414 Nicollet Mall
Minneapolis, MN 55401

March 29, 2024

—Via Electronic Filing—

Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, MN 55101

RE: COMPLIANCE FILING
PETITION FOR APPROVAL OF A POWER PURCHASE AGREEMENT
DOCKET NO. E002/M-21-590

Dear Mr. Seuffert:

Northern States Power Company, doing business as Xcel Energy, submits this Compliance Filing pursuant to the Minnesota Public Utilities Commission's ORDER APPROVING POWER-PURCHASE AGREEMENT, AUTHORIZING COST RECOVERY, AND SETTING ADDITIONAL REQUIREMENTS issues January 24, 2022 ORDER in the above-referenced docket.

We have electronically filed this document with the Minnesota Public Utilities Commission, and copies have been served on the parties on the attached service list. Please contact pamela.k.gibbs@xcelenergy.com or contact me at allen.d.krug@xcelenergy.com if you have any questions regarding this filing.

Sincerely,

/s/

ALLEN D. KRUG
AVP, STATE REGULATORY POLICY

cc: Service List

STATE OF MINNESOTA
BEFORE THE
MINNESOTA PUBLIC UTILITIES COMMISSION

Katie J. Sieben	Chair
Hwikwon Ham	Commissioner
Valerie Means	Commissioner
Joseph K. Sullivan	Commissioner
John A. Tuma	Commissioner

IN THE MATTER OF XCEL ENERGY'S PETITION FOR APPROVAL OF A POWER PURCHASE AGREEMENT WITH SAINT PAUL COGENERATION, LLC	DOCKET NO. E002/M-21-590
	COMPLIANCE FILING

INTRODUCTION

Northern States Power Company, doing business as Xcel Energy, submits this Compliance Filing pursuant to the Minnesota Public Utilities Commission's ORDER APPROVING POWER PURCHASE AGREEMENT, AUTHORIZING COST RECOVERY, AND SETTING ADDITIONAL REQUIREMENTS issued January 24, 2022 in the above-referenced docket.

In that Order, the Commission approved a two-year power purchase agreement (PPA) with Saint Paul Cogeneration, LLC, finding that this PPA met the requirements of Minn. Stat. § 216B.2424, subd. 5c, and allowed the Company to recover the purchased energy costs net of any matching revenues through the Fuel Clause Rider. The Commission also required the Company to file an electrification proposal by March 2024, and to include in that proposal a societal cost-benefit analysis developed with input from the Department of Commerce, Minnesota Pollution Control Agency, Saint Paul Cogeneration, and other interested parties.

In this filing, we present our electrification proposal, developed in collaboration with Saint Paul Cogeneration (section I). Section II updates the societal cost-benefit analysis, conducted earlier and summarized in our November 30, 2023 PROGRESS REPORT.[1] The methods are largely unchanged, but the analysis is updated to use the Commission's newly adopted environmental cost values and other more minor

[1] Northern States Power Company, doing business as Xcel Energy. November 30, 2023 COMPLIANCE FILING – PROGRESS REPORT. *In the Matter of Xcel Energy's Petition for Approval of a Power Purchase Agreement with Saint Paul Cogeneration, LLC.* Docket No. E002/M-21-590.

assumption updates. Section III addresses how our proposal meets each of the applicable requirements of Minn. Stat. § 216B.2424, subd. 5c.

I. ELECTRIFICATION PROPOSAL

A. Project Description

The goal of this proposal is to evaluate modifying the downtown Saint Paul district energy system – which is currently supplied with heat by natural gas and biomass combusted at Saint Paul Cogeneration, and natural gas and fuel oil combusted in District Energy St. Paul's (District Energy) boilers – so that a portion of the thermal energy input would come from a 30 megawatt (MW) electric boiler operating on renewable electricity. The electric boiler would operate in off-peak hours and displace natural gas used in District Energy's boilers.

The Company and Saint Paul Cogeneration discussed various scales of electrification, consistent with the statutory requirement to "evaluate electrification at three or more levels from ten to 100 percent, including 100 percent of the energy used by the Saint Paul district heating and cooling system."[2] We determined that 10 percent of the thermal energy input would require an approximately 20 MW boiler, while 100 percent would require 175 MW. We determined that a 175 MW boiler would be prohibitively expensive, due to the space requirements and distribution system improvements necessary to integrate this large a load, as well as the cost of piping to downtown Saint Paul if a boiler of this size were sited at the High Bridge power plant. We determined that a 30 MW boiler would be technically feasible to integrate into the downtown district energy system and would not require significant distribution system improvements. Because the 20 MW and 175 MW options were addressed in our PETITION FOR APPROVAL OF A PURCHASE POWER AGREEMENT filed July 30, 2021, for the remainder of this filing we discuss only the 30 MW option.[3]

Saint Paul Cogeneration advised the Company that it would operate the electric boiler from November through March in the off-peak hours of 9 pm to 9 am Monday-Friday and all day on Saturday and Sunday. These operating hours would allow the project to take advantage of off-peak electricity pricing, storing hot water in a storage

[2] Minn. Stat. 216B.2424, Subd. 5c.(b)(3).

[3] Northern States Power Company, doing business as Xcel Energy. July 30, 2021 2021 PETITION FOR APPROVAL OF A PURCHASE POWER AGREEMENT. *In the Matter of Xcel Energy's Petition for Approval of a Power Purchase Agreement with Saint Paul Cogeneration, LLC*. Docket No. E002/M-21-590.

tank for discharge as needed in other hours. The boiler would operate about 2,268 off-peak hours per year, consuming 54,721 megawatt hours (MWh) per year.[4]

Operated this way, the electric boiler would displace an estimated 219,721 MMBtu of natural gas that is currently combusted by District Energy to supplement approximately 734,200 MMBtu per year of heat energy provided to the system by Saint Paul Cogeneration. Saint Paul Cogeneration's consumption of biomass, which represents around 237,000 tons per year of wood residuals, would be unaffected by electrification.

Since the statute requires the electrification project to "result in the St. Paul district heating and cooling system being powered by electricity generated from renewable energy technologies,"[5] we considered it a requirement of this project that the 54,721 MWh per year come from a renewable resource. We used generic renewable pricing for that resource in our modeling. We assumed the electric boiler would be operational at the end of 2027 and remain in operation for 30 years.

B. Relationship to State Climate Goals

The project can be seen as part of the broader statewide trend toward electrification of heating, with increasingly clean electricity being used where feasible to reduce fossil fuel combustion and associated greenhouse gas (GHG) emissions. For example, the *Minnesota Climate Action Framework* includes, under Goal 4 – Clean Energy & Efficient Buildings, a priority action to "Reduce emissions related to heating and cooling homes and businesses." Measures of progress for this goal include "By 2030, reduce thermal GHG emissions by at least 20 percent, compared to 2005 levels" and "By 2035, reduce GHG emissions from existing buildings by 50 percent compared to 2005 levels."[6]

The district energy system serving downtown Saint Paul provides heat to both residential and commercial buildings, and operates in part on natural gas, so converting part of its heat input to clean electricity would support these *Climate Action Framework* goals.

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[4] 2,268 hours at the full 30 MW would equate to 68,040 MWh. Saint Paul Cogeneration clarified that they forecast some hours during November through March where the full 30 MW could not be utilized, due to storage being not fully depleted or due to warmer outdoor air temperatures such that the electric boiler is not needed to meet district energy load. The estimate of 54,721 MWh is based on 2,268 hours at an average rate of 24.1 MW throughout the five months. An alternative, equating to the same annual electricity use, would be operating at the full 30 MW in December through February, and at only 14.58 MW in November and March.

[5] Minn. Stat. 216B.2424, Subd. 5c.(b)(3).

[6] *Minnesota's Climate Action Framework*. Goal 4, Clean Energy and Efficient Buildings. Page 50. Available at Climate Action Framework | Our Minnesota Climate (state.mn.us).

C. Linkage of Electrification and PPA Extension

A key question in evaluating the societal benefits of electrification is whether extending the PPA with Saint Paul Cogeneration is assumed to be contingent on implementing the electrification project. The applicable statute originally allowed extension of this PPA *only* if electrification was implemented – but was amended in 2023 to formally delink the two.[7] This would technically allow the Commission to approve a PPA beyond December 31, 2024 without approving an electrification project.

In the Company's view, electrification and the PPA extension remain linked because the Company has many other and lower-cost options to produce or procure the energy and capacity provided by the Saint Paul Cogeneration PPA. However, when paired with the innovative electrification project that supports State climate goals, a PPA extension provides a potentially unique approach to overall energy efficiency. That said, we acknowledge that the two decisions could also be looked at independently. Our analysis presented below indicates that both actions, whether considered in conjunction or separately, yield net societal benefits.

Electrification delivers a societal benefit in Present Value of Societal Cost (PVSC) terms primarily because it avoids GHG emissions. A PPA extension – since Saint Paul Cogeneration has informed the Company that, absent a PPA extension, it would cease operations – delivers a societal benefit primarily by avoiding a significant increase in criteria pollutant emissions from open burning of the wood residuals currently disposed of at Saint Paul Cogeneration. The latter benefit is in fact the largest component of the overall societal cost savings.

D. EnCompass Modeling Results

To evaluate costs of implementing the electrification project and extending the Saint Paul Cogeneration PPA, we conducted modeling in EnCompass, our standard resource planning software. The modeling compared, in PVSC and Present Value of Revenue Requirements (PVRR) terms, the Electrification/PPA Extension Scenario to a reference case representing the Preferred Plan in the Company's 2024-2040 UPPER MIDWEST INTEGRATED RESOURCE PLAN filed February 1, 2024.[8]

[7] Minn. Stat. 216B.2424, Subd. 5c.(f).

[8] Northern States Power Company, doing business as Xcel Energy. February 1, 2024. 2024-2040 UPPER MIDWEST INTEGRATED RESOURCE PLAN. Docket No. E002/RP-24-67.

The key modeling assumptions were:

- In the Electrification/PPA Extension Scenario, a 30 MW electric boiler is added on 12/31/2027 and assumed to operate for 30 years. Annual electricity consumption for the boiler is 54,721 MWh, operating in off-peak hours (Monday to Friday 9 pm to 9 am and all day during weekends) from November 1st through March 31st each year. The boiler is assumed to operate on renewable electricity, using generic renewable pricing assumptions from the resource plan. The Saint Paul Cogeneration PPA is extended for 30 years at $98/MWh.
- In the reference case, no electric boiler is added and the Saint Paul Cogeneration PPA expires on December 31, 2024. All other modeling assumptions match the Preferred Plan filed February 1, 2024.

We emphasize that $98/MWh – the PPA ceiling price per statute[9] – was used for modeling purposes only. The actual PPA price is under negotiation between the Company and Saint Paul Cogeneration and may be less than this ceiling price.

The Electrification/PPA Extension Scenario had very little effect on the expansion plan in EnCompass, since the 30 MW electric boiler load is mostly offset by the 25 MW PPA extension. The expansion plans in the Electrification/PPA Extension Scenario and reference case are very similar through 2040.

The modeling results show a small net PVSC savings for the Electrification/PPA Extension Scenario relative to the reference case. This savings is about $30 million in net present value (NPV) terms over 2025-2050. Consistent with Commission orders, our PVSC modeling includes a $40/ton CO_2 regulatory cost starting in 2028.[10] In PVRR terms, the modeling shows a net system cost of $157 million (NPV, 2025-2050) for the Electrification/PPA Extension Scenario relative to the reference case. See Table 1.

The PVSC savings of $30 million indicates that there is a societal advantage to implementing electrification and a PPA extension, relative to the reference case, even when the PPA extension is modeled at the $98/MWh statutory ceiling price. To the extent the Company and Saint Paul Cogeneration are able to agree on a lower PPA price, the PVSC savings of the Electrification/PPA Extension Scenario would increase, and PVRR net costs would decrease.

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[9] Minn. Stat. 216B.2424, Subd. 5c.(b)(2).

[10] December 19, 2023 ORDER ADDRESSING ENVIRONMENTAL AND REGULATORY COSTS. *In the Matter of Establishing an Updated 2022 Estimate of the Costs of Future Carbon Dioxide Regulation on Electricity Generation Under Minn. Stat. § 216H.06*. Docket Nos. E-999/CI-07-1199, E-999/DI-22-236, and E-999/CI-14-643.

We emphasize that the EnCompass modeling captures only part – in fact, the smaller part – of the overall societal benefit. If we assume, as discussed above, that lacking a PPA extension Saint Paul Cogeneration would close, then the societal cost of open burning of wood waste currently disposed of at Saint Paul Cogeneration would be very high – or, stated differently, the societal benefit of *avoiding* open burning is high. That portion of the benefit, not shown in Table 1, is discussed in the next section.

Table 1
EnCompass Modeling Results, Comparing Electrification/PPA Extension Scenario to Reference Case
(Red numbers are negative costs, i.e. societal benefits)

PVSC Production Cost	Delta in NPV ($m) 2025-2040	NPV ($m) 2025-2040	Delta in NPV ($m) 2025-2047	NPV ($m) 2025-2047	Delta in NPV ($m) 2025-2050	NPV ($m) 2025-2050
Scenario 3 - Base (PVSC)	$0	$ 48,407	$0	$ 61,643	$0	$ 67,004
Scenario 3 - Electrification/PPA Extension (PVSC)	($15)	$ 48,392	($29)	$ 61,615	($30)	$ 66,974
**PVSC scenario includes $40/ton regulatory cost of carbon starting in 2028.*						

PVRR Production Cost	Delta ($m)	NPV ($m) 2025-2040	Delta in NPV ($m) 2025-2047	NPV ($m) 2025-2047	Delta in NPV ($m) 2025-2050	NPV ($m) 2025-2050
Scenario 3 - Base (PVRR)	$0	$ 34,009	$0	$ 45,470	$0	$ 49,888
Scenario 3 - Electrification/PPA Extension (PVRR)	$79	$ 34,089	$126	$ 45,596	$157	$ 50,044

II. SOCIETAL COST-BENEFIT ANALYSIS

The Company in 2022-23 worked with the Department of Commerce, Minnesota Pollution Control Agency, and Saint Paul Cogeneration to develop a societal cost-benefit analysis that compared two scenarios, described below. This analysis was summarized in our November 30, 2023 PROGRESS REPORT,[11] and we update some assumptions here.

- *Reference Case*: with no electrification project approved, the Saint Paul Cogeneration PPA terminates at the end of 2024. Lacking PPA revenues, Saint Paul Cogeneration closes. All wood residuals currently burned at Saint Paul Cogeneration must find alternate disposal; this leads to an increase in open burning. Natural gas use also increases to replace the lost thermal energy provided to the downtown Saint Paul district energy system by Saint Paul Cogeneration.
- *Electrification/PPA Extension Scenario*: a 30MW electric boiler is installed, displacing natural gas currently used to provide supplemental thermal energy to

[11] See footnote 1.

the downtown Saint Paul district energy system. Saint Paul Cogeneration continues to use biomass for about 80 percent if its heat input, which is unaffected by the electrification project. Xcel Energy continues to purchase electricity under the PPA. The new 30 MW of electrical load operates off-peak, and a new renewable resource is needed to power this load.

We made three updates to our earlier analysis:

- Saint Paul Cogeneration provided new ten-year averages for the amount of thermal energy provided by Saint Paul Cogeneration to the downtown Saint Paul district energy system (734,200 MMBtu per year) and wood residuals consumption (237,000 tons per year).
- For GHG emissions – including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from natural gas combustion, as well as CH_4 from open burning of wood waste – our earlier analysis quantified societal damages by applying the Commission's then-current CO_2 externality values, based on the Commission's January 3, 2018 ORDER in the externalities docket.[12] These have since been updated. In its December 19, 2023 ORDER, in compliance with Minnesota Session Laws 2023, Chapter 7, Section 18, the Commission provisionally adopted the Social Cost of Greenhouse Gases (SC-GHG) values from U.S. EPA's September 2022 *External Review Draft of Report on the Social Cost of Greenhouse Gases.*[13] We updated the GHG externality values used in our analysis accordingly; consistent with the Company's *2024-2024 Upper Midwest Integrated Resource Plan,* we used the 2 percent discount rate SC-GHG values for CO_2, CH_4 and N_2O from the EPA report.
- To calculate the net present value of costs and benefits, we used the Company's latest approved weighted average cost of capital of 6.39 percent, consistent with our *Upper Midwest Integrated Resource Plan.*

All other assumptions remained consistent with the earlier societal cost-benefit analysis summarized in our November 30, 2023 PROGRESS REPORT.

The updated assumptions further increase the societal benefit of the Electrification/PPA Extension Scenario relative to the reference case, as shown in Table 2. The total societal benefit – shown below as a negative societal cost – includes

[12] January 3, 2018 ORDER UPDATING ENVIRONMENTAL COST VALUES. *In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under Minnesota Statutes Section 216B.2422, Subdivision 3*. Docket No. E-999/CI-14-643.

[13] December 19, 2023 ORDER ADDRESSING ENVIRONMENTAL AND REGULATORY COSTS. *In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under Minnesota Statutes Section 216B.2422, Subdivision 3*. Docket No. E-999/CI-14-643.

three components: avoided GHG emissions from natural gas that would otherwise be needed to replace the biomass-derived share of thermal energy provided to the downtown Saint Paul district energy system by Saint Paul Cogeneration; avoided criteria pollutant emissions from open burning of 237,000 tons per year of wood waste currently disposed of at Saint Paul Cogeneration;[14] and PVSC savings to the electric system of the Electrification/PPA Extension Scenario.

Table 2
Societal Costs of Electrification/PPA Extension.

Societal costs (in million dollars)	NPV 2025-2050
Avoided GHG emissions from natural gas combustion	-$156
Avoided criteria pollutant emissions from open burning	-$694
PVSC cost of Electrification/PPA Extension	-$30
Total societal cost	-$880

We note that by far the largest share of societal costs comes from criteria pollutant emissions from open burning. This is because of relatively high emission factors for criteria pollutants in the inefficient combustion conditions of open burning,[15] multiplied by the Commission's externality values for criteria pollutants. When the same wood waste is burned at Saint Paul Cogeneration, more efficient combustion combined with criteria pollutant controls keep emission rates low. Of the $694 million (NPV, 2025 to 2050) in societal costs from criteria pollutant emissions, roughly $600 million is from particulate matter alone. This is due to high particulate matter emissions in open burning conditions, and externality values that range from almost $20,000 to over $30,000 per ton, depending on the year.[16] So the societal value of avoiding an increase in particulate matter emissions is quite high.

[14] As noted in our November 30, 2023 PROGRESS REPORT, by agreement with the Minnesota Pollution Control Agency we assumed 100 percent of the wood waste currently disposed of at Saint Paul Cogeneration would be diverted to open burning. The basis of this assumption was that State law prohibits disposal of brush and tree waste in landfills or solid waste facilities, and mulch markets for wood waste are relatively saturated, especially with the growing spread of emerald ash borer, so would have difficulty absorbing a large increase in wood waste.

[15] For emission factors from open burning, we used the U.S. EPA's AP-42: Compilation of Air Emissions Factors from Stationary Sources | US EPA, specifically Chapter 2 Solid Waste Disposal – Section 2.5, Open Burning at https://www.epa.gov/sites/production/files/2020-10/documents/c02s05.pdf. We used the Table 2.5-5 values for Forest Residues – Unspecified species.

[16] See January 3, 2018 ORDER, cited in footnote 12. We used the Commission's High externality values for a "Metropolitan Fringe" location of emissions. Values are even higher for Urban emissions, but we used the Metropolitan Fringe values based on an assumption that if Saint Paul Cogeneration closed, wood wastes would be hauled outside the Metro core for open burning.

III. COMPLIANCE WITH STATUTORY REQUIREMENTS

Minn. Stat. § 216B.2424, subd. 5c lays out specific requirements for this electrification proposal and the extension of a PPA with Saint Paul Cogeneration. This section addresses each applicable statutory requirement in turn.

> *Subd. 5c.(a) No later than August 1, 2021, a public utility subject to subdivision 5 and the cogeneration facility may file a proposal with the commission to enter into a power purchase agreement that governs the public utility's purchase of electricity generated by the cogeneration facility. The power purchase agreement may extend no later than December 31, 2024, and must not be extended beyond that date except as provided in paragraph (f).*

In our July 30, 2021 PETITION FOR APPROVAL OF A PURCHASE POWER AGREEMENT, the Company proposed extending the Saint Paul Cogeneration PPA through December 31, 2024. We also made a preliminary electrification proposal, while noting that our full proposal would come later (i.e., this filing). The Commission in its January 24, 2022 ORDER found the conditions in Subd. 5c(b) were met and approved the PPA extension.

> *Subd. 5c.(b)(2) the price per megawatt hour of electricity paid by the public utility demonstrates significant savings compared to the existing power purchase agreement, with a price that does not exceed $98 per megawatt hour.*

We used the ceiling price of $98/MWh for modeling purposes here, while noting that the actual PPA price is negotiation between the Company and Saint Paul Cogeneration. The PVSC modeling results indicate that the electrification proposal and PPA extension would have a net societal benefit even if the PPA price were to reach the ceiling price; PVSC savings would be greater (and PVRR costs lower) at a lower PPA price.

> *Subd. 5c(b)(3) the proposal includes a proposal to the commission for one or more electrification projects that result in the St. Paul district heating and cooling system being powered by electricity generated from renewable energy technologies. The plan must evaluate electrification at three or more levels from ten to 100 percent, including 100 percent of the energy used by the St. Paul district heating and cooling system to be implemented by December 31, 2027. The proposal may also evaluate alternative dates for implementation.*

Our July 30, 2021 PETITION FOR APPROVAL OF A PURCHASE POWER AGREEMENT discussed various levels of electrification from 10 percent to 100 percent. We found the 100 percent level, requiring roughly 175 MW of electric boiler capacity, to be infeasible from a technical and cost perspective – but that greater than 10 percent

(equivalent to roughly 20 MW) would be feasible. So we settled on a 30 MW, renewably powered electric boiler as the solution to analyze in detail. Note that cooling for the downtown Saint Paul district energy system is already 100 percent electrified and utilizes carbon-free electricity, so the focus of this analysis is on heating.

Our modeling used generic renewable pricing for the incremental energy of 54,721 MWh used annually by a 30 MW boiler operated November through March, meeting the "electricity generated from renewable energy technologies" requirement above. We modeled an online date of December 31, 2027 for the boiler. Per agreement with Saint Paul Cogeneration, we did not model alternative dates.

> *Subd. 5c(b)(3)(i) [the proposal must contain] a description of the alternative electrification technologies evaluated and whose implementation is proposed as part of the electrification project.*

Per agreement with Saint Paul Cogeneration, we only analyzed addition of a 30 MW electric boiler to the district energy system.

> *Subd. 5c(b)(3)(ii) [the proposal must contain] an estimate of the cost of the electrification project to the public utility, the impact on the monthly energy bills of the public utility's Minnesota customers, and the impact on the monthly energy bills of St. Paul district heating and cooling system customers.*

The Company conducted an analysis to estimate the impact of the Electrification/PPA Extension Scenario on the average monthly electric bill of a typical Minnesota residential customer. We used some simplifying assumptions for this analysis, since the impacts of this project are so small relative to the Company's overall revenue requirements.

Per the Commission's January 24, 2022 ORDER, in the case of the initial two-year PPA extension that ends December 31, 2024, the Company was authorized "… to recover the PPA purchased-energy costs, net of any matching revenues, less a market-based amount for the non-Minnesota jurisdictional portion of the energy and capacity benefits."[17] We assume here that the same treatment may be applied to a further PPA extension – i.e., that the Commission may dictate that only the above-market cost of the PPA and the Minnesota-jurisdictional portion of the market costs, rather than the full cost of the PPA, be borne by the Company's

[17] See footnote 1, Order Point 1.

Minnesota customers. This would recognize that the Saint Paul Cogeneration PPA delivers some energy and capacity benefits to the overall NSP Minnesota system.

To estimate the market values delivered by the PPA, we used the MISO market energy and capacity prices for 2025 from our latest *Upper Midwest Integrated Resource Plan* ($35.16/MWh and $107.04/kW-year, respectively) and multiplied those by the 153,000 MWh of energy and 25 MW of capacity provided by the Saint Paul Cogeneration PPA. Deducting those "market cost" values from the overall PPA cost gives the above-market PPA costs. We assigned the above-market PPA costs, plus the Minnesota-jurisdictional share of the market costs, to the Company's Minnesota customers. We then applied those total Minnesota costs to Minnesota retail sales to derive an estimate of the impact on Minnesota rates.

Finally, we applied that rate impact to the monthly electricity bill of a typical Minnesota customer using 650 kWh per month. This results in an estimated bill impact of 29 cents per month, which includes 16 cents/month for the above-market PPA costs and 13 cents/month for the Minnesota share of market costs.

Saint Paul Cogeneration evaluated the impact of electrification on the monthly energy bills of Saint Paul district heating and cooling system customers. They estimated that the proposed 30 MW electric boiler with hot water storage scenario results in an increase in the per-unit energy cost to Saint Paul district heating customers of 128 percent for the thermal energy delivered from the electric boiler as compared to the alternative (natural gas from existing boilers). The difference is the result of 1) the higher cost of electricity versus natural gas, which accounts for approximately 80 percent of the difference in per-unit energy costs, and 2) the debt service costs for the installation of the electric boiler and the modifications to the existing thermal storage to make it compatible with hot water storage, accounting for approximately 20 percent of the difference in per-unit costs. Since the anticipated energy delivery from the electric boiler with hot water storage system is approximately 16 percent of the total annual energy delivered by downtown Saint Paul district energy system, the effect on the average rate to heating customers is approximately a 10 percent increase.

> *Subd. 5c(b)(3)(iii) [the proposal must contain] an estimate of the reduction in greenhouse gas emissions resulting from the electrification project, including greenhouse gas emissions associated with the transportation of waste wood.*

There are two viewpoints from which to consider the GHG emissions avoided by electrification, both of which we think are instructive.

We first consider the CO_2 emissions avoidance of a 30 MW electric boiler on its own, without considering any change to Saint Paul Cogeneration operations. The electric boiler will provide thermal energy to the downtown Saint Paul district energy system, displacing natural gas currently combusted by District Energy to supplement heat provided by Saint Paul Cogeneration. The 54,721 MWh supplied annually to the boiler, converted to MMBtu and then divided by 85 percent to account for the efficiency of District Energy's natural gas boilers, would result in 219,721 MMBtu of natural gas that no longer has to be burned by District Energy. Assuming a standard EPA emissions factor of 117 pounds CO_2 per MMBtu,[18] this results in 12,854 tons of CO_2 emissions per year avoided (with no offsetting emissions from electricity use, since the boiler will be renewably powered).

In an alternate view, assume that with its PPA not extended beyond December 31, 2024, Saint Paul Cogeneration would close. In this case, the entire 734,200 MMBtu per year currently supplied to the downtown Saint Paul district energy system by Saint Paul Cogeneration would need to be replaced. Twenty percent of this is currently from natural gas combustion, so for that portion there would be no net change in emissions. It would also be necessary to replace the 80 percent (587,360 MMBtu) currently from biomass combustion – which we treat as carbon-neutral, per State GHG inventory guidance – which we assume would be replaced with the lowest-cost alternative, natural gas. Replacing the biomass-derived heat input with heat from an 85 percent efficient natural gas boiler would result in a net increase of 691,012 MMBtu of natural gas combustion. Using the same EPA emission factor of 117 pounds CO_2 per MMBtu, this would result in a net increase of 40,424 tons of CO_2 per year that would be avoided by implementing the electrification project and extending the PPA.

The above two calculations, converted to the equivalency of passenger cars driven for a year, are:[19]

- 12,854 tons CO_2 per year is equivalent to taking 2,775 passenger vehicles off the road for a year
- 40,424 tons CO_2 per year is equivalent to taking 8,728 passenger vehicles off the road for a year

The statute also references GHG emissions associated with the transportation of waste wood. We do not dispute that there are GHG emissions from diesel and/or gasoline used by trucks transporting waste wood to Saint Paul Cogeneration. However, in our reference case here – where electrification is not implemented and

[18] See Emission Factors for Greenhouse Gas Inventories (epa.gov).
[19] Using the Greenhouse Gas Equivalencies Calculator | US EPA.

the PPA is not extended – the same quantity of waste wood currently transported to Saint Paul Cogeneration would be transported elsewhere for disposal. Average transportation distances would in fact likely be longer, since waste wood would likely need to be transported outside the Metro core for burning. So we do not quantify GHG emissions from transportation – not because they are zero, but because they would be either the same in both the reference case and the Electrification/PPA Extension Scenario, or more likely, greater in the reference case due to longer transportation distances to open burning sites.

> *Subd. 5c(b)(3)(iv) [the proposal must contain] estimated impacts on the operations of the St. Paul district heating and cooling system.*

Saint Paul Cogeneration evaluated impacts of the electrification proposal on operations of the Saint Paul district heating and cooling system. District energy customers will benefit from the implementation of the electrification project because it would provide added redundancy to the thermal production assets used to meet the thermal energy needs of much of downtown Saint Paul. The addition of a substantial thermal production asset powered by electricity enhances the resilience of the district heating facility since there is added diversification in the available input energy sources that can be utilized to meet peak load. In particular, when natural gas is curtailed during winter peak usage periods, the district heating system would utilize the electric boiler to offset a portion of the load that would otherwise be met using fuel oil. When coupled with hot water thermal storage as is planned for this project, the thermal storage enables the delivery of lower-cost, off-peak electricity to meet the peak thermal load of the Saint Paul district heating system. There is also a benefit to the Saint Paul district heating and cooling customers and the broader community from utilizing carbon-free input energy.

> *Subd. 5c(b)(3)(v) [the proposal must contain] a timeline for the electrification project.*

For modeling purposes we assumed the electrification project would begin (boiler load would go online) on December 31, 2027, and would operate for 30 years.

> *Subd. 5c(b)(4) [The commission is prohibited from approving a new power purchase agreement unless] the power purchase agreement provides a net benefit to the utility customers or the state.*

The estimated societal benefits of the Electrification/PPA Extension Scenario are shown in Table 2 above. For the utility system, our EnCompass modeling indicates a PVSC benefit of $30 million (NPV, 2025-2050) of Electrification/PPA Extension relative to the reference case. For statewide benefits, our analysis shows additional

societal benefits from avoiding an increase in natural gas combustion to replace thermal energy ($156 million, NPV 2025-2050) and from avoiding criteria pollutant emissions from open burning of wood waste ($694 million, NPV 2025-2050) that would occur if Saint Paul Cogeneration were to close.

> *Subd. 5c(c) The commission may approve, or approve as modified, a proposed electrification project that meets the requirements of this subdivision if it finds the electrification project is in the public interest, or the commission may reject the project if it finds that the project is not in the public interest. When determining whether an electrification project is in the public interest, the commission may consider the effects of the electrification project on air emissions from the St. Paul district heating and cooling system and how the emissions impact the environment and residents of affected neighborhoods.*

This statutory language suggests that, in its public interest determination, the Commission may consider the societal benefit of avoiding increased GHG and criteria pollutant emissions and the impacts of those emissions on the environment and residents of affected neighborhoods. Our analysis here depends on the assumption that absent electrification and a PPA extension, air emissions would increase due to open burning, which we assign the Commission's externality values for Metropolitan Fringe emission locations. If the Commission accepts those assumptions, then the public interest determination could consider the avoided externality damages of preventing open burning.

> *Subd. 5c(f) the commission is allowed to approve a power purchase agreement after the agreement period without approving an electrification project. Nothing in this section shall require any utility to enter into a power purchase agreement with the cogeneration facility after December 31, 2024.*

This 2023 statutory change removes the mandatory link between approving an electrification project and extending the PPA. The analysis presented in this filing assumes electrification and PPA extension remain effectively linked, due to the many other and lower-cost options to procure the energy and capacity provided by the Saint Paul Cogeneration PPA. However, we acknowledge electrification and PPA extension both provide societal benefits, whether considered in conjunction or separately.

> *(g) Upon approval of an electrification project, the commission must require periodic reporting regarding the progress toward implementation of the electrification project.*

The Company will report periodically on an interval the Commission finds appropriate. The installation and operation of the electric boiler will be the

responsibility of District Energy and/or Saint Paul Cogeneration, so it may make sense to request they report directly to the Commission.

> *Subd. 5c(h) if the Commission approves the electrification proposal, it may allow the Company to recover prudently incurred costs net of revenues resulting from the electrification project through an automatic cost recovery mechanism that allows for cost recovery outside of a general rate case. The cost recovery mechanism approved by the commission must: (1) allow a reasonable return on the capital invested in the electrification project by the Company, as determined by the Commission, and (2) recover costs only from the Company's Minnesota electric service customers.*

We believe this statutory language was written under the assumption the Company would own the electric boiler. The Company does not currently contemplate doing so; this asset would be funded, owned and operated by Saint Paul Cogeneration or the downtown Saint Paul district energy company. So we believe the language "allow a reasonable return on the capital invested in the electrification project by the Company" to be moot.

The costs of the electrification project to the Company and its customers would include the costs of the PPA with Saint Paul Cogeneration. Our analysis assumes recovery of the above-market costs of the PPA, plus the Minnesota jurisdictional portion of the market costs, from the Company's Minnesota electric customers.

The costs of a new renewable resource providing an estimated 54,721 MWh annually to serve the electric boiler would be recovered from Saint Paul Cogeneration in the rates charged to Saint Paul Cogeneration for electricity.

CONCLUSION

The Company and Saint Paul Cogeneration have worked together to meet the requirements of Minn. Stat. § 216B.2424, subd. 5c regarding a potential electrification project for the downtown Saint Paul district energy system. As noted above, we have included a PPA extension with Saint Paul Cogeneration as an integral part of the electrification project. Taken together, the PPA extension and electrification project provide significant savings from a societal perspective. They also provide significant societal benefits independent of each other and each on its own merits.

The Company recommends that the Commission request comments on this study to determine next steps. In the interim, the Company will be working with Saint Paul Cogeneration on further development of the electrification project and PPA extension

for regulatory review, should the Commission ultimately order the Company to proceed consistent with our integrated approach to both initiatives.

Dated: March 29, 2024

Northern States Power Company

CERTIFICATE OF SERVICE

I, Joshua DePauw, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota

xx electronic filing

DOCKET NO. E002/M-21-590

Dated this 29th day of March 2024

/s/

_____

Joshua DePauw
Regulatory Administrator

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