
APPENDIX H: MINNESOTA POWER'S RENEWABLE ENERGY

Introduction

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

- 12 percent by 2012
- 17 percent by 2016
- 20 percent by 2020
- 25 percent by 2025¹

Minnesota Power has made remarkable strides to achieve the RES a decade ahead of schedule and is continuing to lead the state in renewable integration. Following the commercial activation of the 250 megawatts ("MW") Nobles 2 wind facility, the Company achieved a power supply that included 50 percent renewable energy in December of 2020.² This success is the result of the Company's continuing commitment to delivering safe, reliable and affordable energy to customers. The Company aims to achieve an 80 percent carbon reduction by 2035 with a goal to be 100 percent carbon-free energy by 2050. As fossil fuel facilities transition to new missions and retirement, the Company is investing in biomass, hydro, solar and wind generation to provide its service area with carbon-free power. The completion of the Great Northern Transmission Line ("GNTL") in 2020 brought 250 MW of carbon-free hydropower from Manitoba, Canada to Minnesota Power's customers.³ While Minnesota currently does not count large hydropower toward the RES, this project demonstrates the Company's commitment to carbon-free generation.

It is with great pride that the Company presents this portfolio of renewable energy assets both present and forthcoming.

Overview

Appendix H discusses the development of the Company's renewable energy mix, and the Company's efforts taken to meet both the RES and the Solar Energy Standard ("SES") as outlined in Minn. Stat. § 216B.1691. The renewable assets are grouped by type (Biomass, Hydro, Solar, and Wind). While Minnesota Power's renewable generation already exceeds the 2025 standard, further renewable integration is a continuous effort and a high priority for the Company. Any potential obstacles, as well as potential solutions to the perceived obstacles, are identified at the end of each grouping.

Renewable Generation Fleet

Biomass

¹ Minn. Stat. § 216B.1691, subd. 2(a).

² Johnson, Brooks. "Minnesota Power reaches 50 renewable energy", *Star Tribune*, Dec. 17, 2020. <https://www.startribune.com/minnesota-power-reaches-50-renewable-energy/573411211/>

³ Galford, Chris. "Minnesota Power energizes Great Northern Transmission Line, bringing 250 MW delivery capabilities online", *Daily Energy Insider*, June 15, 2020. <https://dailyenergyinsider.com/news/25907-minnesota-power-energizes-great-northern-transmission-line-bringing-250-mw-delivery-capabilities-online/>

Sustainably managed wood species provide a renewable energy option for power generation in northern Minnesota. Minnesota Power's M.L. Hibbard Renewable Energy Center ("HREC") uses biomass to produce steam sold to a currently indefinitely idled paper and pulp mill in Duluth, Minnesota (see Challenges section below), and electricity for Minnesota Power customers. The reduced demand for biomass caused by the COVID-19 pandemic, related to the idling of paper processing, has resulted in a lower cost for purchasing biomass as a fuel source.

Active Biomass Generation

Hibbard Renewable Energy Center

The HREC, located in Duluth, utilizes primarily waste wood and forest residue, which provides a renewable, recyclable, low sulfur fuel source. HREC also provides steam to the nearby paper manufacturing facility, which is currently idled (see below). 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.⁴

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 supply of mill and forest residues for energy production,
- a healthy logging industry, and
- the potential expansion of the bioenergy industry.

Minnesota Power's biomass generation efforts are focused on existing Company-owned sites and customer sites in order to leverage existing infrastructure to minimize capital expenditures and assure 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 are detailed in Appendix C (Existing Power Supply) to the 2021 Integrated Resource Plan ("2021 IRP").

Challenges

The Company's biomass-generated energy is especially valuable as a producer of steam for industrial paper manufacturing. In an increasingly digital workplace, large scale commercial demand for paper is declining and vulnerable to fluctuating market prices. Additional decreases in demand due to the COVID-19 pandemic prompted Verso to indefinitely idle its Duluth paper mill in June 2020, reducing demand for steam generated at HREC. The Company has been actively engaged in facilitating the sale of the Verso mill. HREC continues to generate electricity for the Minnesota customers despite the paper mill's idle status.

⁴ <https://www.mnpower.com/Community/Tours#:~:text=The%20M.L.,amount%20of%20ash%20being%20landfilled>.

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. The Company operates 10 hydroelectric facilities on 5 rivers in central and northeastern Minnesota. The facilities are operated under eight 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 to the 2021 IRP. Relicensing for all of our facilities is staggered across the next quarter-century, ending in 2044.⁵ Furthermore, a deal struck in 2011 between the Company and Manitoba Hydro came to fruition in 2020 providing 250 MW of hydro power to Minnesota once the newly-completed GNTL was energized. This section of Appendix H addresses actions taken by the Company since 2015.

Manitoba Hydro Power Purchase Agreement

In May 2011, Minnesota Power signed a long-term non-firm power purchase agreement (“PPA”) with Manitoba Hydro. The PPA began in June 2020 with Manitoba Hydro selling 250 MW of electricity for 15 years. A unique aspect of the agreement is a “wind storage” provision that allows the Company to transmit power northward from its wind farms in North Dakota when wind production is high or electric loads are low. Renewable Energy Credits (“RECs”) are generated from the energy produced by Manitoba Hydro, but Minnesota’s current state RES do not allow RECs generated from hydro projects in excess of 100 MW to count for compliance with the RES. In 2019, roughly 4 percent of the energy from Manitoba Hydro was generated from small-scale hydro and can be applied toward the Company’s compliance with the Minnesota RES.⁶

Future Hydro Projects

The Company has no current plans to construct new hydroelectric stations, though the relicensure process with FERC will continue for existing stations. The pre-applications for relicensure for Little Falls, Sylvan, and Pillager facilities will be submitted in 2022, the Saint Louis River stations in 2029, Blanchard in 2037 and Winton in 2038. The Company anticipates that all its hydro facilities could be relicensed by 2044.

Challenges

Minnesota Power knows of no new large hydro project sites in Minnesota. Even if sites were identified, hydro 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 exists in that current Minnesota law does not allow renewable generation from hydro units of 100 MW or larger to apply towards Minnesota’s RES. As such, some 96 percent of the carbon-free energy generated by the Company’s PPA with Manitoba Hydro is not counted toward the RES.

The Company continues to evaluate innovative hydro generation development options and determine feasibility for these projects.

Solar

⁵<https://www.mnpower.com/Environment/Hydro#:~:text=Hydroelectric%20stations,than%20120%20megawatts%20of%20electricity>.

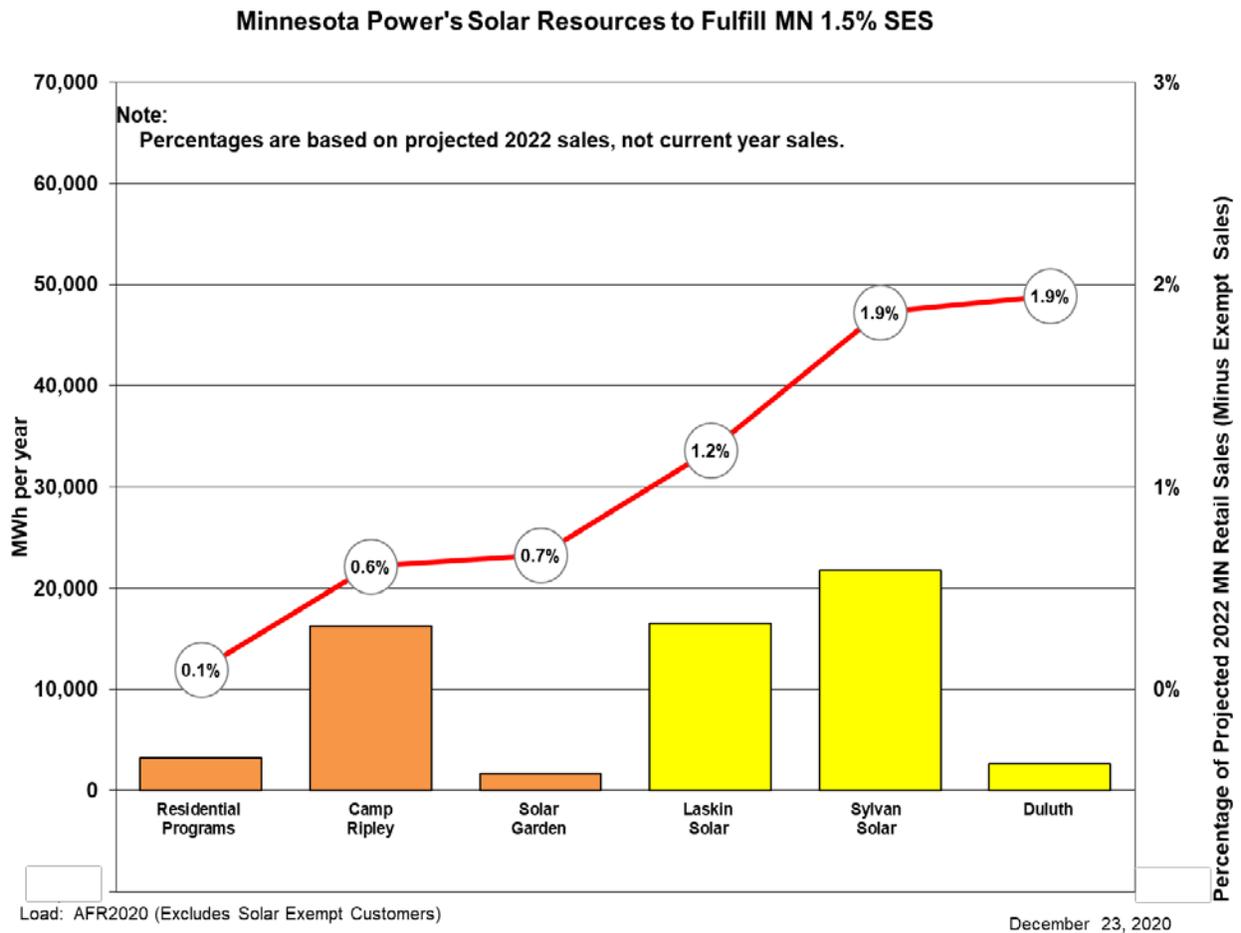
⁶ Minn. Stat. § 216B.1691, subd. 1(a)(3).

Minnesota Power has aggressively pursued solar generation and accompanying service options since the 2015 Integrated Resource Plan (“2015 Plan”). In that time the Company has completed its first utility-scale solar project, as well as a community solar garden (“CSG”) program and several supplemental solar installations at existing Company facilities. Since the SES was implemented in 2013, the Company has developed a robust, portfolio-based solar strategy consisting of three pillars of focus: 1) customer – maintaining relationships and providing thoughtful incentive and education programs; 2) community – enabling customer access to solar energy options and promoting community development; and 3) utility – implementing efficient resources into the customer power supply. This portfolio-based approach has positioned Minnesota Power for ongoing compliance with the SES beyond 2020. The Company reports on its progress toward meeting the SES annually, with its most current report filed on June 1, 2020.⁷ The Company expects to meet its 33 MW SES requirement with its existing solar generation and the addition of three newly proposed solar installations discussed below in the Future Solar Projects section.⁸ If approved by the Minnesota Public Utilities Commission (“Commission”) the projects would be constructed in 2021, as depicted in Figure 1.

⁷ Docket No. E999/M-20-464.

⁸ “Minnesota Renewable Energy Standard: Utility Compliance”, Jan. 15, 2019. <https://www.leg.mn.gov/docs/2019/mandated/190330.pdf>

Figure 1: The Company's Solar Energy Standard Outlook



Camp Ripley 10 MW Solar Project

To embark upon 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. In August 2014, the Company and the Minnesota National Guard entered into a multi-faceted Memorandum of Understanding, which includes an agreement to work together on conservation programs, the 10 MW Camp Ripley Solar Project and backup generation technology. The 10 MW Camp Ripley Solar Project represents approximately one third of the Company's 33 MW of required solar generation to meet the SES, and at the time of construction was the largest solar project on any National Guard base in the nation.⁹

⁹ Docket No. E015/M-15-773.

Community Solar Program

The Company filed and the Commission has since approved a CSG pilot program for Minnesota Power's customers.¹⁰ The Company believes that CSGs represent 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 stated in the Company's SES progress reports, community offerings are an important part of the Company's overall solar strategy, and Minnesota Power has conducted extensive research to develop a thoughtful program focused on its customers.¹¹ 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 customer 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 2020 SolarSense funded 72 projects through a total of \$701,395 in budgeted rebates. Through programs like SolarSense, the Company has supported and incentivized solar energy installations for over 15 years, with 375 rebated customers since 2004.

Minnesota Power has taken steps to enhance the customer experience by providing customers with the tools, technology and information needed to make informed decisions about their energy investments. One example of this is the Company's Low Income Solar Pilot Program, which is the first of its kind in the state of Minnesota and provides funding for projects that make it possible for income-qualified customers to have easier access to solar power. Applications for projects that benefit income-qualified customers or facilities that serve income-qualified customers can be submitted by the Company, customers, solar installers or developers, or community groups. 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.

Both the extension of the SolarSense Program and the Low Income Solar Grant Program have been approved through 2024.¹²

Future Solar Projects

Laskin Solar

The 9.6 MW solar array proposed for installation in 2021 at the Laskin Energy Park in Hoyt Lakes is part of a suite of three new solar projects that have been proposed to be accelerated as part of the Company's Economic Recovery filing.¹³ The Laskin solar array represents a continued investment in host communities that have experienced impacts from the Company's

¹⁰ Docket No. E015/M-15-825.

¹¹ Docket No. E999/M-20-464.

¹² Docket No. E-015/M-20-607.

¹³ Docket No. E,G999/CI-20-492, Laskin, Sylvan, and Duluth solar make up this suite.

closure of coal plants, as coal operations ceased at LEC in 2015 and the facility transitioned to natural gas. The refueling and change in mission 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 is an intentional effort on behalf of the Company to reinvest in communities impacted by its transition to a cleaner energy future. If approved, Laskin Solar is expected to be online in 2021 with an annual production of 16,500 MWh.

Sylvan Solar

The proposed 10 MW solar array near Minnesota Power's Sylvan Hydro Station west of Brainerd, Minnesota, is planned to be fully online in 2021. The Company selected this location in an effort to spur economic recovery efforts within its service territory, because the land is already owned by the Company, and the location would provide proximity to existing Company infrastructure will minimize the expense and complexity of connecting into the local distribution system. Investment at the Sylvan site reinforces the Company's commitment to economic development in the western part of its service territory. The project is planned to provide 10 MW of solar power on a single-axis tracking system, with an estimated annual production of 21,700 MWh.

Duluth Solar

The proposed Duluth Solar project is a 1.6 MW array to be sited in Duluth, Minnesota – home Minnesota Power's corporate headquarters and the Company's largest service center. Duluth Solar would be located in northeast Duluth, on approximately 9 acres of land owned by the City. The Company selected this location because it is no longer used for City maintenance activities, it is located close to the Company's existing distribution infrastructure, will provide economic investment in the community that hosts the Company's corporate headquarters and aligns with the City of Duluth's sustainability goals. The City of Duluth has committed to reducing its Green House Gas emissions 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.¹⁴ As such, the City is supportive of the Company siting new solar projects in Duluth. The Project is planned to be 1.6 MW of solar power, with an estimated annual production of 2,600 MWh.

200 MW Project

The Company, as part of its preferred plan ("2021 Plan") to prepare for BEC Unit 3 retirement in December 2029, intends to add 200 MW of new solar by 2030. The location of the the new solar generation will be at the BEC site or another Minnesota Power site. This project will leverage existing interconnections and be a reinvestment in utility host communities.

Challenges

There are some unique challenges associated with increased solar production and meeting the state solar mandate, including a decreasing investment tax credit and the registration of Solar Renewable Energy Credits ("SRECs"). For instance, both the Company and customers who have sustainability goals both need to keep SRECs for compliance, which can complicate partnership opportunities. The Company analyzes solar system costs and on an ongoing basis weighs the potential of technology improvements that may reduce cost against the solar

¹⁴ <https://duluthmn.gov/sustain/goals-metrics/#:-:text=The%20City%20of%20Duluth%20works,emissions%20by%2080%25%20by%202050>

investment tax credit, which has decreased from 30 percent for projects starting construction in 2019 to 26 percent for 2021 and a permanent 10 percent commercial only tax credit after 2024, in consideration of any resource additions.¹⁵ The Company will continue to monitor developments regarding the solar investment tax credit as the new administration's energy goals take shape.

Minnesota Power has worked directly with the Midwest Renewable Energy Tracking System ("M-RETS") to establish a process for registering and tracking small scale SRECs. The Company now registers SRECs associated with customer-sited solar systems incentivized by the Company on an annual basis. This includes solar systems with a name plate capacity of 40 kW or less as required by the small-scale carve out of the SES.

Wind

Wind development continues to occur primarily in areas with the best regional wind resources: southwestern Minnesota as well as North Dakota 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, including a 250 MW PPA with Nobles 2 Power Partners that took effect in 2020.¹⁶

Taconite Ridge Wind Project

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, Minn., 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 2008.¹⁷

Bison 1 Wind Energy Center

The Bison 1 Wind Energy Center is a 81.8 MW wind development near Center, North Dakota, 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 ("DC 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. The Bison 1 wind project achieved commercial operation in two phases, the first phase in December 2010, and the second in January 2012.¹⁸

Bison 2 Wind Energy Center

The Bison 2 Wind Energy Center 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 high-

¹⁵ <https://www.seia.org/initiatives/solar-investment-tax-credit-itc>

¹⁶ Johnson, Brooks. "Minnesota Power reaches 50% renewable energy", *Star Tribune*, Dec. 17, 2020. <https://www.startribune.com/minnesota-power-reaches-50-renewable-energy/573411211/>

¹⁷ Docket No. E015/M-07-1064.

¹⁸ Docket No. E015/M-09-285.

voltage direct current transmission line (“DC Line”) or the Alternating Current (“AC”) system. The Bison 2 wind project achieved commercial operation in December 2012. The Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource.¹⁹

Bison 3 Wind Energy Center

The Bison 3 Wind Energy Center 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 DC Line or the AC system. The Bison 3 wind project achieved commercial operation in December 2012. The Company owns, operates, and maintains the facility for long-term use as a rate-based renewable wind generation resource.²⁰

Bison 4 Wind Energy Center

The Bison 4 Wind Energy Center is a 204.8 MW wind energy facility in Oliver County in central North Dakota. The Bison 4 Wind Project (“Bison 4 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 DC Line or the AC system. The project achieved commercial operation in December 2014. 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.²¹

Oliver 1 Wind Power Purchase Agreement

The Oliver 1 Wind Project consists of a 50.6 MW wind facility comprised of twenty-two 2.3 MW Siemens 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 1.²² NextEra repowered the Oliver I facility in 2020. The contract term was extended to July, 2040.²³

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, capacity and renewable attributes from Oliver 2.²⁴ NextEra repowered the Oliver 2 facility in 2020. The contract term was extended May 2040.²⁵

Wing River 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, Minn 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

¹⁹ Docket No. E015/M-11-234.

²⁰ Docket No. E015/M-11-626.

²¹ Docket No. E015/M-13-907.

²² Docket No. E015/M-05-975.

²³ Docket No. E-015/M-18-600.

²⁴ Docket No. E015/M-07-216.

²⁵ Docket No. E-015/M-18-600.

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.²⁶

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 Minnesota²⁷. The Nobles 2 wind facility is comprised of 64 Vestas 3.6 MW turbines and 10 Vestas 2.0 MW turbines.

Future Wind Projects

As part of its 2021 Plan, the Company intends to add 200 MW of new wind resources to its power supply portfolio by 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 DC Line that runs between the Square Butte substation near Center, North Dakota and the Company's Arrowhead substation near Duluth, Minnesota.

RECS, SRECS and Projections

Renewable Energy Standard Progress

Between 2006 and 2015, the Company secured via PPAs and renewable energy project construction over 500 MW of wind generated energy to increase its Minnesota RES-eligible renewable energy supply. In 2015, when approved renewable projects achieved commercial operation, the renewable portion of the Company's retail energy supply increased to approximately 25 percent of its projected 2025 retail and wholesale electric sales. Minnesota Power has since exceeded current compliance with the RES a decade ahead of schedule and is well positioned to comply with the standard for 2025 and beyond as illustrated in Figure 2.

While the Company currently exceeds the state's 2025 RES requirement, Minnesota Power continuously assesses a wide range of power supply resources to augment its portfolio. Renewable projects including wind, biomass, hydro and solar are part of the 2021 Plan and ongoing evaluation and consideration of power supply alternatives. Included in the 2021 Plan is a 200 MW wind farm scheduled to be in-service in 2025. This would bring the total RES eligible renewable percentage to just over 50 percent by 2025 as illustrated in Figure 3. Insight into the customer cost impact of the RES and SES requirements are included in Appendix L (Cost Impact Analysis by Customer Class).

²⁶ Docket No. E015/M-07-537.

²⁷ Docket No. E015/M-18-545.

Figure 2: The Company's Total Renewables

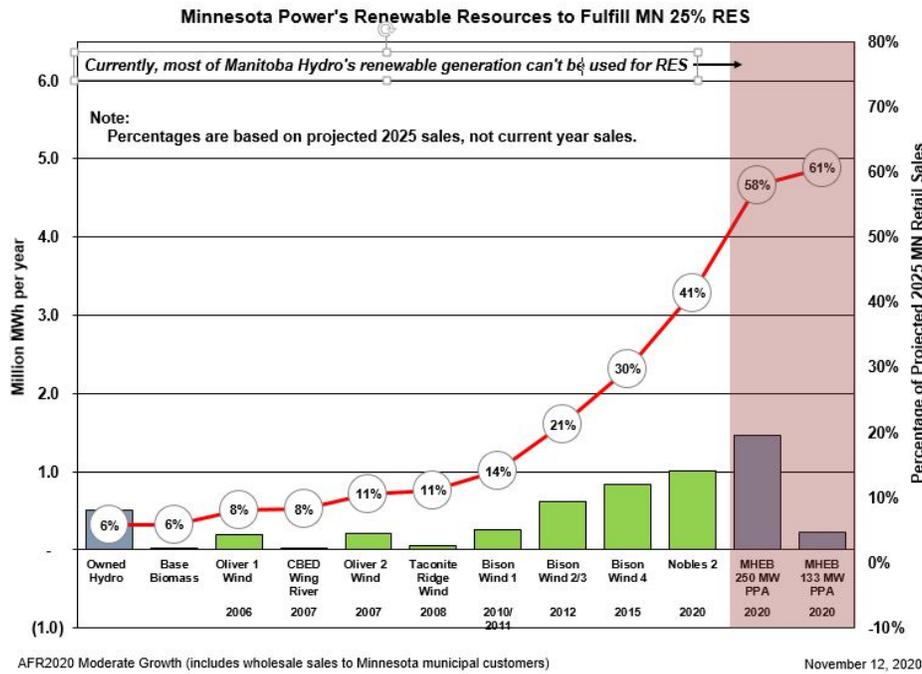
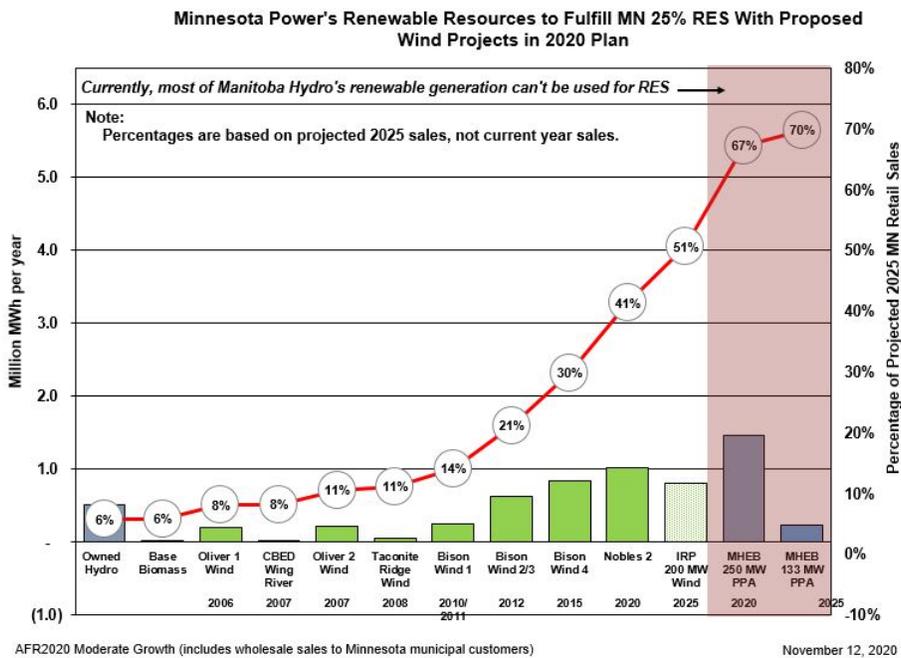


Figure 3: The Company's Total Renewables With Proposed 200 MW Wind Project in 2021 Plan



Renewable Energy Credit (“REC”) 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 *EnergyForward* 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 hydro 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 2015 Plan, significant amounts of wind generation have been 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. The Company continues to follow the next phases of MISO’s Renewable Integration Impact Assessment (“RIIA”) study closely and looks forward to reviewing the draft report anticipated to be published in first quarter 2021.²⁸ Minnesota Power regularly participates in MISO workshops to stay abreast of developments relevant to the RIIA. 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 still in its infancy, though holds the potential to greatly impact integration of renewable generation technologies. The Company is still assessing the ways in which 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.

As Minnesota Power adds more solar energy in its service territory, valuable lessons are being learned. 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 are 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 were the highest. As more solar has been added in California, solar’s contribution toward reliability has declined. This results in it receiving lower capacity credit than other generation resources as now California needs more dispatchable generation for early morning and evening when solar availability is minimal most months of the year. Modeled in this IRP are declining capacity credits for solar based on the RIIA study referenced above.

Minnesota Power’s strategy to ensure continuing compliance with RES and SES 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 2021 Plan. The Company will maintain existing power purchase agreements for long-term wind energy and hydro and further integrate intermittent resources to its energy mix, and will continue to participate in M-RETS.

²⁸ “Renewable Integration Impact Assessment (RIIA)”, <https://www.misoenergy.org/planning/policy-studies/Renewable-integration-impact-assessment/#t=10&p=0&s=&sd=>