APPENDIX E: ENVIRONMENTAL POLICY AND COMPLIANCE ASSESSMENT

Part 1: Minnesota Power Demonstrates Environmental Leadership

Minnesota Power has a history of excellence in environmental stewardship that has contributed to the state's overall track record of leadership on environmental issues. Strong performance has been achieved through the installation of timely, cost-effective environmental controls and new energy resources that balance customers' needs for reliable and affordable energy with sound environmental stewardship. Environmental stewardship is a core value of the Company and Minnesota Power balances the environmental impacts of its activities with its obligation to customers, communities, shareholders, and future generations. Minnesota Power, as outlined in its 2021 Integrated Resource Plan ("2021 IRP"), is meeting its environmental objectives in compliance with, or in advance of, regulatory requirements and deadlines.

Minnesota Power's environmental compliance planning measures are highlighted in Part 2 of this Appendix - Environmental Regulations Summary. Part 2 provides an overview of environmental regulations and the Company's planned measures for compliance assumed in the Base Case. These measures reinforce the Company's commitment to preserving exemplary environmental performance while delivering reliable and affordable electric service to its customers.

Part 2 also describes how planning for required controls reflects environmental regulations that are either finalized or have fairly certain requirements. The Base Case includes measures that address numerous environmental regulations including, but not limited to, the following:

- The Mercury and Air Toxics Standard ("MATS") Rule;
- The Industrial Boiler Maximum-Achievable Control Technology ("MACT") Rule;
- National Ambient Air Quality Standard ("NAAQS") revisions;
- Regional Haze requirements;
- Mercury Emissions Reduction Act ("MERA") State of Minnesota mercury requirements;
- 316(b) cooling water regulations;
- The Coal Combustion Residual Rule ("CCR") Rule; and
- The Effluent Limitation Guidelines ("ELG") Rule.

Minnesota Power took into consideration several environmental costs futures in the 2021 IRP analysis with varying levels of environmental costs for criteria pollutants and carbon regulation costs on emissions from existing and new sources per Minnesota requirements for resource planning. For more information on the Company's approach to modeling environmental costs and carbon regulation costs, please refer to Section IV: Modeling Approach and Appendix J: Assumptions and Outlooks.

Prior Pollution control investments are expected to satisfy regulatory and reduction requirements for sulfur dioxides ("SO_2"), oxides of nitrogen ("NO_x"), and mercury for all of the following regulations:

- Cross State Air Pollution Rule ("CSAPR");

- The ongoing NAAQS revisions attainment requirements in Minnesota; and
- The MERA reduction requirements for mercury.

Broad emission reductions have been a significant result of Minnesota Power's *Energy**Forward*** strategy as the Company passed the milestone of delivering a power supply that is now half renewable energy in 2020. Ongoing emission reductions will be attained as Minnesota Power works toward its goal of being 100 percent carbon free-energy by 2050, with an interim step of 80 percent carbon reduction by 2035. The existing emission controls retrofitted on Minnesota Power's coal-fired generating units positions those units to preserve reliability and protect affordability as the utility works toward achieving carbon reduction targets.

While the Company's preferred plan ("2021 Plan") represents meaningful action on carbon reduction, the Company is also investigating carbon neutrality efforts and the ability to make key advancements in that field in the near term. Minnesota Power is particularly interested in carbon neutrality efforts that leverage the natural resources in northern Minnesota and that invest in the unique region it serves. As an example of this effort, in January 2021, Minnesota Power partnered with the University of Minnesota's Natural Resources Research Institute on a grant application to the United States Forest Service to investigate the production of biochar at Minnesota Power facilities, evaluate carbon credit opportunities, and deploy a biochar soil amendment at a Minnesota Power or customer site. Biochar is carbonized biomass that is obtained from sustainable sources (like northern Minnesota timber) and sequestered in soils to sustainably enhance their agricultural and environmental value.[1] As the paper industries that have supported northern Minnesota's economy for over a century are in decline, finding new and sustainable markets for wood resources is critical to the regional economy and forest management. Minnesota Power looks forward to investigating this, and other, carbon neutrality efforts on its path to a carbon-free energy future.

Part 3 also presents a summary of Minnesota Power's carbon reduction targets that guided the 2021 Plan. The carbon target of 80 percent reduction in carbon emissions is met by expanding the use of renewable energy, continued investment in conservation and distributed renewable programs, and changing operations at BEC3 and BEC4. The Company's carbon reduction plan is being delivered in advance of additional national carbon regulations and in support of existing or potential new Minnesota Greenhouse Gas Regulation ("GHG") goals. The *Energy**Forward*** resource strategy measures position the Company for meeting future carbon regulatory requirements that could be imposed on the Company's electricity generation and will benefit customers for years to come. The Company's measures also significantly contribute to Minnesota's national reputation for environmental stewardship.

Minnesota Environmental Leadership

Minnesotans and their neighbors value the quality of the state's natural resources, and there is always a desire to improve the quality of these resources for everyone's enjoyment. Doing its part, Minnesota Power has delivered emission reductions that have improved air and water quality through responsible environmental stewardship while engaging in its obligation to serve its customers. To date, the Company has reduced NO_x emissions by 88 percent and SO_2 emissions by 98 percent over the past 15 years. Mercury emissions have also collectively decreased by 97 percent in the Company's thermal fleet as compared to 2005 emissions

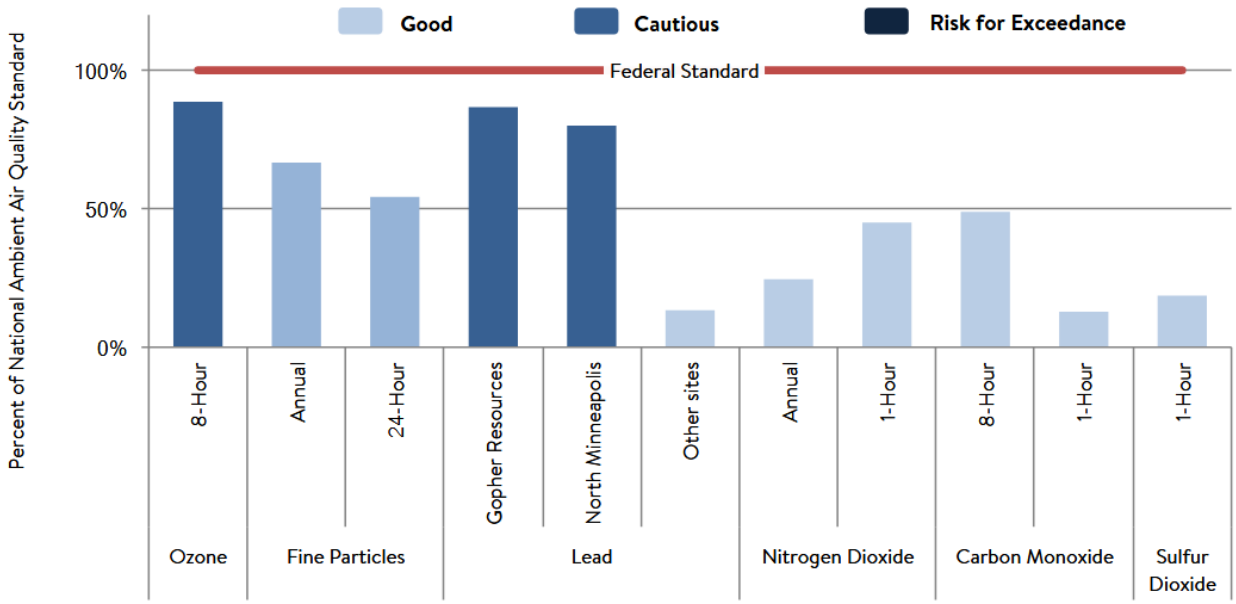
[1] https://biochar.international/the-biochar-opportunity/what-is-biochar/

levels[2]. In addition, there are policies at the federal level and in Minnesota that provide for effective solid waste management and protection of groundwater resources[3].

Air quality in Minnesota has steadily improved over recent decades, and the state anticipates continuing to achieve federal air quality standards set by the Environmental Protection Agency ("EPA"). State policies have provided for significant reductions in local mercury emissions in advance of new national regulatory measures. Minnesota has also provided for reduced emissions loading to water bodies while expanding monitoring for environmental quality indicators. The Minnesota Polution Control Agency ("MPCA") has highlighted the improving air quality in Minnesota compared to NAAQS, as shown in Figure 1 below. As can be seen here, as a percentage of NAAQS, many categories of air quality are in the "good" characterization, while certain areas are "cautious."

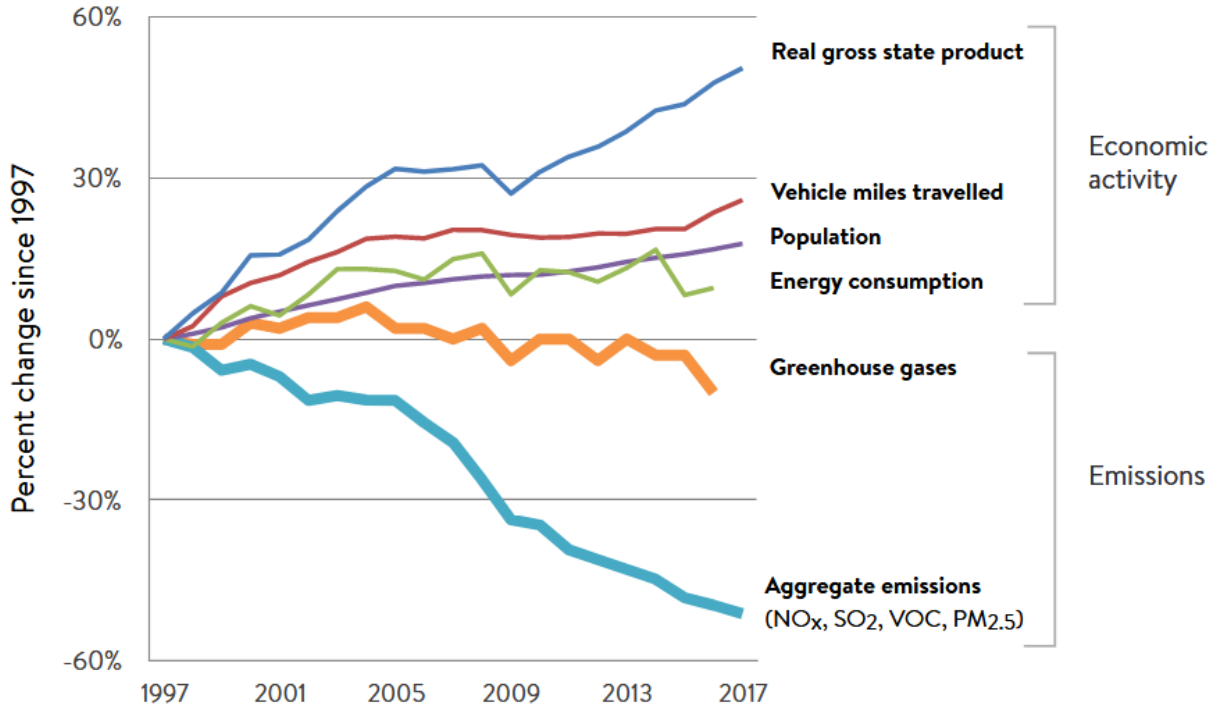
[2] https://www.allete.com/Sustainability/SustainabilityReport - Page 3
[3] 40 C.F.R. § 257.90 - .98.

Figure 1: Minnesota's Air Quality Compared to the NAAQS (2017) [source: MPCA]



A balanced approach is an important part of managing improvements to environmental quality. Potential solutions should stay rooted in sound science, enable policy makers to protect and promote Minnesota job growth, and moderate increasing energy costs that impact Minnesotans while at the same time protecting the environment. As shown in Figure 2, Minnesota has managed to grow its economy while providing for significant emission reductions.

Figure 2: State Economy, Energy Use, Population, Transportation and Air Pollution (source: MPCA)

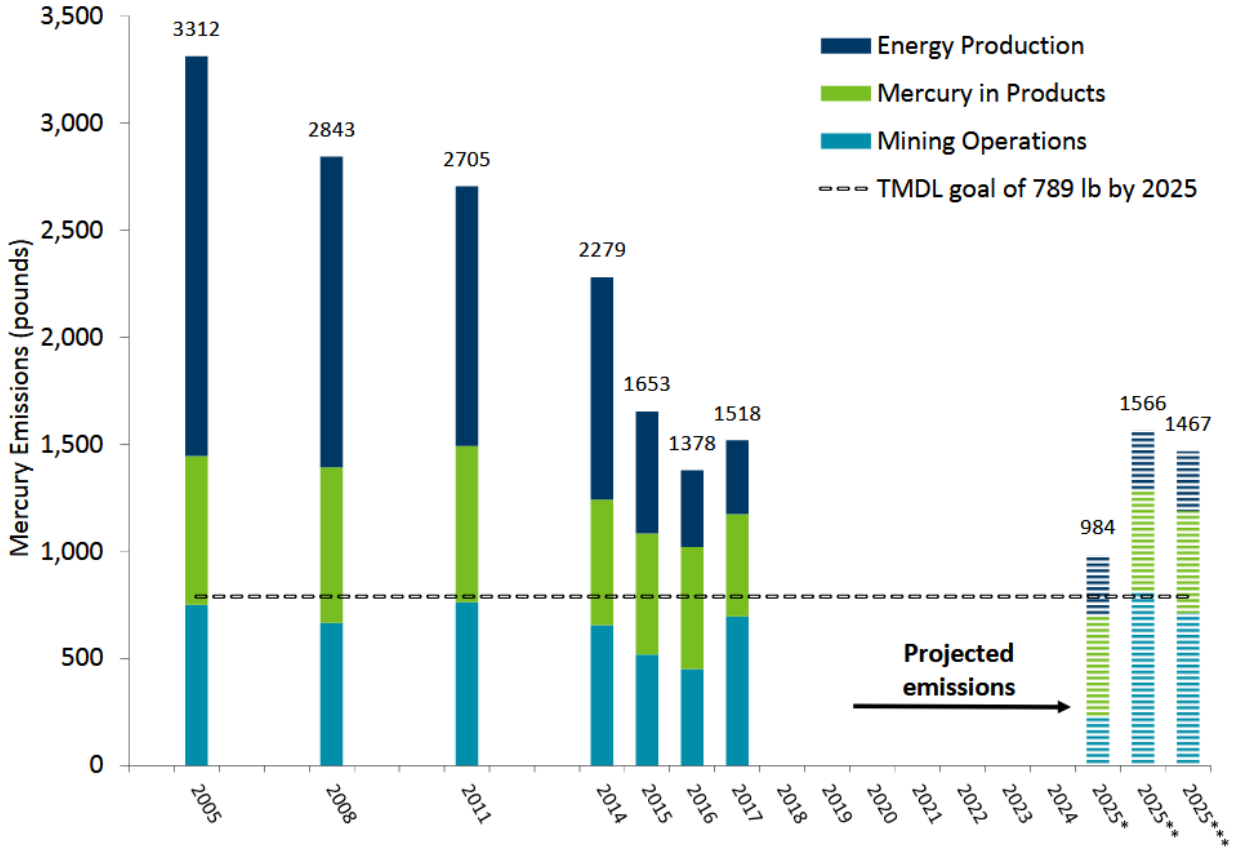


Minnesota has demonstrated environmental leadership by providing for stakeholder process development of important environmental and energy policy initiatives. The following are brief summaries of notable initiatives with graphical representations that highlight certain environmental improvements:

- Mercury in fish improvements through the Minnesota Mercury Reduction Initiative. MERA required that the largest coal-fired electric generation units in Minnesota provide for control retrofits delivering 90 percent mercury emission reductions by 2018 as compared to 2005 emissions. The electric utility sector met this 90 percent reduction goal in 2017[4], and mercury emissions from this sector have continued to decline further since then as a result of generation changes.

[4] https://www.pca.state.mn.us/sites/default/files/wq-iw4-02h7.pdf

Figure 3: MN Mercury Reduction Initiative TMDL[5] Goal Progress (source: MPCA)

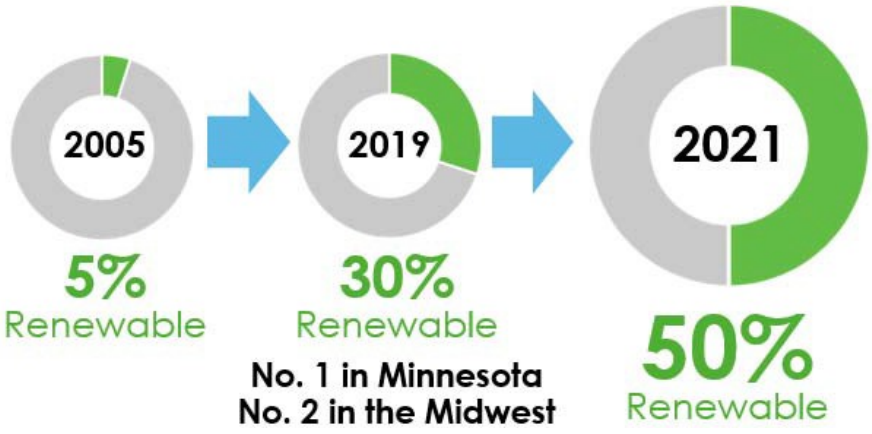


- SO_2, NO_x and volatile organic compound emission reductions through "affordable control" utility emission reduction programs like Clean Air Minnesota, the Metropolitan Emission Reduction Program, and the AREA Plan. The associated local emission reductions improved Minnesota air quality in advance of federal programs such as the Clean Air Interstate Rule and CSAPR while those programs were not yet finalized by the EPA.
- Visibility impairment improvement measures through the MPCA's Northeast Regional Emissions Abatement program required 20 to 30 percent collective reductions in targeted Minnesota SO_2 and NO_x emissions. This is in line with the Regional Haze program and Reasonable Further Progress requirements.
- Conservation and energy efficiency improvement programs have been in place for several decades in the state, and Minnesota Power continues to meet and exceed these goals.
- Minnesota Renewable Energy Standard ("RES") requirements stage in the expanded use of renewable energy by Minnesota utilities through 2025 (25 by 25 RES). A 12

[5] Total maximum daily load.

percent renewables progress target for 2012 was met and Minnesota Power currently provides over 50 percent renewable energy – the highest renewable percentage for any utility in Minnesota.

Figure 4: Minnesota Power's Projected 2021 Renewable Generation (owned and purchased)



- Minnesota's Next Generation Energy Act of 2007 ("NGEA") measures set a goal for GHG emission reductions staging a 15 percent reduction in CO_2 equivalent emissions from all sources by 2015, 30 percent by 2025 and 80 percent by 2050. The Minnesota Climate Change Advisory Group process helped frame initial options for emission reductions. Progress towards goals is being reported by the MPCA to the Legislature biannually (see Figures 5 & 6), with the most recent progress report from April 2021. Minnesota Power has already achieved 50 percent carbon reductions from 2005 levels, well in advance of the goal set in the NGEA.

Figure 5: NGEA Greenhouse Gas Emissions & Reduction Goals (source: MPCA)

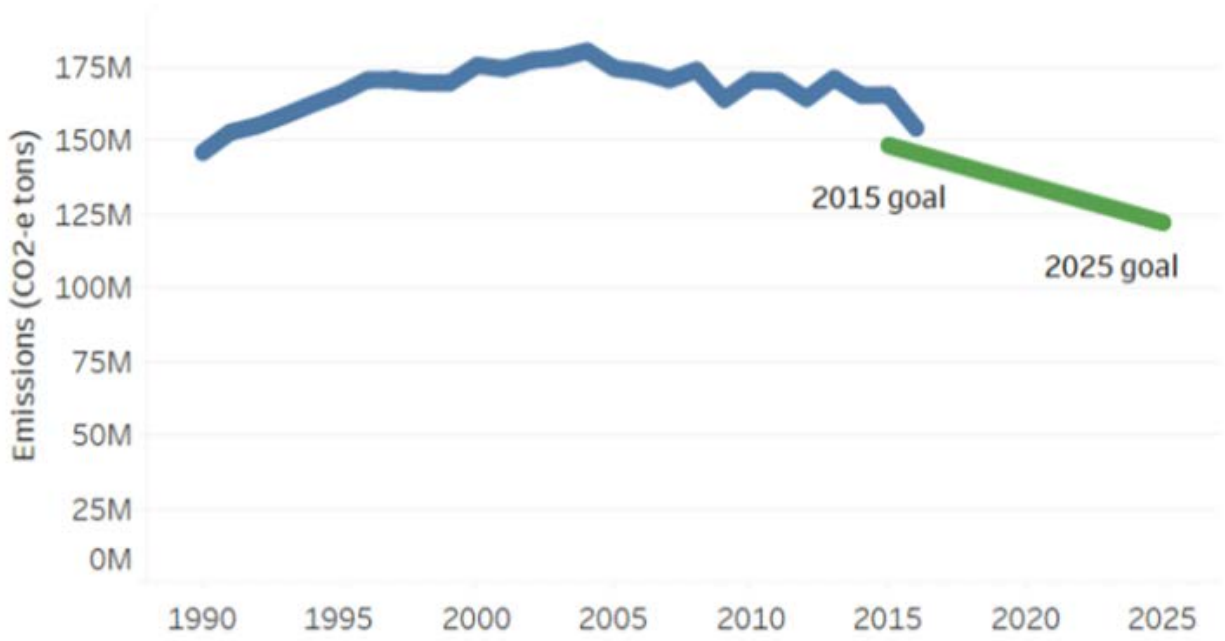
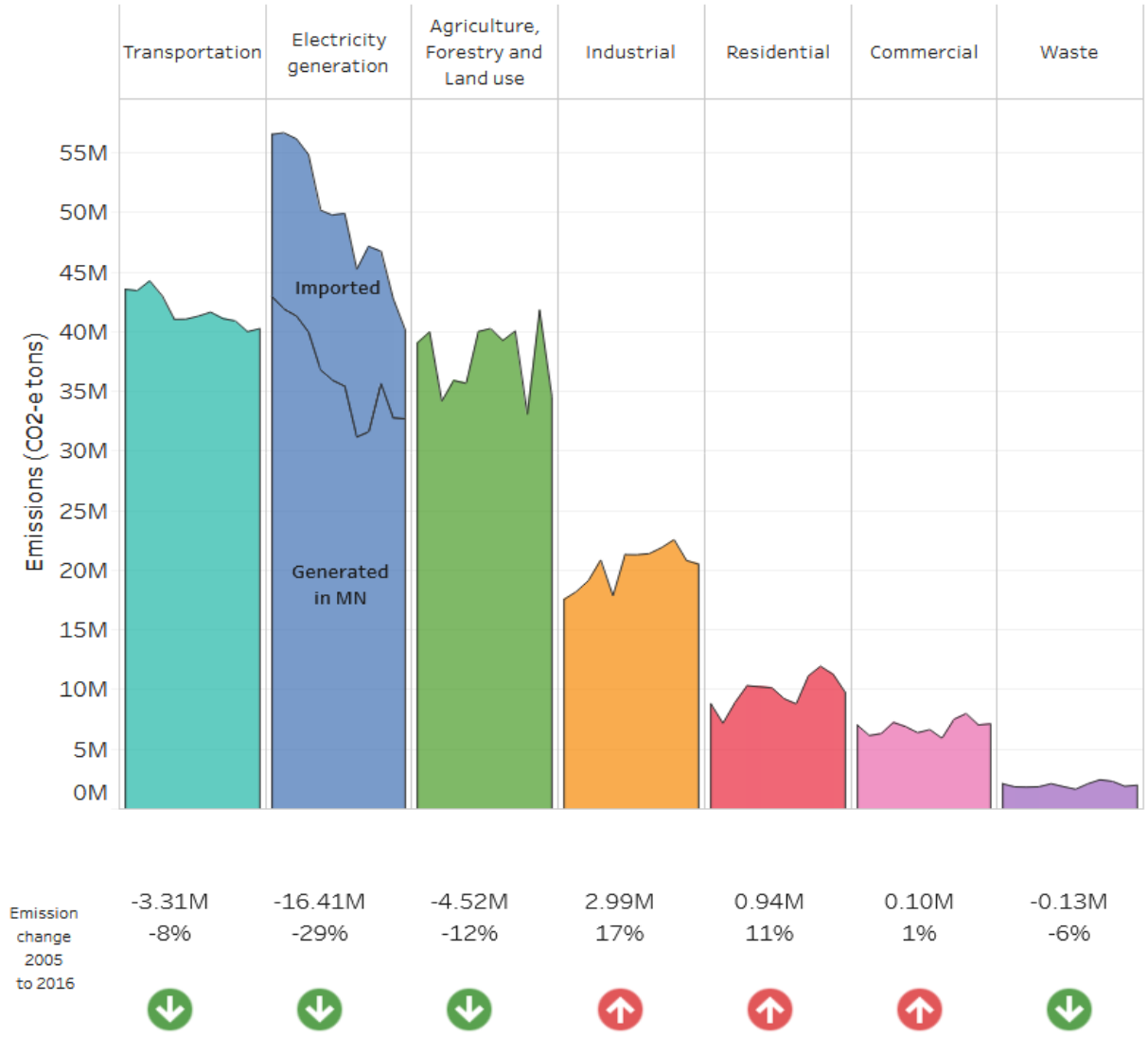


Figure 6: Greenhouse Gas Emissions from Minnesota by Economic Sector, 2005 – 2016 (source: MPCA)



Part 2: Environmental Regulations Summary

The landscape for environmental regulation of coal-fired power plants continues to evolve. New changes to environmental regulations could have a significant impact on Minnesota Power's operations, although the Company doesn't forsee any new regulations in the near term horizon significantly impacting operations at BEC or LEC. This section summarizes the more significant environmental regulations, and estimates a potential range of impact these regulations could have on the Company.

Overview of Environmental Regulations

Minnesota Power closely follows state and federal rulemakings that regulate air emissions, water emissions and solid waste from coal-fired power plants. In the following sections, the Company describes pending environmental regulations relative to the Company facilities and its current assessment of their applicability. The regulations are grouped into two broad categories: 1) those that address air emissions, and, 2) those related to water discharges, water usage, and management of the ash or solid waste, which is a byproduct of coal combustion.

The regulations to be detailed in the following sections include:

<u>Air Regulations</u>

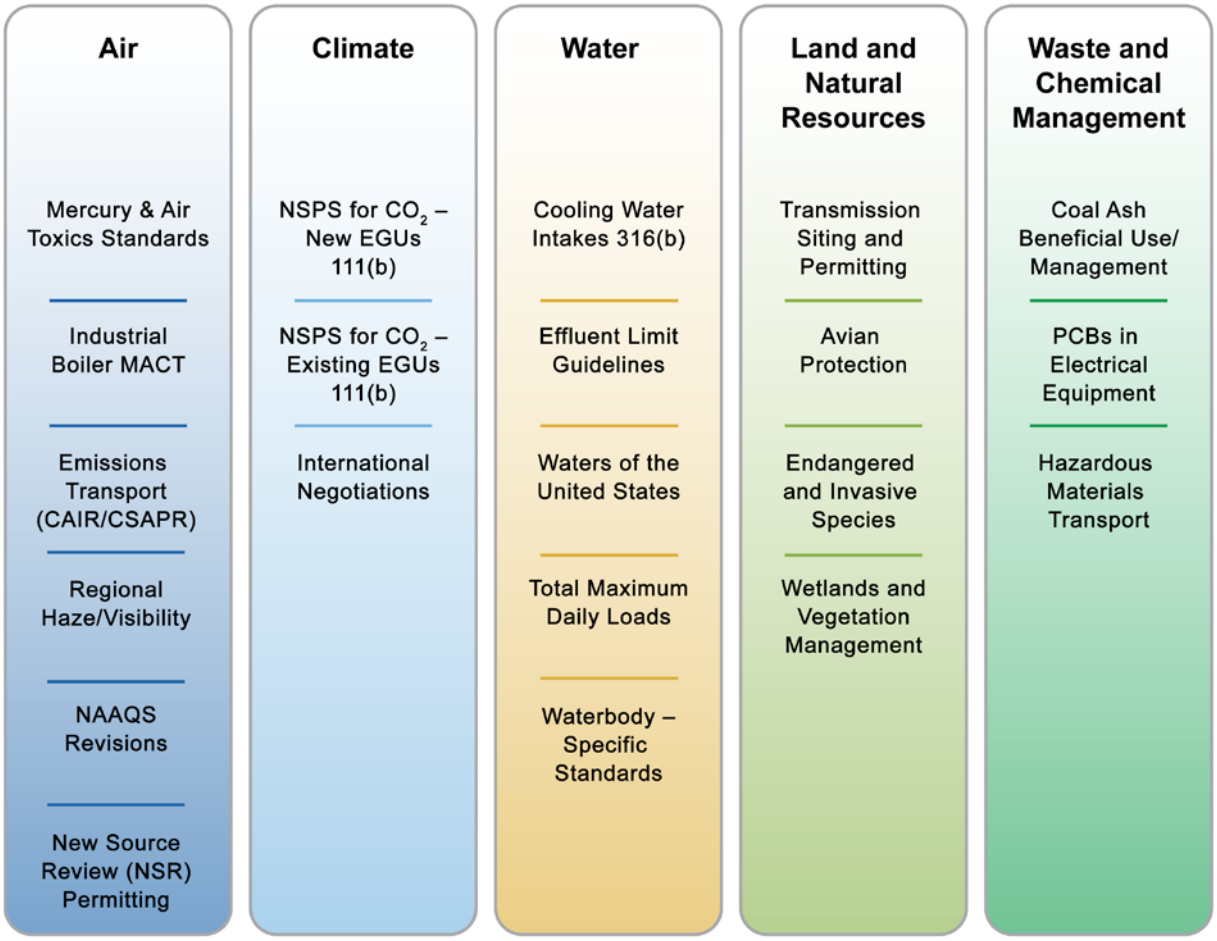
- Cross-State Air Pollution Rule ("CSAPR")
- National Ambient Air Quality Standards ("NAAQS")
- Mercury and Air Toxics Standards ("MATS") Rule
- National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters ("Boiler MACT")
- Minnesota Mercury Emissions Reduction Act ("MERA")
- Clean Air Visibility Rule ("Regional Haze")
- Affordable Clean Energy Rule ("ACE")

<u>Water and Solid Waste</u>

- Coal Combustion Residuals Regulation ("CCR")
- Water Effluent Regulation ("Effluent Limitations Guidelines" or "ELG")

As environmental regulations work their way through the finalization process each rule can be at different stages and have various levels of certainty associated with them. For the purposes of its forward resource planning and decision making, Minnesota Power identifies which regulations are most certain for the time period being evaluated and includes these in its Base Case outlook.

Figure 7: Key Federal Environmental Regulatory Challenges



For its 2021 IRP, Minnesota Power identified that all listed environmental regulations have enough clarity on their status to be considered part of its Base Case outlook. Each of these regulations is explained in detail below, with a potential impact analysis on the Company's generation in the section to follow.

Air Emissions

Cross-State Air Pollution Rule ("CSAPR")

On July 6, 2011, the EPA finalized the CSAPR, which requires 27 states, including Minnesota, to reduce power plant SO_2 and NO_x emissions that can contribute to ozone and fine particle pollution non-attainment in other states. The CSAPR replaced EPA's 2005 Clean Air Interstate Rule ("CAIR"). The CSAPR Phase 1 implementation began on January 1, 2015 and Phase 2 began in 2017. The CSAPR does not directly require the installation of controls. Instead, it sets a strict emission allowance budget for each state and requires facilities to surrender enough emission allowances to cover their emissions on an annual basis. Minnesota Power expects that allowances for the Company are sufficient for current and planned emission levels to comply with CSAPR.

National Ambient Air Quality Standards ("NAAQS")

The NAAQS are established to protect human health ("primary standards") or public welfare ("secondary standards") for criteria pollutants, including particulate matter, SO_2, NO_x, and ground-level ozone. The NAAQS can impact Minnesota Power in two possible ways. First, if air dispersion modeling from a state-approved protocol demonstrates that the NAAQS are being exceeded at a facility's property boundary, the Company would have to take measures to reduce emissions. Second, if a county that contains one of the Company's facilities goes into non-attainment (which means one or more sites demonstrate ambient air concentrations greater than the standard), then existing facilities may have to undertake additional control measures to reduce emissions of that pollutant. The EPA is required to review the NAAQS every five years to assess whether imposing more restrictive standards are warranted to protect human health and the environment. The Company tracks ongoing NAAQS developments and expects that current emission controls will remain compliant with existing or known proposed NAAQS revisions. Therefore the Company is not identifying any additional technology requirements for the NAAQS in the 2021 IRP.

Mercury and Air Toxics Standards ("MATS") Rule

Under Section 112 of the CAA, the EPA is required to set emission standards for hazardous air pollutants ("HAPs") for certain source categories. The EPA published the final MATS Rule in the Federal Register on February 16, 2012, addressing such emissions from coal-fired utility units greater than 25 MW. There are currently 187 listed HAPs for which the EPA is required to evaluate for establishment of MACT standards. In the final MATS Rule, the EPA established categories of HAPs, including mercury, trace metals other than mercury (e.g., arsenic), acid gases (e.g., hydrochloric acid), dioxin/furans, and organics other than dioxin/furans. The EPA also established emission limits for the first three categories of HAPs, and work practice standards for the remaining categories. A particulate limit was established as a surrogate for trace metals other than mercury. Affected sources were required to be in compliance with the rule by April 2015, or no later than April 2016 with a duly approved compliance extension.

Since 2013, the EPA and courts have undertaken various regulatory and judicial actions affecting the MATS Rule, particularly the U.S. Supreme Court June 2015 reversal and remand decision in the *Michigan v. EPA* case. In the resulting 2016 supplemental cost finding and subsequent 2020 corrections to that finding, EPA concluded that it was not "appropriate and necessary" to regulate HAPs emissions from electric steam generating units under section 112 of the CAA. EPA did not propose to remove those units from the list of sources regulated, therefore the primary emission standards and other requirements of the MATS Rule remain in place. However, Minnesota Power is additionally subject to ongoing emission reduction obligations under the Minnesota Mercury Emissions Reduction Act (discussed below) and the July 16, 2014 Consent Decree entered into with the Minnesota Pollution Control Agency and the United States; therefore, the Company does not expect significant changes to our operations regardless of potential changes to the MATS Rule status.

Industrial Boiler Maximum Achievable Control Technology ("Boiler MACT") Rule

On January 31, 2013, the final Boiler MACT Rule was published in the Federal Register. Similar to the MATS Rule, the EPA is required to evaluate HAPs emissions for establishment of MACT standards for boilers. The Boiler MACT Rule establishes emission standards for control of mercury, hydrogen chloride, particulate matter, and carbon monoxide, and imposes work practice standard requirements such as periodic tune-ups. Major sources had to achieve compliance with the final rule by 2016. Minnesota Power facilities impacted by this regulation

include HREC, which did not require significant technology investments to comply with the Boiler MACT Rule. On August 24, 2020, the EPA proposed further amending several of the Boiler MACT numerical emission limits and establishing new compliance dates for the revised limits. Based on review of this draft rule, the Company does not currently anticipate significant additional investments will be necessary to comply with the latest Boiler MACT emission standard revisions.

Minnesota Mercury Emissions Reduction Act ("MERA")

The MERA required Minnesota Power's two largest units, BEC3 and BEC4, to install mercury emission controls with the goal to achieve up to 90 percent mercury removal. The Company installed mercury controls on each unit and has associated air permit emission limits and operational requirements in its Title V air permit from the MPCA. Coupled with the conversion of LEC to natural gas and the retirement/idling of THEC units, the Company has reduced airborne mercury emissions 97 percent from 2005 levels.

Clean Air Visibility Rule / Regional Haze Rule

The federal Regional Haze Rule requires states to submit a State Implimentation Plan ("SIP") to the EPA to address regional haze visibility impairment in 156 federally-protected parks and wilderness areas. The first phase of the Regional Haze Rule for the first planning period, 2008 through 2018, was issued by EPA in 2005. The rule required that certain large stationary sources, put in place between 1962 and 1977, with emissions contributing to visibility impairment, install emission controls, known as Best Available Retrofit Technology ("BART"). BEC3 and THEC3 were subject to BART requirements. The retrofit work completed in 2009 at BEC3 met the BART requirements for that unit, and the June 2015 retirement of THEC3 met the BART requirements for that unit.

The most recent revisions to the Regional Haze Rule were finalized in January 2017 covering the second planning period, 2018 through 2028. The revised rule established requirements for the SIP submittals due July 31, 2021. The Regional Haze SIP is required to identify existing facilities that are significant enough sources of NO_x and SO_2 and located close enough to subject Class I areas to potentially cause or contribute to visibility impairment in those Class I areas. The SIP will analyze, identify, and apply federally-enforceable control strategies for the subject sources. Minnesota Class I areas are the Boundary Waters Canoe Area Wilderness and Voyageurs National Park. Due to their potential emissions and geographical proximity to the BWCAW and Voyageurs, Minnesota Power's BEC and THEC units were selected for inclusion into the Minnesota Regional Haze Round 2 SIP planning process. The Company is currently working with the MPCA to address rule requirements for those units in support of the SIP development, and we currently do not estimate additional controls will be needed to comply with Regional Haze requirements.

Affordable Clean Energy ("ACE") Rule

On June 19, 2019, the EPA issued the final ACE Rule under Section 111(d) of the Clean Air Act ("CAA"), regulating CO_2 emissions at existing coal-fired power plants and simultaneously repealing the Clean Power Plan ("CPP"). The CPP was repealed due to a determination by the EPA that the CPP exceeded the EPA's statutory authority under the CAA. The EPA also published regulations for the state implementation of the ACE Rule and other 111(d) rules.

The ACE Rule package was subsequently litigated on the basis of both technical environmental aspects as well as overarching legal concepts, including standing and deference. *American Lung Association and American Public Health Association v. EPA, et al.* was argued in front of the U.S. Court of Appeals for the District of Columbia Circuit on October 8, 2020.

On January 19, 2021, the D.C. Circuit issued an opinion vacating the ACE Rule, including its embedded CPP repeal and amendments to the 111(d) implementing regulations. This action remands the ACE Rule back to the EPA for further consideration, consistent with the Court's finding that EPA erred in interpreting the CAA while developing the ACE Rule package. The Rule vacatur does not become officially effective until the Court issues its mandate following the filing of any rehearing or appeals of its January 19, 2021 decision.

Pending potential future legal actions in the D.C. Circuit or the Supreme Court, the EPA can be reasonably expected to craft another replacement rule regulating carbon dioxide emissions from existing power plants. EPA's mandate to do so originates from the 2007 *Massachusetts v. EPA* Supreme Court decision and EPA's resultant 2009 Endangerment Finding on CO_2.

At this time, Minnesota Power cannot speculate on the outcome or specifics of legal actions or a future rule. However, Minnesota Power will continue to work with the EPA and/or MPCA through development, issuance, and implementation of any replacement rule.

Additionally, EPA has also issued rulemaking to apply CO_2 emission New Source Performance Standards ("NSPS") to new, modified, and reconstructed fossil fuel-fired electric generating units under Section 111(b) of the CAA. The final NSPS rule was finalized in October 2015, revised in December 2018, and most recently finalized again on January 13, 2021. The Company's proposed natural gas combined cycle facility, the Nemadji Trail Energy Center, is expected to fully meet the NSPS requirements, and should not be impacted by this rulemaking. However, additional rulemakings may occur and we will continue to monitor 111(b) developments.

Water Issues/Ash Management

Regulation of Coal Combustion Residuals

On April 17, 2015, the EPA finalized regulations for coal combustion residuals ("CCR") generated by the electric utility sector (40 CFR Parts 257 and 261). The final rule regulates the disposal of CCR under Subtitle D of the Resource Conservation and Recovery Act ("RCRA") as a non-hazardous waste. The rule established new minimum criteria for existing and new CCR landfills and impoundments, including design and operating criteria, groundwater monitoring and corrective action, closure requirements and post-closure care conditions. Since 2015, the CCR rule has undergone multiple revisions as a result of legal challenges and subsequent regulatory revisions. Most notably, in August 2018, a U.S. District Court for the District of Columbia decision vacated specific provisions of the CCR rule that allowed continued operation of clay-lined impoundments that met other CCR requirements. The Court decision changed the status of three existing clay-lined impoundments at BEC, requiring those impoundments to cease receipt of CCR and begin closure, though timelines to do so were not specified. Additional rule revisions were proposed by EPA in August and December 2019 to address outstanding issues from litigation and establish closure timelines for unlined impoundments, respectively. The Part A rulemaking was finalized on September 28, 2020, allowing qualifying facilities to seek an extension to operate clay-lined ponds for a finite amount of time to allow development of alternative closure capacity, not later than 2023. The Part B rulemaking, which allows owners of clay-lined impoundments to seek an alternative liner demonstration, was finalized November 12, 2020.

Capital investments identified by Minnesota Power to comply with the CCR rule include conversion to dry bottom ash systems on BEC3 and BEC4 and installation of a flue gas desulphurization ("FGD") gypsum dewatering system. These projects will allow placement of dry

CCR materials in the onsite dry ash disposal area and eliminate wet ash sluicing and storage operations. The projects will also facilitate dewatering and final closure of the existing CCR impoundments at BEC. The dry ash conversion and gypsum dewatering projects are expected to occur in 2021-2023 with dewatering and closure of the ash ponds to follow over a 10-15 year period. Regardless of the outcome of outstanding CCR rule revisions or if BEC is retired early, these projects are anticipated to proceed as necessary and viable methods for achieving closure of the facility ash complex and ensuring short- and long-term compliance with wastewater and CCR regulations.

Regulation of Water Effluent

In 2015, the EPA issued revised federal effluent limitation guidelines ("ELG") for steam electric power generating stations under the Clean Water Act. It set effluent limits and prescribed BACT for several wastewater streams, including FGD water, bottom ash transport water and coal combustion landfill leachate. In 2017, the EPA announced a two-year postponement of the ELG compliance date of November 1, 2018, to November 1, 2020, while the agency reconsidered the bottom ash transport water and FGD wastewater provisions. On April 12, 2019, the U.S. Court of Appeals for the Fifth Circuit vacated and remanded back to the EPA portions of the ELG that allowed for continued discharge of legacy wastewater and leachate. On October 13, 2020, the EPA published a final ELG Rule in the Federal Register allowing re-use of bottom ash transport water in FGD scrubber systems with limited discharges related to maintaining system water balance. The rule sets technology standards and numerical pollutant limits for discharges of bottom ash transport water and FGD wastewater. Compliance deadlines depend on subcategory, with compliance generally required as soon as possible beginning October 13, 2021, but no later than December 31, 2023, or December 31, 2025 in some specific cases. The rule also establishes new subcategories for retiring, high-flow, and low-utilization units, and establishes a Voluntary Incentives Program ("VIP") for FGD wastewater.

The ELG Rule's potential impact on Minnesota Power operations is primarily at BEC. BEC currently discharges bottom ash transport water through its National Pollutant Discharge Elimination System ("NPDES") permit, and also has a closed-loop FGD system that does not discharge to surface waters, but may do so in the future if additional water treatment measures are implemented. At this time, the Company estimates that the planned dry conversion of bottom ash handling and storage at BEC in response to the CCR revisions requiring closure of clay-lined impoundments, as well as other water re-use practices, will reduce or eliminate the need for additional significant compliance expenditures for ELG requirements.

Additional requirements on wastewater quality may also be imposed by the MPCA during NPDES permit renewals, triennial reviews, or by special rulemaking. For example, the State of Minnesota has an existing 10 mg/L sulfate limit based on wild rice protection, which has historically not been implemented into most Minnesota NPDES permits. Due to increased scrutiny of the sulfate limit in recent years, implementation of a sulfate limit on NPDES permittees that discharge to wild rice waters is possible in this IRP planning horizon if a new sulfate rulemaking to protect wild rice is published. Currently, there is no state rulemaking activity on the sulfate standard.

Projected Impact on Minnesota Power's Generation Facilities

As part of its ongoing planning process, the Company reviewed if there are any potential impacts of these recently enacted and proposed rules that need to be taken into consideration in the IRP analysis for BEC, LEC, and HREC.

Minnesota Power's emission reduction projects implemented over the past decade, such as the AREA Plan and BEC3 and BEC4 retrofits, have positioned the Company to be well-prepared for both current and future environmental regulations. While some rules have the potential to require additional measures to be implemented, at this time the Company's expectation is that its thermal fleet can continue to operate over the study period without the need for significant capital investment beyond what is included in the base case to comply with future environmental regulations.

Base Case

The Base Case for the 2021 IRP identified regulations that have clarity on their status and would be considered part of its Base Case outlook.

As previously mentioned, since many of the rules impact the same pollutant, the controls that may be required to meet one regulation will cover another. For example, in the Base Case it is assumed that the environmental control technologies required for the MATS rule will continue to meet NAAQS requirements, and the control technologies chosen for CCR will meet ELG requirements. The assumptions for the Base Case make up the best known information for each rule at this time; however, information can change significantly prior to final rule implementation.

Minnesota Power Generating Unit Outlook

The following section identifies the regulations that are taken into consideration in the Base Case for each unit, or set of units.

Boswell Energy Center Unit 3

For BEC3, the environmental regulations taken into consideration when developing the Base Case outlook is discussed here. Largely, BEC3's portion of the water and coal combustion residual requirements is addressed in the Base Case outlook because BEC3 has already been retrofitted with extensive emission control equipment.

Base Case Outlook For BEC3

Air Emissions

As described in Appendix C, a major environmental upgrade was completed at BEC3 in 2009 to meet state and federal environmental requirements. Following the retrofit, the unit now employs low NO_x burners, over-fired air, and a selective catalytic reduction system for NO_x control, a WFGD system for SO_2 control, an activated carbon injection system, and a fabric filter for mercury and particulate control. These controls represent state-of-the-art technology for addressing air emissions, and thus, no further air emission controls are anticipated at this time.

Mercury (MATS, MERA)

The MATS Rule requires certain coal-fired units to meet a mercury emission limit. The BEC3 activated carbon injection system and fabric filter installed to meet MERA expectations was designed to capture up to 90 percent of mercury that would otherwise be emitted. Because of significant emissions control this system affords for mercury, BEC3 did not need to do anything further to reduce mercury under the MATS regulation.

Acid Gases (MATS)

The MATS Rule requires Minnesota Power facilities to meet an hydrochloric acid ("HCl") limit as a surrogate for acid gas emissions. The WFGD system for SO_2 control is also effective at removing acid gases, including HCl. BEC3 meets the requirements of the MATS without additional investment.

Particulate Matter (MATS)

The MATS Rule includes a PM limit as a surrogate for trace metals other than mercury. The fabric filter installed on BEC3 as part of the retrofit is effective at removing particulate, including associated trace metals. No additional control requirements were required.

Water Issues/Waste Management

ELG

The ELG rule establishes new water discharge requirements for Steam Electric Stations. The most applicable standards for BEC include requirements for FGD streams and bottom ash transport water. The final rule was published on October 13, 2020 with new FGD wastewater discharge requirements and bottom ash transport water discharge standards. A prohibition on bottom ash water discharge applies no later than December 31, 2025, requiring reuse of bottom ash transport water in plant process with limited exceptions for discharge to surface water. This will require high levels of water re-use within the plant and/or conversion to a dry bottom ash handling system. Minnesota Power is currently planning for dry conversion for both FGD and bottom ash systems, and the Company's plans for water re-use include numerous options to recycle most water in plant processes rather than discharging to surface waters.

CCR

The CCR rule was revised on September 28, 2020 to establish requirements in response to a 2018 D.C. Circuit decision (the "USWAG decision"), which determined that clay-lined impoundments are subject to closure. Under the revised rule (the 'Part A" rulemaking) the BEC3 FGD Pond is required to cease disposal of CCR and non-CCR wastes as soon as technically feasible. This will require installation of a gypsum dewatering system to eliminate FGD wastewater discharges to the pond and facilitate dewatering for closure. Dewatered FGD materials will be placed in the on-site dry ash disposal area and/or beneficially re-used. Additional water treatment may be necessary to dewater the BEC3 FGD via discharge to surface water or for re-use in plant processes.

The revised rule also requires closure of BEC's Bottom Ash Pond, which currently accepts bottom ash and bottom ash transport water from both BEC3 and BEC4. Conversion to dry bottom ash handling will eliminate wet sluicing and storage of bottom ash and transport water at BEC, and will also facilitate pond dewatering and closure. Post bottom ash conversion, the dry bottom ash solids from BEC3 will be placed in the onsite dry ash disposal area.

Boswell Energy Center Unit 4

For BEC4, the Mercury Emission Reduction Project ("BEC4 Project") addressed all of the air regulation requirements currently included in the Base Case and had overall positive impacts on future water treatment regulation as new systems require less water. The range of cost impacts on the unit based on Base Case are represented in Table 3. The environmental regulations taken into consideration when developing the Base Case outlook for BEC4 are discussed below.

Base Case Outlook For BEC4

Air Emissions

From 2013 through 2016, BEC4 implemented a major control retrofit to add a semi-dry flue gas desulfurization system, fabric filter, and powder activated carbon injection system. The multi-pollutant system reduces mercury, particulate matter, sulfur dioxide, and other HAPs while also reducing plant waste water. Combined with BEC4's existing low NO_x burners, separated close-coupled over-fire air system, and SNCR technologies for NO_x control, the BEC4 retrofit project helped achieve compliance with MATS, MERA, and other enacted or pending federal and state environmental rulemakings regulating air and water emissions and solid byproducts from coal-fired power plants.

Mercury (MATS, MERA)

The MATS Rule requires coal-fired units to meet a mercury emission limit. Under MERA, Minnesota Power installed mercury control technology on BEC4 to achieve 90 percent mercury removal. Under the Base Case outlook, this emission limit and technology also complies with the MATS mercury limit. The mercury control technology was compared to other remission and retirement alternatives and found to be the best alternative.

Acid Gases (MATS)

The MATS Rule requires Minnesota Power facilities to meet an HCl limit as a surrogate for acid gas emissions. The semi-dry FGD system for SO_2 control is also effective at removing acid gases, including hydrochloric acid. Under the Base Case outlook, the BEC4 Project meets the requirements of the proposed MATS without additional investment.

Water Issues/Waste Management

CCR

Under the revised CCR rule, the clay-lined BEC4 Pond is required to cease disposal of CCR and non-CCR wastes. However, CCR disposal is no longer necessary in this pond due to the retrofit of BEC4 pollution control equipment. This retrofit transitioned the unit to dry fly ash and scrubber solids handling, and the combined scrubber solids and fly ash is now placed in the onsite dry ash disposal area.

The dewatering and closure of the pond does require additional technology. Installation of a thermal evaporation system will be used to facilitate pond dewatering activities, a technology which minimizes the need for water treatment and discharge to surface waters. The thermal evaporation system can also be used for other wastewater streams to help with compliance with NPDES, ELG, or other water quality requirements. Depending on BEC4 operations in the future, additional water treatment may be necessary to dewater the pond via discharge to surface water or for re-use in plant processes to meet closure timelines under the CCR rule. The Part A Rule will also require closure of the facility Bottom Ash Pond, as stated above. Again, conversion to dry bottom ash handling will eliminate wet sluicing and storage of bottom ash at BEC, and will also facilitate pond dewatering and closure. Post bottom ash conversion, the dry bottom ash solids from BEC4 will be placed in the onsite dry ash disposal area.

ELG

The ELG rule establishes new water discharge requirements for Steam Electric Stations. The most applicable standards for BEC include requirements for FGD streams and bottom ash transport water. The final rule was published on October 13, 2020 with new FGD wastewater discharge requirements and bottom ash transport water discharge standards. A prohibition on

bottom ash transport water discharge applies no later than December 31, 2025, requiring reuse of bottom ash transport water in plant process with limited exceptions for discharge to surface water. However, after the BEC4 retrofit, BEC4 no longer operates a wet fly ash handling system or a wet FGD stream to which these restrictions would apply.

Pond 4 contains significant volumes of FGD waters from historical wet scrubbing operations, and ELG requirements may apply to legacy wastewaters from BEC4 wet scrubbing applications if surface discharge were required for pond dewatering. A final rule to regulate legacy wastewaters under the ELG is expected, but the EPA currently has not announced a timeline for rule publication.

Laskin Energy Center Units 1 and 2

The environmental regulations taken into consideration when developing the Base Case outlook for LEC is discussed below.

Base Case Outlook For LEC

Air Emissions

Since the MATS rule sets standards for HAPs emitted from coal and oil-fire power plants, it does not regulate emissions from natural gas plant units like LEC, which has since been converted from coal-fired operations.

Water Issues/Waste Management

CCR

LEC is no longer producing CCR. Cessation of coal ash disposal at LEC eliminates the need for future impoundment or landfill construction. The existing impoundments are inactive, andhave been closed in accordance with CCR rule provisions. Significant costs related to CCR management at LEC are not expected.

ELG

The conversion of LEC to gas eliminated wet and dry handling of ash and associated wastewaters. Legacy wastewaters, such as leachate from the closed impoundments, may be subject to ELG requirements. A final rule to regulate legacy wastewaters under the ELG is expected, but EPA currently has no announced timeline for rule publication.

Part 3: 2021 Plan Environmental Targets

With the 2021 Plan and the sustainable solutions brought forward in it, Minnesota Power's generation fleet continues to transform into a less carbon intensive power supply. The Company's 2021 Plan will outline a plan to achieve 80 percent carbon reduction by 2035, an important milestone on its path to achieve the goal of a carbon-free energy power supply by 2050. Furthermore, initiatives taken by the State of Minnesota, such as those described in Part 1 of this Appendix, combined with the installation of new control technology on its coal fleet, ensure a holistic approach to reducing emissions of all types.

BEC3 & BEC4 are outfitted to meet all applicable environmental standards, addressing the air, water and solid waste issues of concern. An array of renewable energy resources, both directly owned and under contract, utilizing renewable wind, solar, hydro, and biomass, conservation and renewable distributed generation programs, combined with the additional wind and solar identified in the 2021 Plan and changing operations at BEC will place the company on a path to meet carbon reduction targets.

Looking ahead, Minnesota Power expects the environmental footprint of electric utilities to continue to shrink through sustainability targets set by the Company, and as decarbonization solutions become more economical. As noted above, Minnesota Power has set its own carbon vision with an intent for our generation factilities to be coal-free by 2035, a milestone towards a goal of providing 100 percent carbon-free energy by 2050.

As the MPCA has highlighted, the focus for further environmental performance improvements in the state will shift away from electric utilities to other emission source types that have emerged as significant contributors, such as the transportation sector's impact on urban air quality (as illustrated in Figure 6 above).

Minnesota Power's water, wastewater and ash management measures already provide for treatment of water to meet discharge standards, which satisfy existing Minnesota requirements. In turn, existing Minnesota water quality requirements are expected to either meet, or be more stringent than, existing and pending EPA requirements. While EPA's CCR requirements for impoundments and landfills are triggering additional actions, existing Company operations are in full compliance with state requirements and future reductions in water discharges will better position the Company for compliance with increased water-based regulations. Finally, increased beneficial use of ash byproducts position the Company well for coal ash handling and storage requirements under CCR and ELG.

Collectively, the array of measures implemented by Minnesota Power now and through the 2021 Plan have positioned the Company to be well prepared for current and pending environmental requirements. The resource actions taken to-date and identified in the 2021 Plan results in significant carbon reductions that surpass existing NGEA GHG goals, puts the Company on a path to meet sustainability goals.