modeling software assumes no price adjustment in response to supply constraints or other factors. In other words, the model assumes that firms can increase their production as needed and are not limited by availability of labor or inputs and that firms in the local economy are not operating at full capacity.

Fixed production patterns: Input-output (I-O) models assume inputs are used in fixed proportion, without any substitution of inputs, across a wide range of production levels. This assumption assumes that an industry must double its inputs (including both purchases and employment) to double its output. In many instances, an industry will increase output by offering overtime, improving productivity, or improvements in technology.

Industry homogeneity: I-O models typically assume that all firms within an industry have similar production processes. Any industries that fall outside the typical spending pattern for an industry should be adjusted using IMPLAN's Analysis-by-Parts technique.

Leakages: A small area can have a high level of leakage. Leakages are any payments made to imports or value added sectors, which do not in turn re-spend the dollars within the region. What's more, a study area that is actually part of a larger functional economic region will likely miss some important linkages. For example, workers who live and spend outside the study area may actually hold local jobs.

[3] Bureau of Economic Analysis https://www.bea.gov/papers/pdf/WP_IOMIA_RIMSII_020612.pdf