APPENDIX H: MINNESOTA POWER'S RENEWABLE ENERGY

This appendix includes information on Minnesota Power's renewable energy, presented in the following sections:

- Part 1: Introduction
- Part 2: Renewable Generation Fleet
- Part 3: Renewable Energy Credits ("RECs"), Solar Renewable Energy Credits ("SRECs"), and Projections

A. Introduction

Minnesota's Renewable Energy Standard ("RES") requires Minnesota Power (or the "Company") to generate or procure sufficient electricity from an eligible energy technology, such that at least the following standard percentages of the Company's total Minnesota retail electric sales are generated from eligible energy technologies by the end of the year indicated:

- 12 percent by 2012
- 17 percent by 2016
- 20 percent by 2020
- 25 percent by 2025
- 55 percent by 2035[1]

Minnesota Power has a significant portfolio of owned and contracted wind, hydroelectric, and solar resources and has plans to reach more than an 80 percent renewable energy supply by 2030. Minnesota Power's 2021 Integrated Resource Plan ("2021 IRP") approved by the Minnesota Public Utilities Commission (the "Commission") in 2023 includes adding up to 400 MW of wind and up to 300 MW of regional or net-zero solar by 2026, as practicable. The 2021 IRP also includes significant investment in energy storage to support the expansion of renewables on the Company's system.

Following the establishment of the Minnesota Carbon-Free Electricity Standard ("CFS") in 2023, the Company continues to evaluate technology options and economic pathways to develop an annual energy portfolio that is compliant with the CFS 100 percent by 2040 obligation. As Minnesota Power advances toward ceasing coal at its last two remaining coal fired units, the Company is investing in biomass, hydroelectric, solar, and wind generation to serve customers with carbon-free power to meet the CFS benchmarks established by the end of each year as follows:

- 80 percent by 2030
- 90 percent by 2035
- 100 percent by 2040[2]

Additionally, the Company continues to align its goals with other Minnesota statutes including Minnesota's Solar Energy Standard ("SES")[3] and Minnesota's Distributed Solar Energy Standard

[1] Minn. Stat. § 216B.1691, subd. 2a.
[2] Minn. Stat. § 216B.1691, subd. 2g.
[3] Minn. Stat. § 216B.1691, subd. 2f.

("DSES")[4] by investing in large scale solar greater than 40 kilowatts ("kW"), small scale solar less than 40 kW, and distribution connected solar with a capacity of 10 MW or less. It is with great pride that the Company presents this portfolio of renewable energy assets both present and forthcoming.

This appendix discusses the development of the Company's renewable energy mix, including projects in development, and the Company's efforts taken to meet the requirements set forth in Minn. Stat. § 216B.1691. The renewable assets are grouped by type (Biomass, Hydropower, Large Scale Solar, Small Scale Solar, and Wind). While Minnesota Power's renewable generation already exceeds the 2025 standard, further renewable generation integration is a continuous effort and a high priority for the Company. Any potential obstacles, as well as potential solutions to those identified obstacles, are discussed at the end of each grouping.

B. Renewable Generation Fleet

Biomass

Sustainably managed wood species provide a renewable energy option for power generation in northern Minnesota. Minnesota Power currently operates one biomass generation facility: the M.L. Hibbard Renewable Energy Center ("HREC") in Duluth, Minnesota.

Active Biomass Generation

Hibbard Renewable Energy Center, located in Duluth, Minnesota utilizes primarily waste wood and forest residue, which provides a renewable, recyclable, low sulfur fuel source. Previously, HREC produced steam, which was sold to a paper and pulp mill in Duluth. Following a change in ownership of the paper mill and a transition to the production of tissue papers, steam from HREC was no longer used as part of this process. HREC now exclusively provides renewable energy to Minnesota Power customers and economically dispatches in the Midcontinent Independent System Operator ("MISO") energy market. 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 the only biomass facility 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 feedstock.

Future Biomass Generation

The key driver to developing new competitively-priced biomass generation is having a sufficient supply of reasonably priced fuel to support the expenditure of the large scale capital that is required to construct and refuel biomass generation facilities. The following considerations are important in determining accessibility to reasonably priced biomass fuel now and in the future:

- balanced forestry practices that maximize the production of biomass on a sustainable basis while maintaining the appropriate levels of diversity in the region's forests;
- a healthy fiber industry that creates the demand for roundwood;
- a low cost and regionally located supply of mill and forest residues for energy production;

[4] Minn. Stat. § 216B.1691, subd. 2h.

[5] https://www.mnpower.com/Community/Tours#:~:text=The%20M.L.,amount%20of%20ash%20being%20landfilled.

- a healthy logging industry; and
- the potential expansion of the bioenergy industry.

Minnesota's current annual harvest (2.77M cords/year) is well below the sustainable harvest levels determined through the General Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (or "GEIS"), which indicated a sustainable harvest level of 5.47M cords/year.[6] With numerous paper mill closures and an overall decline in timber demand statewide, the current harvest levels of 2.77M cords/year reveal that Minnesota's forests have an urgent and pressing need for additional outlets for biomass utilization in order to reduce wildfire vulnerability by removing short-lived, diseased, and otherwise unmerchantable trees.

Minnesota Power's efforts in exploring additional biomass generation are focused on existing Company-owned sites and customer sites in order to leverage existing infrastructure to minimize capital expenditures and ensure that projects are competitively priced with other renewable generation alternatives. Minnesota Power continues to explore biomass generation options, both as potential new facilities and as generation alternatives such as co-firing at Boswell Energy Center ("BEC"), the Company's sole remaining coal station. The evaluation of these options is detailed in Appendix J (Assumptions and Outlooks) to the 2025-2039 Integrated Resource Plan ("2025 IRP").

A potential biomass conversion at BEC would not only provide important reliability benefits for the electric system as biomass is a renewable energy source that is not weather dependent, but would also require skilled labor for the construction, operation, and maintenance of the facility. In addition to retaining skilled labor, the facility's continued operation would also provide significant opportunities for related industries, like logging and sawmill operations for local communities, and would maintain the significant tax revenue benefits to the Boswell host community of Cohasset. The use of locally sourced biomass from Northern Minnesota's certified forests would not only reduce wildfire fuels as addressed above but incentivize the continued investment in and sustainable management of those same forests.

Reutilization of coal-fired facilities also has important siting and permitting benefits. Utilizing brownfield spaces on or near coal generation sites reduces environmental impacts, and the discreet footprint of biomass operations allows for co-development of solar and energy storage systems, all near existing interconnections. Biomass conversions have the potential to be sited and permitted onsite in an expedient manner compared to greenfield development.

Challenges

Deriving energy from biomass is a well-established process. The primary challenges to biomass generation are in the development of fuel processing infrastructure and the establishment of regulatory and life-cycle analysis processes. On November 7, 2024, 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-

[6] De Pellegrin Llorente, I., Fauskee, J., Burns, S., Deckard, D. "Minnesota's Forest Resources 2020." Department of Natural Resources; Division of Forestry, available at https://files.dnr.state.mn.us/forestry/um/forest-resources-report-2020.pdf; Jaakko Pöyry Consulting, Inc., Final Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota, Prepared for the Minnesota Environmental Quality Board. Tarrytown, NY: Jaakko Pöyry Consulting, Inc. (1994).

free generation resources based on a fuel life-cycle analysis.[7] The deployment of any future biomass facilities will depend upon the adequate demonstration that such facilities use fuel that is sustainably sourced and reduce carbon emissions.

Hydropower

Hydropower is central to Minnesota Power's history and is a key component of the Company's renewable generation strategy. The Company was founded in 1906 in part by harnessing the energy of the St. Louis River near Duluth and today operates the largest hydroelectric system in Minnesota.

Active Hydropower Generation

The Company operates 10 regulated hydroelectric facilities and one non-regulated hydroelectric facility on five rivers in central and northeastern Minnesota. The facilities are operated under seven licenses from the Federal Energy Regulatory Commission ("FERC") and produce more than 120 MW of electricity in total. The full details of these facilities and their output are provided in Appendix C (Existing Power Supply) to the 2025 IRP. Relicensing for all Minnesota Power facilities is staggered across the next two decades, ending in 2044.[8]

Further, a deal struck in 2011 between the Company and Manitoba Hydro came to fruition in 2020, providing 250 MW of hydroelectric power to Minnesota once the Great Northern Transmission Line ("GNTL") was energized.

Future Hydropower Projects

The Company has no current plans to construct new hydroelectric stations, though the relicensing process with FERC will continue for existing stations. The Final License Application ("FLA") was submitted for the Prairie River Project in 2021. The Pre-Application Documents ("PAD") and Notice of Intents ("NOI") for relicensure of the Little Falls, Sylvan, and Pillager facilities were submitted in 2023 and will be submitted for the Saint Louis River Project in 2030, Blanchard in 2038, and Winton in 2039. The Company recently received $3.1 million in awards from the U.S. Department of Energy ("DOE") under the Bipartisan Infrastructure Law's Maintaining and Enhancing Hydroelectricity Incentives program to maintain the Scanlon and Blanchard dams. The Company's 1.6 MW Scanlon Hydro dam on the St. Louis River in Carlton County will receive $1.21 million to replace the century-old gates and hoists for reliable, long-term operation and to provide reliable spill capacity for high-flow events. Minnesota Power's 18 MW Blanchard Hydro dam on the Mississippi River near Royalton in Morrison County will receive $1.9 million to overhaul and rewind one of three generators and to install new equipment to improve the station's efficiency. Together, the awards reduce overall project costs by nearly one third for Minnesota Power customers.[9]

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[7] *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); *see also* Minnesota Public Utilities Commission, "State provides further guidance for utilities on Carbon Free Standard," (Sept. 27, 2024), available at https://content.govdelivery.com/bulletins/gd/MNPUBUC-3b898c5?wgt_ref=MNPUBUC_WIDGET_2

[8] https://www.mnpower.com/Environment/Hydro#:~:text=Hydroelectric%20stations,than%20120%20megawatts%20of%20electricity.

[9] Feds award Minnesota Power $3.1 to upgrade Scanlon, Royalton dams, Duluth News Tribune, available at https://www.duluthnewstribune.com/news/local/feds-award-minnesota-power-3-1-million-to-upgrade-scanlon-royalton-dams (Sep. 13, 2024).

Challenges

Minnesota Power knows of no new large hydropower project sites in Minnesota. Even if sites were identified, hydropower development is likely limited to expansions at existing impoundments due to anticipated resistance to the construction of new dams and challenged economics to alternatives. A further challenge to existing hydro generation on Minnesota Power's system is the cost of maintaining aging small generation facilities. Certain small generation stations are over a century old and require ongoing capital investment to ensure continued reliability of operations. The Company is exploring potential options for the future of these sites while also evaluating innovative hydro generation development options and determining feasibility for these technologies.

Solar

Solar is an important component of the Company's continued effort to diversify its generation profile along with wind, hydropower, and distributed solar generation to provide energy during higher demand periods. Minnesota Power's investment in utility-scale solar emphasizes the Company's commitment to customers and communities while striving for an equitable clean-energy transition.

Active Large Scale Solar Generation

Camp Ripley 10 MW Solar Project

To embark on its first utility scale solar opportunity, the Company identified a partner with aligned goals for a renewable energy future. Minnesota Power partnered with the Minnesota National Guard and installed a 10 MW solar array at Camp Ripley, near Little Falls, Minnesota, in 2016. This unique partnership leveraged the Company's energy expertise and Camp Ripley's available land to make progress in meeting both Minnesota's SES and the Department of Defense's cost savings and energy resiliency goals. The 10 MW Camp Ripley Solar Project represented approximately one-third of required solar generation to meet the SES in 2023, and at the time of construction was the largest solar project on any National Guard base in the nation.[10]

Sylvan Solar

The 15.2 MW solar array near Minnesota Power's Sylvan Hydro Station west of Brainerd, Minnesota came online in July 2023. This location was selected to spur economic recovery efforts within Minnesota Power's service territory, and the location is near existing infrastructure. Investment in the Sylvan Solar site reinforces the Company's commitment to economic development in the western part of its service territory. Sylvan Solar was built on land owned by Minnesota Power and consists of locally manufactured Heliene 400-watt Bifacial modules. This asset accounts for approximately 29 percent in of the Company's requirement to meet the 2023 SES. This 25-year Power Purchase Agreement ("PPA") will go through the middle of 2048, providing Minnesota Power with solar energy to support the Company's renewable energy portfolio.

Duluth Solar

The Duluth Solar project is a 1.6 megawatt alternating current ("MWac") array sited in Duluth, Minnesota that came online July 2023. The location was selected because it was no longer used

[10] *In the Matter of the Petition of Minnesota Power for Approval of Investments and Expenditures in the Camp Ripley Solar Project for Recovery Through Minnesota Power's Renewable Resources Rider under Minn. Stat. § 216B.1645 and Related Tariff Modifications*, Docket No. E-015/M-15-773, Petition (Aug. 21, 2015).

for City maintenance activities, was located close to Minnesota Power's existing distribution infrastructure, provided economic investment in the community that hosts the corporate headquarters and the Company's largest service center, and aligned with the City of Duluth's sustainability goals. The City of Duluth has committed to reducing its greenhouse gas emissions by 80 percent by 2050, intending to accomplish that goal through a combination of energy conservation, renewable energy projects, supporting multi-modal transportation, and adapting infrastructure to the changing climate.[11] As such, the City is supportive of the Company siting new solar projects in Duluth. As with the Sylvan Solar project, this facility was built using locally supplied Heliene 400-watt Bifacial modules. This asset accounts for approximately five percent of the Company's requirement to meet the 2023 SES. This 25-year PPA will go through the middle of 2048, providing Minnesota Power with solar energy to support the Company's renewable energy portfolio.

Laskin Solar

Laskin Solar is a 9.6 MW solar array sited at the Laskin Energy Park in Hoyt Lakes, Minnesota. The Laskin Solar project represents a continued investment in host communities that have experienced impacts from the closure of coal plants, as coal operations ceased at the Laskin Energy Center ("LEC") in 2015, and the facility transitioned to natural gas. The refueling and change to a peaking capacity resource resulted in a significant reduction in the number of employees at the facility along with decreased economic activity in the community. Siting a new solar project at Laskin targeted reinvestment in a community impacted by the transition to a cleaner energy future. Laskin Solar was built on land owned by Minnesota Power utilizing locally supplied modules from Heliene. This asset accounts for approximately 19 percent of the Company's requirement to meet the 2023 SES. This 25-year PPA will go through the middle of 2048, providing Minnesota Power with solar energy to support the Company's renewable energy portfolio.

Active Small-Scale Solar

Community Solar Program

In 2016, the Commission approved a community solar garden ("CSG") pilot program for Minnesota Power's customers.[12] The Company's CSG provides an opportunity for more customers to participate in solar, regardless of whether they own their own home, have suitable rooftops, or sizable upfront capital for investment. The program officially started in January 2018 and has been fully subscribed since September 2018, with a waitlist for subscriptions that ensures continued full subscribership. The solar assets in the program total 1.04 MW and the solar output has provided credits to customer accounts beyond expectations. The pilot program provides customers with a streamlined customer experience, consumer protections, increased optionality, and a market-based approach to the pricing structure. As described in the Company's SES progress reports and its annual Community Solar Garden report, community offerings are an important part of the Company's overall solar strategy, and Minnesota Power has conducted

[11] https://duluthmn.gov/sustain/goals-metrics/#:~:text=The%20City%20of%20Duluth%20works,emissions%20by%2080%25%20by%202050

[12] *In the Matter of a Petition by Minnesota Power for Approval of a Community Solar Garden Pilot Program, Small-Scale Solar Energy Standard Compliance Eligibility, and Method for Program Cost Recovery*, Docket No. E-015/M-15-825, Order Approving Pilot Program with Modifications (July 27, 2016).

extensive research to develop a thoughtful program focused on its customers.[13] The Company continues to consider new opportunities for CSGs based on customer demand.

Distributed Solar Generation

Minnesota Power has a long-standing history of encouraging the adoption of renewable energy options, such as grid-connected solar electric systems, while ensuring affordable and reliable service to its customers. Minnesota Power currently supports retail customers in the residential and commercial segments who are interested in solar systems via the SolarSense rebate program. Available since 2004, the SolarSense rebate program helps reduce the cost of installing solar through a capacity-based incentive. In 2017, the Company received approval to significantly expand the SolarSense Program, nearly tripling the number of incentives for customer-sited solar installations from 2017 through 2020.[14] These incentives are based on how much energy a customer's photovoltaic ("PV") system is expected to produce.

In 2020, the Company modified the incentives for customer-sited solar installations from 2021-2024 and converted the Low Income Solar Pilot Program into a Low Income Solar Grant Program, which has been renamed the Income Qualified ("IQ") Solar Grant Program.[15]

On May 31, 2024, the Company proposed to extend SolarSense and the IQ Solar Grant Program for an additional three years. The proposal was approved by the Commission on January 8, 2025, extending the SolarSense and IQ Solar Grant programs through 2027.[16] Minnesota Power's IQ Solar Grant Program is the first of its kind in the state of Minnesota and aims to expand participation in solar programs to all customers by exploring innovative ways to overcome solar adoption challenges that many low-income customers face. These challenges included, among other things, the large upfront cost of installing solar, home ownership status, physical condition of the home, split incentives inherent to a landlord/tenant arrangement, and lack of information. Between 2014 and 2023, the Company provided rebates to more than 20 low-income solar projects.

These programs, rebates, and tools will assist the Company in meeting the small-scale requirement of the SES, which mandates that 10 percent of the 1.5 percent standard come from systems 40 kW or less.

In 2023, the Minnesota Legislature established the DSES in Minnesota Statute § 216B.1691 Subd. 2h, which requires that at least three percent of Minnesota Power's total retail electric sales in Minnesota be generated from solar energy generating systems by the end of 2030. Compliance with the DSES is meant to be an iterative process that incorporates stakeholder feedback into multiple "rounds" of request for proposals ("RFP") to identify projects that will help meet the DSES.

[13] *See, e.g.*, *In the Matter of Commission Consideration and Determination of Compliance with Minnesota's Renewable Energy Objectives for Year 2023,* Docket No. E-999/PR-24-12, Minnesota Power's 2023 Annual Compliance Report (June 3, 2024); *In the Matter of Minnesota Power's On-going Compliance of its Solar Garden Pilot Program with Minnesota's Solar Energy Standard*, Docket No. E015/M-15-825, Annual Report (May 31, 2024).

[14] *In the Matter of the Petition for Approval of Minnesota Power's New SolarSense Customer Solar Program*, Docket No. E-015/M-16-485, Order Approving Program Changes, Denying Cost Recovery in Part, Requiring Annual Report, and Requiring Compliance Filing (Feb. 10, 2017).

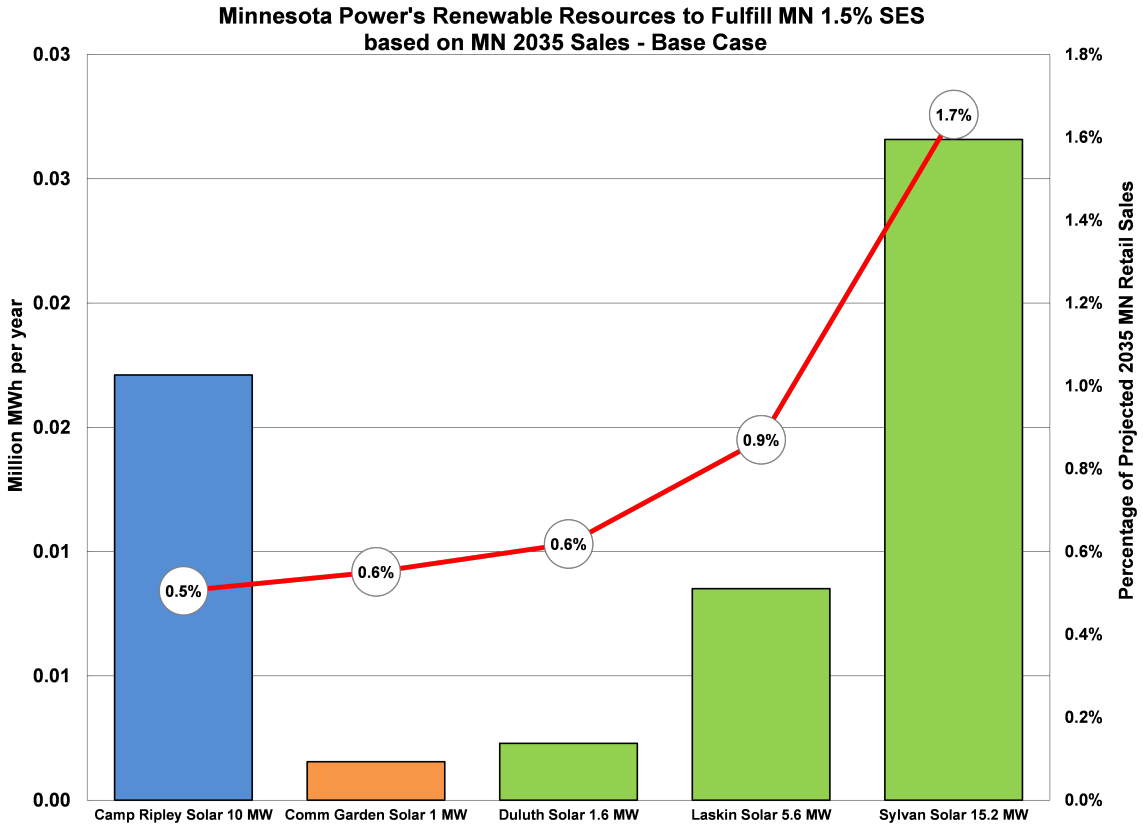
[15] *In the Matter of Minnesota Power's Petition for Approval of Its New SolarSense Customer Solar Program*, Docket No. E-015/M-20-607, Order Approving Program Extension and Changes, in Part, with Modifications (Dec. 17, 2020).

[16] *In the Matter of Minnesota Power's Ongoing Compliance of its SolarSense Program with Minnesota's Solar Energy Standards*, Docket No. E-015/M-20-607, Order Accepting Report and Approving Program Extension with Certain Proposed Modifications (Jan. 8, 2025).

Minnesota Power issued its first DSES RFP on January 30, 2025[17] and currently expects to need approximately 65 to 85 MW of DSES projects to be in compliance with the DSES by the end of 2030.

Figure 1 shows how the Company is meeting the SES requirements. The Company reports annually on its progress toward meeting the SES with its most current report for year ending December 31, 2023 filed on June 3, 2024.[18]

Figure 1. Minnesota Power SES Compliance Projection



Future Large Scale Solar Projects

Minnesota Power continues to advance its 2021 IRP approved by the Commission in 2023, which included up to 300 MW of regional solar as practicable. Minnesota Power issued a Solar Request for Proposal on November 15, 2023, for up to 300 MW of regional solar energy to come online by 2027. Proposals were accepted through January 19, 2024, and Minnesota Power filed

[17] I*n the Matter of the Implementation of the New Distributed Solar Energy Standard Pursuant to 2023 Amendments to the Minnesota Statutes, Section 216B.1691*, Docket No. E-002, E-015, E-017/CI-23-403, DSES Request for Proposals Issuance Notice (Jan. 31, 2025).

[18] *In the Matter of Commission Consideration and Determination of Compliance with Renewable Energy Standard and Solar Energy Standard for Year 2023*, Docket No. E-999/M-24-12, Minnesota Power Renewable Energy Standard and Green Pricing Program Compliance Filing (June 3, 2024).

the Company's project selection and petition for Commission approval on November 13, 2024 in Docket Nos. E-015/M-24-343 and E-015/M-24-344.

Boswell Solar Project

The Boswell Solar Project is an 85MW "net-zero" interconnected solar facility to be constructed in Itasca County, Minnesota near the Boswell Energy Center. The project will be connected to the 230 kV substation at Boswell Energy Center via an approximately 2.75-mile 230 kV transmission line (Boswell Interconnector). The Project will generate carbon-free energy for customers, help Minnesota Power make progress on the Carbon Free and Renewable Energy Standards, boost the tax base of local economies, and create local union jobs. Siting a new solar project at the Boswell Energy Center is an intentional effort on behalf of Minnesota Power to reinvest in communities impacted by coal plant retirements as part of its transition to a cleaner energy future. To benefit customers further, the Boswell Solar Project will leverage existing utility assets and an existing MISO generator interconnection, along with taking advantage of Inflation Reduction Act ("IRA") tax incentives for carbon free energy that qualify for the Energy Community Tax Credit Bonus – all serving to reduce costs to customers. This project was identified as a competitive resource addition to Minnesota Power's supply portfolio in compliance with the Commission's 2021 IDP Order.

Regal Solar Project

The Regal Solar Project is a 119.5 MWac solar facility to be constructed near Rice, Minnesota in Benton County. The project will generate carbon-free energy for customers, help Minnesota Power make progress on the Carbon Free and Renewable Energy Standards, boost the tax base of local economies, and create local union jobs. The Regal Solar Project has already secured the necessary permitting from the Commission and has an executed Generator Interconnection Agreement with MISO. The project was selected as part of a competitive procurement process as ordered in the Commission's 2021 IRP Order.

Challenges

There are some unique challenges associated with increased solar production and meeting Minnesota's SES and DSES, including the registration of SRECs. For instance, both the Company and customers who have sustainability goals need to keep SRECs for compliance, which can complicate partnership opportunities. Supply chain constraints remain a concern in the solar marketplace and are intensified by ongoing regulatory uncertainty that could drive up costs. Currently, many solar modules used in the US market are imported. Continued uncertainty around import tariffs, ongoing anti-dumping and countervailing duties ("AD/CVD") investigations, and risk of non-compliance with the Uyghur Forced Labor Prevention Act ("UFLPA") create price variability within the solar supply chain. While a more robust domestic solar manufacturing sector, supported though tax credits in the IRA, can help alleviate some of these risks, domestic manufacturing is still ramping up and the US remains heavily reliant on imported materials and equipment. Solar projects also face increasing permitting and siting challenges. Resistance to the removal of farmland from production for use as solar generation and concerns about clearing forested areas are contributing to siting challenges for solar developers. Concerns about noise, glare, and changing landscape can complicate the permitting process. Like many sectors, labor shortages continue to be a concern. Growth in the data center and other sectors is creating increased competition for skilled laborers necessary for the design and construction of solar projects, resulting in increased costs and schedule uncertainty. Further, reduced capacity accreditation for solar in the new MISO seasonal construct makes utility scale solar less attractive than other options. The Company analyzes solar system costs on an ongoing basis and weighs the potential of technology improvements that may reduce the capital cost of solar in consideration of any

resource additions. The Company will continue to monitor developments regarding the solar tax credits as the new federal administration's energy goals take shape.

Wind

Active Wind Generation

Wind development continues to occur primarily in areas with the best regional wind resources: southwestern Minnesota and North and South Dakota. The Company continues to evaluate opportunities that enhance the geographic diversity of its wind resources. Over the past several years, there have been significant improvements in wind turbine technology (larger rotors and improved controls) and wind resource assessment (better siting and turbine layout). Minnesota Power has capitalized on these developments through a series of owned wind resources and PPAs.

Taconite Ridge Wind

The Taconite Ridge Wind Project was the Company's first wind project and is a 25 MW wind facility comprised of ten 2.5 MW Clipper C96 Liberty turbines located on the Laurentian Divide in Mountain Iron, Minnesota, on U.S. Steel property. This wind facility was built by the Company to own, operate, and maintain for long-term use as a rate-based renewable wind generation resource. Taconite Ridge Energy Center achieved commercial operation in June 2008.[19]

Bison 1 Wind Facility

The Bison 1 Wind Facility is a 81.8 MW wind development near Center, North Dakota, is comprised of 16 Siemens SWT-2.3-101 turbines and 15 SWT-3.0-101 turbines, and interconnects to the electric grid at the Square Butte Substation, which allows the wind energy to flow via the Company's existing high-voltage direct current transmission line ("HVDC Line") or the Alternating Current ("AC") system. This wind facility was built by Minnesota Power and the Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource. Bison 1 achieved commercial operation in two phases, the first phase in December 2010, and the second in January 2012.[20]

Bison 2 Wind Facility

The Bison 2 Wind Facility is a 105 MW wind project near Center, North Dakota, is comprised of 35 Siemens SWT-3.0-101 turbines, and interconnects to the electric grid at the Square Butte Substation, which allows the wind energy to flow via the Company's existing HVDC Line or the AC system. The Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource. Bison 2 achieved commercial operation in December 2012.[21]

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[19] *In the Matter of the Petition by Minnesota Power for Approval of Investments and Expenditures in Taconite Ridge I Wind Energy Center for Recovery Through Minnesota Power's Renewable Resources Rider Under Minn. Stat. § 216B.1645*, Docket No. E-015/M-07-1064, Order Approving Taconite Ridge I Investment and Expenditures, Finding that Minn. Stat. § 216B.1645, subd. 2a Does Not Apply to Petition, and Requiring Clarification of Reporting Requirements (Mar. 4, 2008).

[20] *In the Matter of the Petition of Minnesota Power for Approval of Investments and Expenditures in the Bison I Wind Project for Recovery through Minnesota Power's Renewable Resources Rider under Minn. Stat. § 216B.1645*, Docket No. E-015/M-09-285, Minnesota Power Compliance Filing (Jan. 5, 2011) and Minnesota Power Compliance Filing (Feb. 21, 2012).

[21] *In the Matter of the Petition of Minnesota Power for Approval of Investment and Expenditure in the Bison 2 Wind Project pursuant to Minn. Stat. §216B.1645*, Docket No. E-015/M-11-234, Minnesota Power Compliance Filing (Jan. 4, 2013).

Bison 3 Wind Facility

The Bison 3 Wind Facility is a 105 MW wind project near Center, North Dakota, is comprised of 35 Siemens SWT-3.0-101 turbines and interconnects to the electric grid at the Square Butte Substation, which allows the wind energy to flow via the Company's existing HVDC Line or the AC system. The Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource. Bison 3 achieved commercial operation in December 2012.[22]

Bison 4 Wind Facility

The Bison 4 Wind Facility is a 204.8 MW wind energy facility in Oliver County in central North Dakota. The Bison 4 wind project consist of 64 Siemens 3.2 MW SWT-3.2-113 turbines and interconnects to the electric grid at the Square Butte Substation, which allows the wind energy to flow via the Company's existing HVDC Line or the AC system. Bison 4 positioned the Company to meet its projected 2020 renewable requirement by the end of 2014. The Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource. The project achieved commercial operation in December 2014.[23]

Oliver 1 Wind Power Purchase Agreement

The Oliver 1 Wind Project consists of a 50.6 MW wind facility comprised of 22 Siemens 2.3 MW turbines located near Center, North Dakota. This facility was built by NextEra Energy Resources and began commercial operation in December 2006. The Company had a 25-year PPA with NextEra Energy Resources for all energy, capacity, and renewable attributes from Oliver 1.[24] NextEra repowered the Oliver I facility in 2020, and the contract term was extended to July 2040.[25]

Oliver 2 Wind Power Purchase Agreement

The Oliver 2 Wind Project is a 48 MW expansion of the original Oliver 1 Wind facility comprised of thirty-two 1.5 MW GE turbines. The facility achieved commercial operation in December 2007. The Company had a 25-year PPA with NextEra Energy Resources for all energy,

[22] *In the Matter of the Petition by Minnesota Power for Approval of Investments and Expenditures in the Bison 3 Wind Project Pursuant to Minn. Stat. §216B.1645*, Docket No. E-015/M-11-626, Minnesota Power Compliance Filing (Jan. 4, 2013).
[23] *In the Matter of the Petition of Minnesota Power for Approval of Investments and Expenditures in the Bison 4 Wind Project for Recovery through MP's Renewable Resources Rider under Minn. Stat. §216B.1645*, Docket No. E-015/M-13-907, Minnesota Power Compliance Filing (Jan. 15, 2015).
[24] *In the Matter of a Petition by Minnesota Power for Approval of a Wind Purchase Power Agreement, Revised Rider for Fuel Adjustment, and Approval to Count the Wind Energy Toward Minnesota Power's Renewable Energy Objective*, Docket No. E-015/M-05-975, Order Approving Wind Purchase Power Agreement, Including the Request for Variances, Revised Rider for Fuel Adjustment and Deferral to the Resource Plan (Dec. 20, 2005).
[25] *In the Matter of Minnesota Power's Petition for Approval of Amendments to FPL Energy Oliver Wind I, LLC and FPL Energy Oliver Wind II, LLC (Oliver) Power Purchase Agreements (PPA)*, Docket No. E-015/M-18-600, Order (Dec. 11, 2018).

capacity, and renewable attributes from Oliver 2.[26] NextEra repowered the Oliver 2 facility in 2020, and the contract term was extended to May 2040.[27]

Wing River Community-Based Energy Development ("C-BED") Wind Power Purchase Agreement

The Wing River project is a 2.5 MW wind project comprised of one 2.5 MW Nordex N90 turbine located near Hewitt, Minnesota and conducted through the now defunct C-BED statute. This project began operation in July 2007 achieving two firsts: 1) the first C-BED project in Minnesota to begin operation; and 2) the first 2.5 MW Nordex turbine installation in the United States. The Company has a 20-year PPA with Wing River LLC for all energy, capacity, and renewable attributes from the Wing River C-BED Wind Project.[28]

Nobles 2 Wind Power Purchase Agreement

The Company received Commission approval to enter into a PPA with Nobles 2 Power Partners for 250.4 MW of wind-generated energy and capacity from the Nobles 2 wind-generation facility in Nobles County in southwestern Minnesota.[29] The Nobles 2 wind facility is comprised of 64 Vestas 3.6 MW turbines and 10 Vestas 2.0 MW turbines.

Future Wind Projects

The Commission's January 9, 2023 Order approving Minnesota Power's 2021 IRP required Minnesota Power to acquire "at least 300 MW and up to 400 MW of wind with at least 200 MW in service by 2026 as practicable."[30]

Minnesota Power filed an RFP for up to 400 MW of wind resources regionally located within MISO Local Resource Zone 1 for the Commission's review on December 15, 2023,[31] and issued the RFP on February 15, 2024. The RFP seeks to maximize the economic benefits of wind development by including preferences for diverse bidders and domestically sourced materials, project labor resource requirements for using local union labor for construction and permanent staffing, and the development of apprenticeship programs. Minnesota Power received six proposals from five parties. Quantitative and qualitative evaluations on these received bids were performed by Minnesota Power and Independent Evaluator ("IE") Levelized Consulting. Following these evaluations, the Company internally short-listed four projects ranging in size from 180 MW to 284 MW for further evaluation.

[26] *In the Matter of a Petition for Approval of a Wind Energy Power Purchase Agreement with FPL Energy Oliver Wind II, LLC and to Implement a Renewable Resources Rider*, Docket No. E-015/M-07-216, Order (May 11, 2007).
[27] *In the Matter of Minnesota Power's Petition for Approval of Amendments to FPL Energy Oliver Wind I, LLC and FPL Energy Oliver Wind II, LLC (Oliver) Power Purchase Agreements (PPA)*, Docket No. E-015/M-18-600, Order (Dec. 11, 2018).
[28] *In the Matter of Minnesota Power's Petition for Approval of a Wind Energy Power Purchase Agreement with Wing River Wind LLC*, Docket No. E-015/M-07-537, Notice of Approval of C-BED Project (May 30, 2007).
[29] *In the Matter of Minnesota Power's Petition for Approval of a 250 MW Nobles 2 Wind Power Purchase Agreement*, Docket No. E-015/M-18-545, Order Approving Power Purchase Agreement with Revisions, Requiring Reporting, and Requiring Compliance Filing (Jan. 23, 2019).
[30] *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 at Order Point 1.a. (Jan. 9, 2023).
[31] *In the Matter of Minnesota Power's Application for Approval of its 2021-2035 Integrated Resource Plan*, Docket No. E-015/RP-21-33, Minnesota Power Compliance Filing (Dec. 15, 2023).

Bids from the RFP were received on April 11, 2024, and Minnesota Power is in discussions with several wind projects that were shortlisted after a detailed review of bids. Minnesota Power plans to file the petition requesting approval later in 2025.

Challenges

As the penetration of wind power has increased throughout the MISO region, transmission interconnection costs and the submission of new applications in the interconnection queue for new wind projects have grown. Concerns regarding adequate transmission and integration costs will continue for wind. The Company executed a unique solution for its customers to provide transmission access to North Dakota wind resources through the purchase of the existing HVDC Line that runs between the Square Butte substation near Center, North Dakota and the Company's Arrowhead substation in Hermantown, Minnesota. However, transmission interconnection and congestion cost issues remain challenges for integration of additional wind resources.

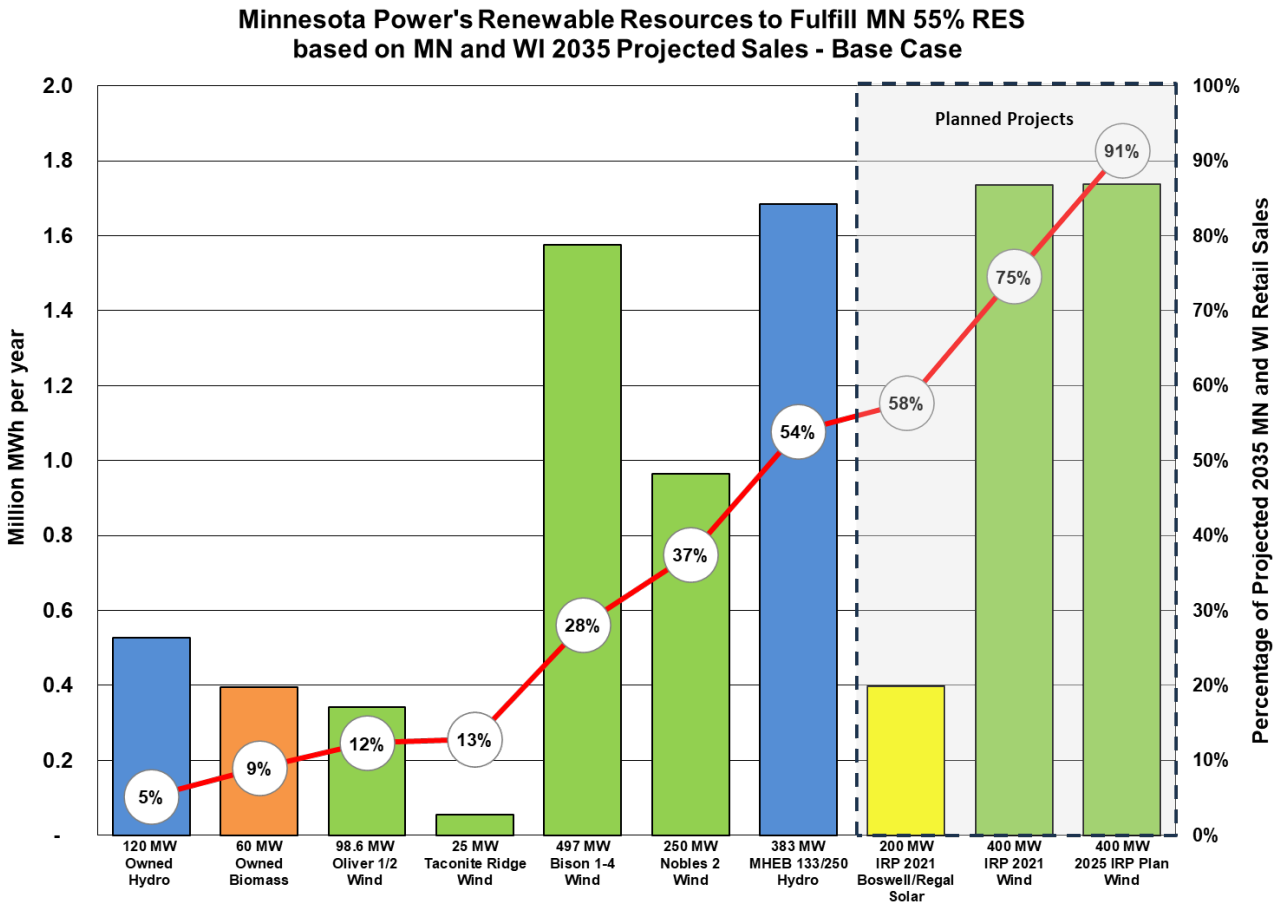
C. RECs, SRECs, and Projections

Renewable Energy Standard Progress

While the Company is on track to exceed the state's 55 percent RES requirement, Minnesota Power continuously assesses a wide range of power supply resources to augment its portfolio. Renewable projects including wind, solar, hydro, biomass, and storage are part of Minnesota Power's Preferred Resource Plan ("2025 Plan") and ongoing evaluation and consideration of power supply alternatives.

Figure 2 below shows the progress MP has made to achieve 50 percent renewable, and the planned projects from the last IRP and the proposed additional renewables in the 2025 Plan. The planned renewable additions from the last IRP include two additional solar projects – Boswell and Regal – which are anticipated to be in-service by 2027 and 400 MW additional generic wind farms, representative of projects received in the RFP, scheduled to be in-service in 2027. The 2025 Plan is proposing to add 400 MW of more wind. This would bring the total RES eligible renewable percentage to just over 90 percent by 2035, in compliance with the 2035 milestone outlined in the CFS.

Figure 2. Minnesota Power RES Compliance Projections



Renewable Energy Credit Outlook

The Company has taken significant steps since 2005 to develop and implement a portfolio of renewable resources that incorporates substantial, cost-effective wind energy into its supply mix and maximizes other existing renewable resources. With the execution of its *Energy**Forward*** strategy, the Company has sufficient RECs to meet and exceed the RES incremental percentage requirements well ahead of schedule. With a significant amount of wind and hydropower energy in its energy mix, the Company is continually evaluating other additional renewable energy resources such as biomass and solar.

Since the filing of the Company's 2021 Plan, significant amounts of wind generation have been and continue to be added to the Company's generation mix and to MISO as a whole. Improvements to MISO's wind forecasting tools and models have resulted in increased accuracy in forecasting models. Higher overall wind penetration in energy generation is leading to increasing market price volatility, a trend the Company expects to grow in the future. The deployment of large utility scale solar generation in the MISO footprint is just beginning, but a significant increase in deployment is expected. Currently, the MISO interconnection queue has a large number of solar projects. Minnesota Power regularly participates in MISO workshops to stay abreast of developments relevant to renewable integration studies. When recommendations from the study are made, the Company integrates them and also provides additional feedback to MISO.

Energy storage as a resource type is being deployed to support the integration of renewable generation technologies. Minnesota Power is working on adding 500 MWh of energy storage identified in the last IRP and recommending in the 2025 Plan to add more energy storage. The Company will continue studying ways in which additional energy storage could augment its existing and future generation, as well as the development of the necessary market tools to make the best use of it.

Additionally, the Company is following developments across the country related to increased solar integration. Solar integration in California has demonstrated several significant impacts, most notably by introducing the "Duck Curve," where demand for non-renewable resources is greatest during the early morning and late evening, but minimal to none during the day. This results in very low market prices during the day, where prior to solar, that is when market prices where the highest. As more solar has been added in California, its contribution toward reliability has declined. This results in solar receiving lower capacity credit than other generation resources as California now needs more dispatchable generation for early morning and evening when solar availability is minimal most months of the year.

Minnesota Power's strategy to ensure continuing compliance with RES, SES, and DSES is thoughtful and includes a diversity of resource considerations. The Company plans to maintain existing renewable energy resources, such as Company-owned wind facilities on Minnesota's Iron Range and in North Dakota, while continuing to implement new ones, such as the solar and wind projects outlined in the 2025 Plan. The Company will maintain existing PPAs for long-term wind energy and hydropower, will further integrate intermittent resources into its energy mix, and will continue to participate in M-RETS.

Rate Impacts of Standard Obligations

Each electric utility must submit to the Commission a report containing an estimation of the rate impact of activities necessary to comply with Minn. Stat. § 216B.1691, subd. 2e. The report must be updated and submitted as part of each integrated resource plan or plan modification filed under section Minn. Stat.§ 216B.2422. Minnesota Power has been adding cost-effective renewable resources to its system to reduce emissions consistent with the analysis in the Company's resource plans and acquisitions. The Company's analysis in the 2025 Plan considers the costs and impacts of these renewable generation additions but does not require any additions to meet standard obligations. Therefore, standard obligations do not impact the Company's rates.