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Minneapolis, MN 55401

March 31, 2023

—Via Electronic Filing—

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

RE: COMPLIANCE FILING
GENERAL TIME-OF-USE SERVICE TARIFF
DOCKET NO. E002/M-20-86

Dear Mr. Seuffert:

Northern States Power Company, doing business as Xcel Energy, submits to the Minnesota Public Utilities Commission (Commission) this filing in compliance with the February 1, 2023 ORDER APPROVING TIME OF USE PILOT AND SETTING ADDITIONAL REQUIREMENTS in the above-referenced docket. In addition to the information provided in compliance with the Commission's February 1, 2023 Order, with this filing the Company is also requesting Commission approval of changes to the pilot tariff.

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 me at Holly.R.Hinman@xcelenergy.com or (612) 330-5941, or Becky Billings at Becky.J.Billings@xcelenergy.com or (612) 702-1730 if you have any questions regarding this filing.

Sincerely,

/s/

HOLLY HINMAN
DIRECTOR, REGULATORY AND STRATEGIC ANALYSIS

Enclosures
cc: Service List

STATE OF MINNESOTA
BEFORE THE
MINNESOTA PUBLIC UTILITIES COMMISSION

Katie J. Sieben	Chair
Valerie Means	Commissioner
Matthew Schuerger	Commissioner
Joseph K. Sullivan	Commissioner
John A. Tuma	Commissioner

IN THE MATTER OF THE PETITION OF
NORTHERN STATES POWER COMPANY
FOR APPROVAL OF A GENERAL TIME-
OF-USE SERVICE TARIFF

DOCKET NO. E002/M-20-86

COMPLIANCE FILING

INTRODUCTION

Northern States Power Company, doing business as Xcel Energy, submits to the Minnesota Public Utilities Commission (Commission) this Compliance Filing discussing implementation details for a General Time-Of-Use (TOU) Service Pilot. This filing is made in compliance with the February 1, 2023 ORDER APPROVING TIME OF USE PILOT AND SETTING ADDITIONAL REQUIREMENTS (February 1, 2023 Order) in the above-referenced docket.

The Company has contracted with a consultant, Opinion Dynamics, to provide expertise on developing key implementation details for the pilot, along with pilot evaluation services. As a part of their work, Opinion Dynamics has prepared a memorandum providing discussions of several of the topics included in the Commission's February 1, 2023 Order. Specifically, their memorandum covers the following topics:

- Detailed information regarding the sample size for each rate design in the pilot, including control groups, a discussion of the number of participants needed to obtain statistically significant results to inform a default general service TOU rate, and the percentage of meters dedicated to EV charging providers and EV fleet operators¹

¹ Order Point 2c from February 1, 2023 Order.

- Assessment of—and control for—impacts of self-selection biases from the opt-in enrollment structure and incremental benefits of the new meters and price signals²
- Baseline procedures for customers without an interval meter currently installed on their premises³
- Design of intake survey and interview content used to contextualize unique usage patterns of participants⁴

We provide the memorandum as Attachment A to this Compliance Filing.

The balance of this Compliance Filing includes information on the following topics required by the Commission's February 1, 2023 Order.

- Additional details regarding the Commission's March 15, 2022 Order in Docket No. E002/M-21-101
- Incremental costs from managing the Minnesota-specific general service TOU rate pilot
- Pilot timing considerations regarding deployment of Advanced Metering Infrastructure (AMI) meters with Distributed Intelligence (DI) capabilities
- Strategies for implementing commercial and industrial (C&I) TOU rates based on experience and expertise from the Company's Colorado service territory
- The anticipated criteria to be used to call CPP events
- Results of Xcel's analysis of dual-enrollment opportunities for select customers already enrolled in demand response (DR) programs
- Discussion of possibility of applying a bill credit for year two of the program to the Metropolitan Council's Transit Authority division

Finally, in the process of preparing this Compliance Filing the Company identified clarifying tariff edits that we believe will increase understanding of the pilot terms. As such, with this Compliance Filing we request Commission approval of modifications to the tariffs. We discuss the tariff modifications in Section H below.

² Order Point 2d from February 1, 2023 Order.

³ Order Point 2f from February 1, 2023 Order.

⁴ Order Point 2h from February 1, 2023 Order.

A. Additional Details Regarding the Commission’s March 15, 2022 Order in Docket No. E002/M-21-101⁵

The Commission’s February 1, 2023 Order required the Company to provide additional details on the Order in Docket No. E002/M-21-101. In March 2022, the Commission issued their Order approving our Load Flexibility Pilots and Demonstration Projects. Our Peak Flex Credit demand response (DR) pilot was included as one of the pilots approved in that order.⁶ The Peak Flex Credit Pilot is a dispatchable load-shedding program for commercial customers designed to test whether a flexible offering with various options would increase customer interest in demand response.

The Commission also approved the EV Optimization Pilot, now called the Optimize Your Charge program, as part of the Load Flexibility portfolio. As a part of the pilot, the Company will study the management of EV grid impacts by incentivizing customers to schedule their daily EV charging outside of Xcel Energy’s system peak hours, at staggered times designed to avoid the secondary demand spikes that may occur if all customers begin charging as soon as the off-peak period starts.

After the Commission approved the Load Flexibility Pilots, the Company submitted updated tariffs for the Peak Flex Credit pilot on May 27, 2022 to incorporate the modifications required by the Commission’s Order. The modified tariff was approved by the Commission on September 12, 2022.

The Commission’s approval of the pilot included modifications, such as a requirement to allow third-party aggregators to participate in a second tranche of the pilot and clarified that customers participating in both the Peak Flex Credit Pilot and General TOU Service Rate in this pilot would be allowed. We also believe there will be limited overlap between the Optimize Your Charge Pilot and the TOU/CPP pilots as they require additional, separate metering.

While participants in the General TOU Service Rate in the pilot will also be allowed to participate in the Peak Flex Credit option, that same option will not be available to the participants in the CPP rate. The CPP rate and Peak Flex Credit Pilot are both demand response options reducing load because of a pricing signal. To overlap these options would provide a double benefit for the same effort, an outcome we do not view as reasonable.

⁵ Provided in compliance with Order Point 2a from February 1, 2023 Order.

⁶ Order Point 1

B. Incremental Costs from Managing the Minnesota-specific General Service TOU Rate Pilot⁷

The Company will provide pilot program support, including education efforts, communications, training, and marketing to help customers with initial and ongoing awareness of their participation in the pilot. This will require internal program staff along with a contractor to assist with the development and delivery of communications and educational materials.

Of the approximately 2,600 eligible customer premises,⁸ we are offering roughly 50 percent of those customers the opportunity to enroll in the TOU portion of the pilot. We will recruit from a pool of about 1,600 non CPP pilot-eligible customers that will also need communication materials. This includes printing for direct mail engagement, and labor for email and web site development. The cost of engaging these 1,600 customers and enrolling the target amount of pilot participants is estimated to be \$5,700 plus contract labor. A breakdown of the costs, excluding internal labor, is shown in Table 1 below.⁹

**Table 1
Estimated Costs**

Activity	Cost
Direct Mail 1 – 1,600 targets	\$2,000
Direct Mail 2 – 1,600 targets [with suppressions]	\$2,000
Program FAQ – 400 Printed	\$1,100
Enrollment Form – 200 Printed	\$600
Total	\$3,700

C. Pilot Timing Considerations Regarding Deployment of AMI Meters with DI capabilities¹⁰

The Company is anticipating that we will launch this pilot formally later this year. We anticipate the rollout of AMI will be completed by the end of 2024. As such, this pilot will launch ahead of the completion of the AMI rollout. We anticipate most participants will have existing or new interval meters (rather than AMI meters) in use during pilot operations. Some participants may receive new AMI meters before or

⁷ Provided in compliance with Order Point 2b from February 1, 2023 Order.

⁸ Table 3 in Attachment A provided with this Compliance Filing breaks down the eligible customers in greater detail

⁹ Work will also include emails, web site development, and webinar trainings. These activities will be supported by internal labor and is not included in the table below.

¹⁰ Provided in compliance with Order Point 2e from February 1, 2023 Order.

during pilot operations, but the full capabilities of the AMI system will not be available until the AMI rollout is complete. We did not factor AMI meters into the design of the pilot because we do not anticipate having a large enough population of customers with AMI meters to be a major part of the pilot.

Not all the DI capabilities inherent in the new AMI system will be available until after the AMI rollout is complete.¹¹ The first wave of capabilities is primarily focused on customer- and grid-use cases. Initial new capabilities will enhance the experience for customers, including energy usage dashboards, an enhanced web and mobile application, and enhanced outage notifications. Further, customers with single phase meters will be able to use the Home Area Network and Xcel Energy Launchpad to connect customer-authorized third-party devices directly to the meters, allowing them to use new data options to explore ways to keep their bills low. The Company is currently exploring expanding this capability to polyphase meters.

While not inherently linked to this pilot, the rollout of AMI meters will give us access to more granular usage information for a wider population than we currently have. This will happen with both pilot participants and non-pilot participants. With greater data available for more customers, we will be able to have greater insights on customer usage patterns. This information will be crucial to developing future TOU rate designs for a larger customer group. This will also help us get a better sense of the incremental benefits of new meters and the impact of price signals from pilot rates. Those learnings will be paired with learnings from this pilot when we are preparing any future proposals for permanent rate options for C&I customers.

D. Strategies for Implementing C&I TOU Rates Based on Experience and Expertise from the Company's Colorado Service Territory¹²

As we noted in our June 16, 2022 comments, there are material differences between the rates and rate designs associated with the Public Service Company of Colorado (PSCo) pilot and the pilot approved by the Commission in this docket. For example, the TOU rate in Colorado features a two-period rate rather than three-periods, and a demand charge that does not differ between peak and base period. In addition, the CPP rate in Colorado features both an energy and demand charge which do not differ based on time. Key reasons for this difference include variations in customer base—industries, number of customers, and share of load—and factors such as different rate case outcomes, state policies, geography, and climate. The latter is especially

¹¹ More information about the distributed intelligence capabilities of AMI can be found in the supplemental Direct Testimony of Company Witness Michael Remington filed in Docket No. E002/GR-21-630 (July 29, 2022). Please note that DI capabilities will initially only be accessible for customers with single phase meters. The full capabilities will not be available for polyphase meters at launch.

¹² Provided in compliance with Order Point 2h from February 1, 2023 Order.

important in demand management programs as climate can have a profound impact on the ability of customers with a highly weather-dependent load to react to different price signals.

Issues arose during PSCo's initial Colorado TOU pilot, and we have used the learnings from those experiences to make improvements for the Minnesota pilot. For example, the Colorado TOU pilot did not have an initial plan to measure load shifting. The pilot design also incentivized low-load factor customers to join the pilot simply to avoid the demand changes they are normally subject to. With the small number of participants and limited insights into customer load shifting, PSCo was not able to gather meaningful insights into the effectiveness of the pilot on changing customer behavior. The Company is working with Opinion Dynamics to evaluate and measure the impact of the pilot in Minnesota. We believe this firm's data expertise and evaluation capabilities will allow us to gather meaningful insights about the effectiveness of the pilot. Whether the insights gained are statistically significant, quantitative but directional, or qualitative will be contingent on receiving a large enough number of customers enrolling in the pilot.

On July 1, 2022, PSCo launched another TOU pilot for secondary general service commercial and industrial customers. For this pilot, PSCo has made several additional changes with the goal of operating a more successful pilot. This pilot has a capacity cap of 30 MW, so some changes are necessary due to the limited capacity available. The changes built into this new pilot include:

- Customer demand is limited to 2,000 kW to avoid a few large customers subscribing to all the pilot capacity.
- Customer participation size is limited further by dividing the 30 MW capacity into three different demand size tranches to provide a representative distribution of participants.
- Customers need a minimum load factor of 30 percent to participate to avoid windfall gains from low-load factor customers switching to pilot to take advantage of lower demand charges.¹³
- Any eligible customer can opt in, but outreach will be targeted to gather a representative sample of the customer class.
- Full baseline interval usage data will not be available for all participants but are planning to use data from newly installed AMI meters to establish a quasi-control group instead of a smaller random sample.

¹³ PSCo initially asked to limit it to 40 percent and above but was ordered to lower the limit to 30 percent.

PSCo was directed to implement the pilot by the Public Utilities Commission of the State of Colorado (Colorado Commission).¹⁴ PSCo proposed a tariff for the pilot with an effective date of July 1, 2022. On June 30, 2022, the Colorado Commission issued a decision approving the pilot but also ordering an analysis of the TOU periods used for the pilot and for PSCo's other TOU rates. As a part of this decision, the Colorado Commission expressed support for the progress that had been made on the design of the rate tariff schedule, but strongly urged PSCo to provide in an upcoming Phase II electric rate case a comprehensive, data-driven analysis of whether the currently used TOU periods reflect existing system realities and where the PSCo system is heading given recent and forecasted increases in solar generation. That Phase II electric rate case is expected to be filed by May 15, 2023.

E. The Anticipated Criteria to be Used to Call CPP Events¹⁵

The Company provided some context for when CPP events will be called in our June 16, 2022 comments. There are three main criteria that contribute to the need for calling a curtailment event. Those criteria are economic, capacity, and contingency.

For other DR programs that include similar “curtailment” events, we generally follow Midcontinent Independent System Operator (MISO) guidance and instructions for when to call events. As region-wide electric system conditions influence the cost of resources, following that guidance has served as a useful indication for when events need to be called. We believe that guidance will serve the CPP portion of the pilot well and anticipate that most events that will be called will follow MISO instruction. However, as we stated in our June 16, 2022 comments, the MISO curtailment rules will be used as a baseline. The Company will additionally use information specific to our system conditions and have the flexibility to call events outside of MISO direction.

Anticipated energy costs, weather conditions, system constraints and conditions, and generation and transmission resource limits can all contribute to the need for an event. A prime example of this is that if the day-ahead energy market is showing high prices, the Company may call an event in response to those price increases. However, we do not have a specific price threshold, as the other factors previously mentioned also play into the need for an event.

The Company's commercial operations group provides continuous system monitoring and forecasting, to determine if a day ahead pricing, contingency, or capacity conditions would benefit from the implementation of a CPP event. CPP will take a

¹⁴ Proceeding No. 20AL-0432E, Decision No. C21-0536, Decision Point 12

¹⁵ Provided in compliance with Order Point 2i from February 1, 2023 Order.

tiered approach to event calls during the duration of the pilot. Outlined above, the MISO guidance will be the highest priority of events and be considered a Tier 1 CPP pilot dispatch. Historically the Company has received only a handful of MISO directed dispatches. For purposes of the pilot, the Company will use the following criteria for Tier 2 events. Tier 2 events will be based on the day-ahead load forecasts, generator availability, and forecasted renewable resource generation. If the day-ahead forecast indicates that system peaking conditions may occur, or the forecasted total available generation to load ratio falls below 120 percent, then the Company would consider calling an event. Forecasted energy and fuel costs will also factor into potential calling an event if curtailments would lower the overall system costs compared to what the overall system costs would be in the absence of a curtailment event. Events will be a minimum of 1 hour in duration but can go up to 5 hours.

F. Results of Xcel’s Analysis of Dual-enrollment Opportunities for Select Customers Already Enrolled in DR programs¹⁶

The following are ways in which a customer and their service may be referred to:

- Customer – can have multiple accounts and premises.
- Account – can only be associated with one customer, there can be multiple premises on an account.
- Premise – can have single or multiple meters associated with them
- Meter – a single point of electrical service

The “Dual Enrollment” restriction is only applicable to Meters. Therefore, a customer and/or Account may be enrolled in more than one DR product simultaneously, as long as no single meter is enrolled in multiple DR products.

Table 2 below provides a high-level summary of Demand Response programs that are available to Xcel Energy Business customers in Minnesota.

¹⁶ Provided in compliance with Order Points 2k and 9 from February 1, 2023 Order.

Table 2
Demand Response Program Summary

Program	Customer Incentive
Electric Rate Savings (ERS) - Customer agrees to reduce electric usage to a pre-determined level during peak events. Rate Codes A23, A24, and A27	Tariff – a rate with discounted demand charges
Peak Flex Credit (PFC) - Customer agrees to reduce electric usage to a Firm Demand level during peak events.	Bill Credit – based on the selected response time option
Peak Partner Rewards (PPR)- Customer agrees to reduce electric usage by a minimum amount.	Bill Credit –Reservation Incentive for agreeing to curtail load if an event is called and a Performance Incentive for reducing load by the agreed upon amount for the entire event.
Business Saver’s Switch - remote-controlled switch cycles AC on and off during peak events.	Bill Credit - per ton of enrolled air conditioning on June through September bills
AC Rewards for Business – slight adjustments are made to AC units via smart thermostats during peak events	Bill Credit - \$25/thermostat/year. Additionally, smart thermostats are provided free of charge during direct installations.

The Company does not allow multiple DR products on a single meter for several reasons. Some of these reasons include the following:

- Current M&V procedures rely on meter readings which currently does not include the data and granularity to identify individual loads.
- To accurately and reliably separate individual loads on a single meter additional sub-metering hardware, software, and labor would be required that is not included in existing program budgets and would negatively affect the cost effectiveness of programs.
- In some scenarios it may be required that The Company activate multiple DR programs simultaneously. In those cases if an individual load is enrolled in multiple DR programs the Company would not realize the full benefit of each program and could be at risk of double counting benefits or not achieving filed load reduction obligations with MISO.

G. Discussion of Possibility of Applying a Bill Credit for Year Two of the Program to the Metropolitan Council’s Transit Authority Division¹⁷

The Commission requested that the Company consider the possibility of providing refunds to Metro Transit for both years of the pilot. In its current form, the pilot provides refunds to customers during the first year. These refunds protect customers from receiving bills that are more than ten percent higher than they would be if the customer did not participate in the pilot. Participants can leave the pilot after the first year. This means that customers who would otherwise receive a large bill increase during the first year of the pilot will be protected and they will gain helpful knowledge to decide if they want to continue to participate.

After discussions with representatives of the Metropolitan Council, we believe there is a valid basis for the Commission to order that transit operators receive bill protections for both years of the pilot. We suggest, however, that the Commission consider broadening this modification to include all public transit operators, rather than just Metro Transit.

The Commission would need to determine that providing two years of bill credits to transit customers—while other commercial customers receive one year of bill credits—is a reasonable outcome. As the Commission is aware, all rates charged by a public utility shall be “just and reasonable.”¹⁸ Rates shall also “not be unreasonably preferential, unreasonably prejudicial, or discriminatory, but shall be sufficient, equitable, and consistent in application to a class of consumers.”¹⁹ Finally, to the maximum extent reasonable, the Commission must set rates to further Minnesota’s policy goals, including its efforts to promote energy conservation and optimization.²⁰

Providing Metro Transit and other transit operators with bill protection for both years of the pilot could be considered “preferential,” since other participants would not receive this protection. We believe, however, that there are important factors that would justify this decision.

First, allowing public transit operators to receive refunds for both years of the pilot provides additional support for vehicle electrification, which the State has established

¹⁷ Provided in compliance with Order Point 10 from February 1, 2023 Order.

¹⁸ Minn. Stat. § 216B.03. A “rate” is broadly defined as “every compensation, charge, fare, toll, tariff, rental, and classification, or any of them, demanded, observed, charged, or collected by any public utility for any service and any rules, practices, or contracts affecting any such compensation, charge, fare, toll, rental, tariff, or classification.” Minn. Stat. § 216B.02, Subd. 5.

¹⁹ Minn. Stat. § 216B.03.

²⁰ Minn. Stat. § 216B.03.

as an important policy goal. The State has required the Metropolitan Council to develop and maintain a zero-emission and electric transition plan.²¹ This demonstrates that the State values transit electrification. Likewise, the State has established a policy goal of ensuring that 20 percent of all light-duty vehicles in the state are electric by 2030. Allowing transit operators to receive bill credits during both years of the pilot will increase the likelihood of participation through the pilot. This will provide these operators with valuable information they can use to better plan their transitions and further their fleet electrification efforts. It will also provide the Company with an additional year of data to evaluate how transit customers will respond to TOU and CPP pilot rates. This will be valuable information, since the Company expects that transit electrification will grow.

Second, the nature of the ongoing transition to electric busses could limit the ability of transit operators to apply any lessons gained during a single year of pilot operations. This makes it more likely that transit operators would withdraw from the pilot after the first year because they are uncertain about how the pilot rate would impact their bills going forward. Based on discussions with representatives of the Metropolitan Council, the Company understands that the transition from fossil fuel to electric busses will occur in stages, with electric busses being purchased over time for expanded service, such as new routes or additional lines on existing electrified routes. The result of this growth is that new electric busses could have different operating and charging characteristics than the electric busses that are in service at a given time. Faced with possible different charging characteristics from their new busses, transit operators without bill protections in the second year could be forced to choose between continuing to participate in the pilot without fully understanding the bill impact or exiting the pilot. If transit operators exit the pilot after the first year, both the transit operators and the Company will lose the opportunity to gain valuable information on the impact of these rates from a second year of participation.

We believe that the combination of these factors provides a unique scenario for transit operators that seek to learn how our pilot rates could impact their bills. Keeping these customers in our pilot for its duration is also valuable to the Company. As a result, we believe there is a valid basis for the Commission to determine that public transit operators should receive bill protections for the full duration of the pilot. We also believe that, while Metro Transit specifically raised the issue in its previous comments, the reason for extending these bill protections apply equally to all public transit operators that seek to electrify their fleets.

²¹ Minn. Stat. §473.3927.

Enabling extended bill protections for public transit operators will require a modification to tariff previously approved by the Commission. We discuss this proposed tariff change, along with other needed modifications, in the next section.

H. Tariff Modifications

In their February 1, 2023 Order in this docket, the Commission approved the tariff to be used for the pilot. After the issuance of that Order, the Company has identified three clarifying edits that we believe are necessary to provide additional context. We have included a proposed modified tariff as Attachment B to this Compliance Filing. We respectfully ask that the Commission approve this proposed modified tariff.

1. Determination of Base Period

In the section of the approved tariff discussing the determination of base period demand, which is included in section No. 5, Page No. 37, we have several needed changes to correct small errors and provide additional missing information to readers about how the base period demand is determined. The first is to the heading of the section itself. The heading is missing the word “demand”, which makes it unclear whether the section is discussing how the base period itself is determined or the determination of the base period demand. We propose changing the header to read “Determination of Base Period Demand” to make this clear.

This section was also missing information about adjustments that are needed related to power factor and a demand limiter. To correct these omissions and align the determination of base period demand with how peak period demand is determined, we request to add two additional sentences. The first additional sentence, related to power factor, reads:

The adjusted demand in kW for billing purposes shall be determined by dividing the actual base period demand by the power factor expressed in percent but no more than 90% multiplying the quotient so obtained by 90%, and round to the nearest whole kW.

The second additional sentence, related to the demand limiter, reads:

In no month shall the base billing demand be greater than the value in kW determining by dividing the kWh sales for the billing period month by 100 hours per month.

2. *Determination of Distribution Demand*

The approved tariff did not include any information for the determination of distribution demand used to calculate the distribution demand charge. This information was included in the initially proposed tariff that was filed in our initial proposal in this docket but was inadvertently left out when modifications were proposed to convert the proposal from a new permanent rate to a pilot. We believe adding information about determining distribution demand would add additional context that would help tariff users fully understand pilot operations. We ask that the Commission approve a request here to add a section with this clarification to Section No. 5, Page No. 36. This new section would read as follows:

The distribution demand will be the greatest 15-minute load, occurring at any time during the past 12 months, ending with the current billing month, not adjusted for power factor, and rounded to the nearest whole kW. Unusual incremental demand amounts incurred after a failure on the Company's distribution system will be excluded from distribution demand billing in kW at the Company's discretion.

3. *Bill Protections*

As we mentioned above, offering extended bill protections to public transit providers would require a modification to the tariff approved by the Commission for this pilot. The currently approved tariff limits the bill protection to 12 months for all participants. We request adding an additional sentence to the end of the bill protection section in Section No. 5, Sheet No. 35. The new sentence would read as follows:

The bill protection in this paragraph will not terminate after the first 12 months of participation in the pilot program for energy consumed by the operators of public transit systems to charge electric vehicles that are used to transport transit riders.

CONCLUSION

The Company is pleased to submit this Compliance Filing providing additional implementation details as required by the Commission's February 1, 2023 Order in this docket. We respectfully ask that the Commission consider and approve the proposed changes to the pilot tariff.

Dated: March 31, 2023

Northern States Power Company



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Memorandum: Commercial and Industrial Critical Peak Pricing and Time of Use Pilot Design and Evaluation Best Practices

To: Xcel Energy
From: Opinion Dynamics Evaluation Team
Date: March 20, 2023
Re: C&I CPP/TOU Pilot Questions and Requests from MPUC

Opinion Dynamics (“the consultant”) is a research and evaluation consulting firm contracted by Xcel Energy to serve as the third-party measurement and verification (“M&V”) consultant for the General Time of Use (TOU) Service rate and the Critical Peak Pricing (CPP) rate pilot (“the pilot”), resulting from Xcel Energy’s “petition in response to a Commission directive that the Company file a proposed revised time-of-day rate for general service customers and commercial EV charging.”¹ Drawing on our extensive experience consulting on advanced rate pilot design, implementation, research, and evaluation – as well as industry literature and Xcel Energy customer data - this memo addresses questions and requests from the Minnesota Public Utilities Commission’s (MPUC) 20-0086 Order 02012 in relation to the commercial and industrial (C&I) TOU and CPP pilot design, implementation, and evaluation.

Item C

“Detailed information regarding the sample size for each rate design in the pilot, including control groups, a discussion of the number of participants needed to obtain statistically significant results to inform a default general service TOU rate, and the percentage of meters dedicated to EV charging providers and EV fleet operators”

Xcel Energy is conducting a General Time of Use Service Pilot Program to test the performance of two rate designs, those being a Critical Peak Pricing (CPP) rate and a three-tier Time of Use (TOU) rate, in its Minnesota territory (“Xcel Energy MN”). The results of the pilot will inform the new default general service TOU rate for Xcel Energy MN’s C&I customers.

To obtain statistically significant results² to inform a default general service TOU rate, the consultant estimates that Xcel Energy must recruit and retain at least 1,200 premises into the CPP rate and at least 3,100 premises

¹ Quoted from Docket No. E-002/M-20-86

² For this analysis we assumed an alpha of 0.05 and power of 0.80.

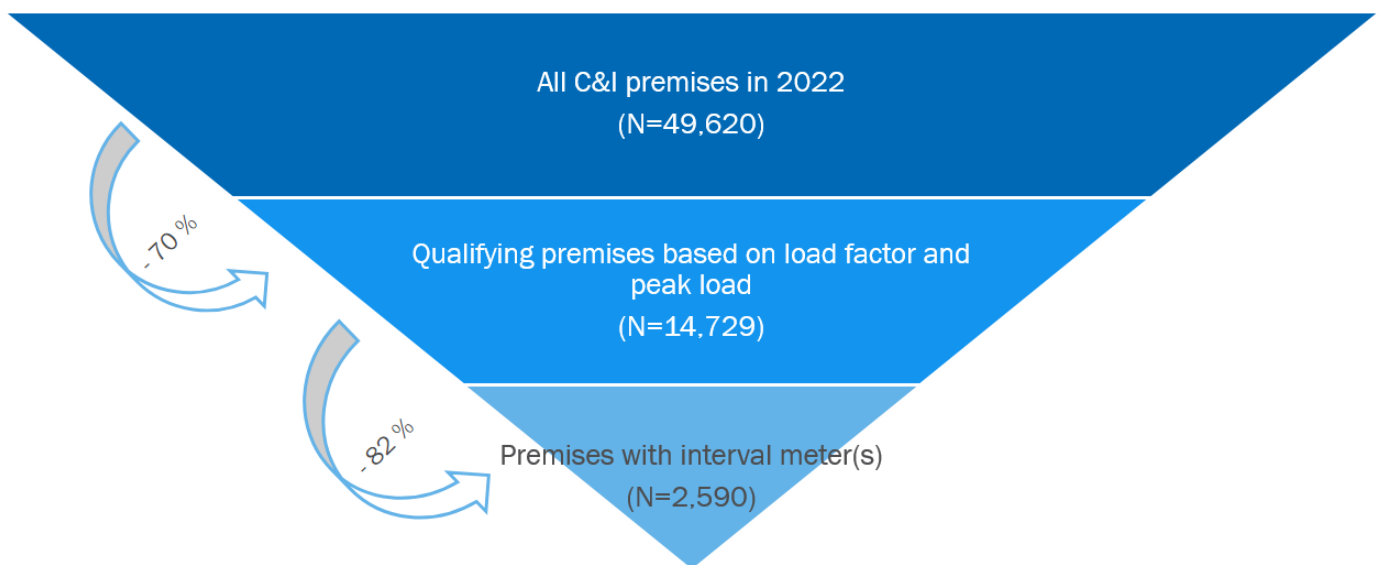


into the TOU rate, for a total of no fewer than 4,300 premises completing the pilot.³ The number of required premises to obtain statistically significant results depends on a variety of factors including the actual effect of the rate, and it is possible that an even greater number of premises will be required. This possibility is discussed in more detail later in this memo. Based on the number of eligible premises⁴ and expected effect size, the consultant is concerned that the pilot may not achieve statistically significant estimates of rate impacts. In addition, our analysis suggests that key characteristics of those customer premises that meet pilot eligibility criteria and have an existing interval meter differ substantially from the overall C&I customer base, and may not be representative of the population. The remainder of this response documents our findings and approach in detail.

Participation Expected Based on Customer Characteristics

Xcel Energy MN serves 2,590 C&I premises that meet the pilot eligibility criteria and have one or more eligible interval meters installed. This represents about 5% of the total customer premises (Figure 1).

Figure 1. Pilot Eligibility and Anticipated Participation



Participation Needed for Statistically Significant Results

³ The pilot will be evaluated at the service point, or meter, level. The analysis presented here was conducted at the premise level due to data constraints and to maintain consistency with our reference points in existing data and the literature. On average, each customer premise in the eligible population has 1.2 meters, so the pilot is likely to include some meters belonging to the same customer premise.
⁴ Eligible premises are defined as those with a load factor $\geq 30\%$, peak demand ≥ 50 kW in one or more of the preceding twelve months. For the purposes of this analysis, we also limit eligible premises to those with one or more interval meters already installed, given that interval meter data is necessary to measure impacts and Xcel Energy has a limited number of interval meters that can be provided to interested customers currently without one.



The purpose of a power analysis is to estimate the smallest sample size required for an analysis, given a desired significance level for the analytic outcome, statistical power, and anticipated effect size. The consultant considered the number of premises that would be needed to detect effect sizes associated with TOU and CPP rates observed in the literature and in Xcel Energy’s Colorado territory (“Xcel Energy CO”) at a confidence interval of 95 percent. Because the statistical power of an analysis relies on past assumptions to extrapolate to future outcomes including the actual effect size attributable to the rate, the number of participating premises at the end of the pilot (e.g., due to attrition from opt-outs and account closures), and variation in energy demand and consumption patterns between enrolled premises and over time, the results of the analysis should be considered estimates.⁵ The consultant tested a variety of scenarios to approximate a range of possible outcomes.

Based on a review of the literature, the consultant found a range of effect sizes attributable to CPP rates among C&I customers. For our analysis, we relied on two primary reference points, these being the most recent ex ante savings achieved by Xcel Energy CO’s CPP rate (9% of average demand)⁶ and simulation results generated by the Brattle Group of expected CPP impacts among Xcel Energy’s medium C&I customers in Xcel Energy’s Northern States Power (NSP) service territory (8.7% of average peak demand).⁷ It is important to note that established rates, such as the CPP rate in the California IOUs’, sometimes observe much lower ex post savings than were tested in this analysis.⁸ If the pilot were to achieve a smaller effect than expected, the number of premises required to detect statistically significant results would increase. However, the consultant opted not to use such conservative figures for our analysis because we feel the Xcel Energy CO CPP results and Brattle Group simulation are more representative of Xcel Energy MN C&I customers’ potential given that both studies reference the same or similar Xcel Energy customer base examined here.

The consultant was able to identify only limited examples of TOU rate effects among C&I customers in the literature. For consistency, we again referenced the results of The Brattle Group’s simulation of expected TOU impacts among medium C&I customers in the NSP service territory (4.2% of average peak demand),⁹ and also test a range of effect sizes around that value. Due to the lower estimated effect size for TOU, we expect this rate design to require a greater number of premises to obtain statistically significant results than CPP.

Before completing our analysis, we derived the standardized effect sizes for each effect size scenario to be tested, using the average per participant demand shed (rate impact or effect size) reported in the Brattle Group’s simulations and the Xcel Energy MN-provided premise data on peak demand, and taking into consideration the peak demand variation among Xcel Energy MN’s medium C&I premises.¹⁰ We used the most

⁵ An important consideration is the tradeoff between the representativeness of the sample and the statistical power of the analysis. In general, if customers are more similar we can assume we need a smaller sample to detect statistically significant results, however, the results may not be generalizable to the overall customer base. When there is greater variation among customers, we can assume we need a larger sample to detect statistically significant results, but the findings may be more generalizable, even if they are only directional in nature.

⁶ Xcel Energy CO 2022 CPP Performance Summary (Internal Analysis by Xcel Energy). We account for both load reductions and increases in this savings estimate. Note that the baseline in this study is defined as average customer demand whereas The Brattle Group simulation baseline is average customer peak demand.

⁷ Faruqui, Ahmad, Ryan Hledik, and David Lineweber. *Demand Response Market Potential in Xcel Energy’s Northern States Power Service Territory*. The Brattle Group. 2014.

⁸ In 2020, average statewide load impacts for CPP were 1.3%. Marrin, K., A. Nguyen, X. Zhang, L. Ciocia, and D. Luu. *2020 Statewide Load Impact Evaluation of California Non-Residential Critical Peak Pricing Programs*. Applied Energy Group. 2021.

⁹ Faruqui, Ahmad, Ryan Hledik, and David Lineweber. *Demand Response Market Potential in Xcel Energy’s Northern States Power Service Territory*. The Brattle Group. 2014.

¹⁰ Medium C&I customers were defined as those with peak demand of 25 kW to 1,000 kW, to align with The Brattle Group’s definition in their simulation.



common measure of standardized effect size, Cohen’s d, where the average difference in peak demand is divided by the pooled standard deviation of the average monthly peak demand per premise (Equation 1).¹¹

Equation 1. Cohen’s d

$$\text{Cohen's } d = \frac{\text{Group A Mean} - \text{Group B Mean}}{\text{Pooled Standard Deviation}}$$

In the final power analysis, the consultant considered the number of premises needed to detect each effect size, assuming a significance level of 0.05 and power of 0.80, as well as a range of values above and below the effect size observed in the Brattle Group simulations. The power analysis was conducted using a two-tailed paired t-test.

The consultant found that, given the expected standardized effect size, the pilot would need to recruit at least 1,200 and up to 5,100 premises onto the CPP rate to measure statistically significant results (Table 1). The large ranges reported account for uncertainty about the savings the pilot will achieve, as well as the potential variation in consumption and demand among participating premises (e.g., between a medium service business and an industrial customer). It is important to note that should the pilot achieve smaller effects than assumed in this analysis, the number of premises required would increase accordingly.

Table 1. Premises Needed to Measure Anticipated CPP Effect Size

Source	% Reduction in Demand	Average Load Shed (kW)	Standardized Effect Size	Approximate Number of Premises Needed for Analysis
Brattle Simulation – Reported Value	8.7%	7.6	0.060	2,200
Brattle Simulation - Lower Bound ^a	5.7%	4.9	0.039	5,100
Brattle Simulation – Upper Bound ^b	11.7%	10.2	0.080	1,200
Xcel Energy CO CPP	9.0%	39.1	0.056 ^c	2,500

Note: All scenarios assume alpha of 0.05, power of 0.80, and are evaluated using a paired t-test.

a Defined by the consultant as the simulated reduction in demand – 3% to account for a range of possible outcomes.

b Defined by the consultant as the simulated reduction in demand + 3% to account for a range of possible outcomes.

c The Xcel Energy CO standardized effect size is calculated using a larger value of average demand shed and pooled standard deviation calculated between the pre and post- event period. This translates to a standardized effect size of 0.056, despite the load shed of 9.0% being greater than the load shed of 8.7% as estimated in The Brattle Group simulation.

The consultant found that, given the expected standardized effect sizes, the pilot would need to recruit at least 3,100 and up to 113,200 premises onto the TOU rate to measure statistically significant results (**Error! Reference source not found.**). As noted above, the large ranges reported account for uncertainty about the savings the pilot will achieve, as well as the potential variation in consumption and demand among

¹¹ Cohen, Jacob. 1988. *Statistical Power Analysis for the Behavioral Sciences*. Lawrence Earlbaum Associates. To derive the pooled standard deviation in advance of knowing which premises will participate in the pilot or what their post period consumption and demand patterns will be, we made the following assumptions: To standardize the effect size from the Brattle Group simulation, we calculated the pooled standard deviation of all medium C&I premises on TOU and non-TOU rates in 2022. Given that for Xcel Energy CO CPP we had access to the ex ante impacts, to standardize the effect size from that program we calculated the standard deviation of demand shed derived from the pre- and post-period of the CPP events across those premises.



participating premises. It is important to note that should the pilot achieve smaller effects than those assumed in this analysis, the number of premises required would increase accordingly.

Table 2. Premises Needed to Measure Anticipated TOU Effect Size

Source	% Reduction in Demand	Average Load Shed (kW)	Standardized Effect Size	Approximate Number of Premises Needed for Analysis
Brattle Simulation – Reported Value	4.2%	3.7 kW	0.029	9,200
Brattle Simulation - Lower Bound ^a	1.2%	1.05 kW	0.008	113,200
Brattle Simulation – Upper Bound ^b	7.2%	6.3 kW	0.050	3,100

Note: All scenarios assume alpha of 0.05, power of 0.80, and are evaluated using a paired t-test.

a Defined by the consultant as the simulated reduction in demand – 3% to account for a range of possible outcomes.

b Defined by the consultant as the simulated reduction in demand + 3% to account for a range of possible outcomes.

For both rates and across the range of scenarios considered, the required number of premises to achieve statistically significant impacts is substantially greater than the projected number of premises that will enroll in the pilot. To reach the minimum number of participants, Xcel Energy would need to achieve an opt-in rate of 100% among eligible premises with an existing interval meter and would need to supply a new interval meter to over 1,100 premises. In addition, to achieve statistically significant results, the pilot would need to retain virtually all premises for analysis (i.e., Xcel Energy would need to minimize attrition and minimize the number of premises removed from the analysis due to incomplete or poor quality data). In light of these findings, the consultant did not consider the ideal number of premises to retain for a hypothetical control group as part of the analysis as no premises would remain available for control.

The consultant recommends conducting a census attempt (i.e., marketing the pilot to all eligible customer premises) to maximize the number of participants in the pilot. Achieving the enrollment levels described above are without precedent in the industry for an opt-in pilot targeted to C&I customers and the consultant suggests it would also be valuable to set parameters for how directional, qualitative results could be used to assess the pilot’s performance in the absence of statistically significant quantitative results. In our response to Item D we describe directional and qualitative approaches to ensuring learnings can be extracted from the pilot.

Pilot Generalizability

Given that the objective of the pilot is to inform the default general service TOU rate for all C&I customers, the representativeness of participating customers is a key consideration for the generalizability of results. Through descriptive analysis of pilot-eligible customer premises compared to the overall C&I customer population, the consultant finds that, on average, eligible customer premises differ from the typical C&I premise with respect to current rate class participation, industry, peak demand, and load factor (Table 3). For example, a near majority of eligible premises are currently on the Electric Rate Savings (ERS) demand response rate (45%), while only 3% of the entire C&I population are on ERS. The largest proportion of eligible premises belong to the education sector (29%), yet they only account for 4% of all C&I premises. Eligible premises also exhibit very different demand patterns than an average C&I premise, and in particular have much higher average peak demand.



Table 3. Comparison of Customer Characteristics

Characteristic	All Premises (N = 49,620)		Eligible Premises with Interval Meter (N = 2,590)	
	#	%	#	%
Rate Class				
General Service Rate	47,393	96%	1,059	41%
ERS	1,311	3%	1,173	45%
Legacy Time of Use	600	1%	61	2%
ERS (TOU variant)	316	1%	297	11%
Industry				
Accommodation and Food Services	4,496	9%	47	2%
Education	1,884	4%	749	29%
Manufacturing	4,270	9%	417	16%
Public Administration	2,635	5%	280	11%
Real Estate and Rental and Leasing	5,406	11%	122	5%
Retail Trade	5,855	12%	125	5%
All Other	25,074	51%	850	32%
Demand Characteristics				
Average Peak Demand (kW)	84		754	
Median Peak Demand (kW)	24		244	
Average Load Factor	0.40		0.53	
Median Load Factor	0.39		0.52	

Note: Percentages may not sum to 100% due to rounding errors.

There are likely to be further differences between eligible premises and those most likely to opt-in to the pilot. For example, premises with enabling technology may be more likely to opt-in to the pilot than those without, and they will likely achieve greater impacts than similar future premises that are defaulted onto the rate without this technology. The consultant therefore recommends that Xcel Energy and the Commission exercise caution when drawing conclusions about the performance of a new default general service TOU rate among the broader C&I customer population based on the results of the pilot.

Relatedly, EV chargers represent a new customer grouping with their own unique business needs and corresponding energy and demand consumption patterns. It will be important to limit the number of EV chargers in the pilot because including a large number of this customer type will further limit the generalizability of results to the broader C&I customer base. In addition, they will lack baseline data if an interval meter is only installed upon enrollment in the pilot. The consultant agrees with the filing's guidance



that “individual charging providers participating under this exception will be limited to no more than five (5) charging sites for inclusion in the pilot.”¹²

Item D

“Assessment of – and control for – impacts of self-selection biases from the opt-in enrollment structure and incremental benefits of the new meters and price signals”

Before deploying as a mass market offering or a default rate, industry best practice suggests that new rate types should be piloted to a sample of target customers on an opt-in basis to better understand customer response and rate impacts. This staged approach is common among American electrical utilities, with the California IOUs’ recent residential transition to a TOU default being a high-profile example of this process: California IOUs first piloted TOU rates using an opt-in pilot, followed by a subsequent opt-out (default) pilot, conducting extensive customer and load research throughout and then taking these learnings to inform the default transition for the majority of their residential customer bases.

Although opt-in pilots are a standard first step prior to deploying subsequent mass market rate offerings, they run the risk of self-selection biases in that the makeup of those opting into the pilot may not resemble the larger customer base that they represent, thereby obscuring the representativeness of any pilot findings (including revenue recovery, bill impacts, load response, and customer metrics such as opt-out rates, satisfaction, and more). Especially with larger C&I customers where electricity expenditures can be a significant proportion of their operating costs, there is the added risk that “structural benefiter” – or those that stand to spend less on electricity bills under the new rate without having to modify their energy usage or demand profiles – may be disproportionately more likely to opt-in to the rate offering. This is particularly concerning in the case of Xcel Energy’s pilot because the eligible population differs from the overall C&I customer population on so many characteristics which likely correspond with their “structural benefiter” status. A resulting skewed participant sample would therefore bias pilot results, limiting extrapolation of any findings to the larger population for which the rate is intended to be defaulted to.

Thus, utilities piloting new rates must take measures to limit self-selection bias and attempt to recruit as representative of a sample as possible. There are a variety of industry best practices that can be employed to mitigate self-selection bias:

- **Bill Protection:** Bill protection is an important opt-in pilot offering that can limit the amount of bias in a participant sample. There are several types of customers that may be hesitant to try a new rate for financial reasons, such as risk-averse customers or structural non-benefiters. Bill protection can help alleviate these valid customer concerns and can result in a more representative participant sample, although it also comes with the risk of suppressing savings, since customers do not face consequences for failure to perform on the rate.
- **Account Manager Involvement:** Involving account managers in the recruitment process can increase opt-in rates in general, and particularly among customers with lower awareness or propensity to join the pilot without encouragement. While structural benefiters are most likely to opt-in independently,

¹² Clark, Christopher B. *General Time of Use Service Pilot Program: Rate Code A25, A26* (Docket No. E002/M-20-86). Northern States Power Company, a Minnesota Corporation. Filed 4/7/2022.



customers that stand to see moderate benefits or neutral outcomes from the pilot may opt-in when their account manager helps them to understand the offering and potential benefits to them.

- **Stratified Sample Frames:** The sample of customers to be recruited into the pilot offering can be stratified to increase the representativeness of the pilot customer group when compared to the customer population. This option is only available when there are enough customers to withhold some from recruitment (thus, this is not possible with a census approach). In addition, depending upon the degree of difference between the eligible customer population compared to the overall customer population, it may not be possible to generate a truly representative sample, or there may be trade-offs between the size and the representativeness of the sample.

In the case of Xcel Energy's pilot, as the consultant anticipates a census attempt will be required to maximize the number of participants in the pilot, a stratified sampling approach will not be feasible. Instead, we recommend that Xcel Energy sets recruitment goals by customer segment (e.g., customer size, industry) and that account managers conduct targeted outreach in support of these goals. This approach will maximize the chances that descriptive and directional impact results can be reported for individual customer segments. In addition, including a sufficient number of customers from key segments will allow Xcel Energy to collect primary data on customer experience that can inform the application of the future default rate to the entire C&I customer base.

To the extent that self-selection bias is not mitigated through the recruiting process, the consultant will assess the degree of self-selection bias in the resulting pool of participating customers and will apply measures to make transparent, and where possible, minimize the effect, on savings estimates. We will explore options including:

- **Descriptive Analysis of Pilot Customers:** As in the pre-pilot analysis presented in Item C, in which the consultant compared the pool of eligible customer premises to the overall Xcel Energy MN C&I customer base, we will also compare pilot participants to both of these groups on observable characteristics such as size and baseline consumption, industry, baseline rate class, and geography. While the exact degree of self-selection bias cannot be precisely quantified, this exercise will allow the consultant, Xcel Energy, and the Commission to better understand the possibility and limitations of generalizing pilot findings to the larger customer base.
- **Incremental Benefits of New Meters:** There is a possibility that customers that receive an interval meter for the first time upon pilot enrollment change their behavior or operations due to new information they get from the more granular data generated by the interval meter rather than due to the price signal. The design of the pilot does not allow the consultant to control for this scenario, but we will explore the prevalence of customers receiving new meters in the descriptive analysis described above and explore any potential impacts on customer performance on the pilot rates in our primary research.
- **Modeling Approaches** that may apply if the pilot achieves sufficient participation to measure a statistically significant effect.
 - **Inverse Propensity Weighting:** Inverse propensity weighting is a statistical method in which a sample weight is applied in modeling to account for imbalances in the sample compared to the population. This allows for adjustment of savings estimates to increase representativeness and generalizability. However, this approach can only be applied when there is a sufficient number of



premises in the pilot to model statistically significant results. As discussed above, this is an unlikely outcome and thus this approach is unlikely to be available to us.

- **Quasi-Experimental Design:** When a randomized control trial is not feasible,¹³ the next-best standard in the industry is a quasi-experimental design. For example, evaluators may leverage a matched comparison group composed of premises that do not participate in the pilot but have similar demand and energy consumption patterns to treated premises. Ideally, comparison premises are identified in advance and excluded from recruiting efforts, although when this is not feasible (as anticipated in the case of this pilot), an alternative is to identify comparison premises from those premises that were recruited but did not opt into the pilot. The latter approach can introduce bias, since premises that choose not to participate in the pilot likely differ from those who choose to do so in meaningful ways. Due to the often unique demand and consumption patterns of large C&I customers like those eligible for the pilot, a large pool of untreated premises must be available on which to deploy statistical matching techniques, and it may not be possible to identify appropriate comparisons for some premises. In the event that a matched comparison group cannot be constructed, another option that will be explored is the use of a synthetic comparison group.

The consultant intends to utilize a matched or synthetic comparison group where possible, but also anticipates challenges due to the potential inability to detect statistically significant results, the inclusion of large C&I premises with unique demand patterns, and the limited pool of eligible but untreated premises from which to identify matches.

- **Modeling Approaches** that can apply even if the pilot does not achieve sufficient participation to measure a statistically significant effect.
 - **Pooled Models by Segment:** If the number of premises in the pilot permits, we plan to model results by customer segment (e.g., industry, baseline peak demand) to better assess how customers with different business needs and baseline demand profiles respond to the pilot rates. Depending on the load characteristics of individual customers, we plan to exclude extremely large customers from pooled models in order to avoid biasing the overall impact estimates. In the event that there are insufficient premises to model results by segment, the consultant will still endeavor to report directional results by segment.
 - **Individual Pre/Post Modeling:** For extremely large customers, and/or if none of the options above are viable, the consultant will utilize an individual pre-post modeling approach in which we compare each premise to itself before and after participating in the pilot, controlling for weather. It is important to note that a pre-post analysis will not account for self-selection bias but may be the only possible impact evaluation method depending on the number of participants and effect size.

The consultant will consider a combination of quasi-experimental and pre-post approaches to maximize the robustness of savings estimates within the constraints the evaluation may face. For example, we may be able to identify matched comparisons for medium C&I customers in the pilot but not for larger customers, in which case we will run pre-post models for all premises in addition

¹³ Variations on a randomized control trial (RCT), such as randomized encouragement design (RED) and recruit and deny, are promising alternatives, but also require a greater number of premises than available.



to models with a matched comparison group where possible. This approach will allow us to evaluate and situate the results of the pre-post analysis, by comparing the results where both methods are viable.

- **Qualitative Research:** In the event that there are an insufficient number of premises to obtain statistically significant results and/or the consultant is unable to account for self-selection bias via a matched comparison group, results will be directional rather than conclusive. While primary research is crucial for understanding customer motivations and experiences, in this instance primary research will also be important for contextualizing, augmenting, and triangulating results derived through the descriptive, directional analysis of load impacts. The consultant will carefully construct primary research instruments, including surveys and/or interviews, to cover topics including, but not limited to:
 - Customer motivations for joining the pilot;
 - Customer experience participating in the pilot;
 - Perceived impact on bill, load, and operations;
 - Interest in continuing on the rate and reasons for interest/disinterest;
 - Strategies used to adjust load and enabling/disabling factors (e.g., technology, backup generation, operational realities);
 - Incremental benefits of new interval meter(s) (if applicable); and
 - Facility and operating characteristics of participating customers.

Item F

“Baselining procedures for customers without an interval meter currently installed on their premises”

Industry best practice calls for identifying a representative set of load profiles for customers without interval meters currently installed on their premises. These load profiles can either be sourced from the utility, industry literature, or custom created in select situations. Each load profile should have 8760 values – one for each hour of the year. Matching customers with the most representative load profile they belong to, and then scaling up or down the base load profile based on each customer's actual annual usage, yields hourly estimates of usage for the whole year.

The consultant will review the data provided by Xcel Energy to determine the number of premises without interval meters. We will further classify the count of premises between TOU and non-TOU generalized rate groupings. We understand Xcel Energy has load profile data (on an 8760 basis) for these rate groupings. We will review and assess the extent to which this data could be used to baseline the hourly usage for premises without interval meters. We may further supplement this data with National Renewable Energy Laboratory's (NREL) end-use load profiles data for the U.S. Building Stock¹⁴, if needed.

¹⁴ NREL's load profile data can be accessed at the following location: <https://data.openei.org/submissions/4520>.



Lastly, the consultant expects there will be certain instances when there is no historical usage data available - for example, a newly constructed office building or a hospital that has just opened for patient services. In these situations, we first recommend determining the North American Industry Classification System (NAICS) code of such customer premises. Then we will match this information with the annual energy usage averages by NAICS, constructed by using the data already provided to us by Xcel Energy. We recommend using Xcel Energy's TOU load profile data (discussed in the second paragraph of this section) for these premises.

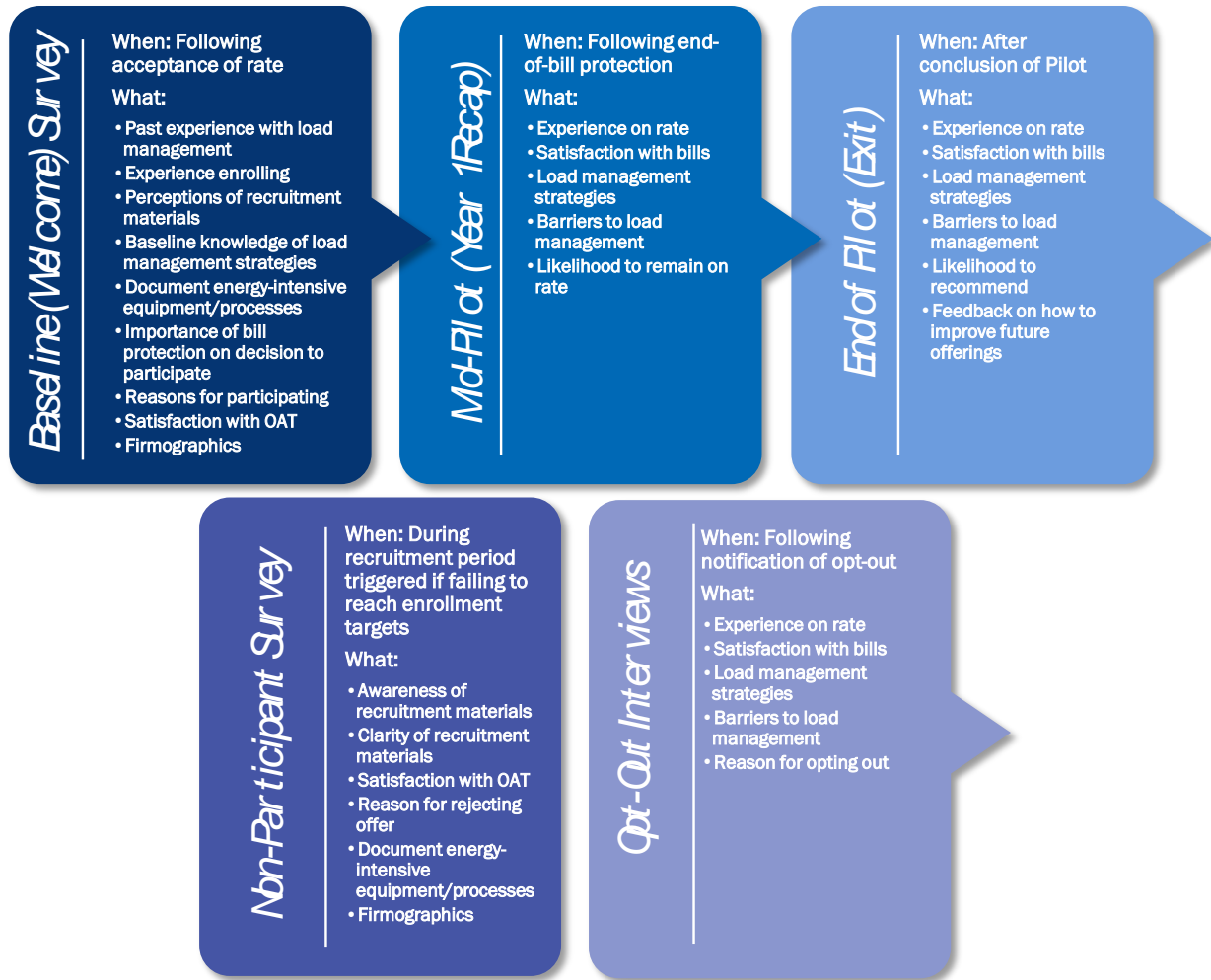
Item G

“Design of intake survey and interview content used to contextualize unique usage patterns of participants”

Xcel Energy has prepared an intake survey that will collect key preliminary data points from interested customers. The consultant has reviewed the intake survey and agrees it captures appropriate data for the given moment in time (i.e., pre-participation) to help contextualize the unique usage patterns of participants. Industry best practices recommend ongoing surveys and/or interviews with rate pilot participants throughout the lifecycle of the pilot. In addition to the intake survey, the consultant will be surveying or interviewing participating customers throughout the pilot, including a welcome survey that will take place shortly after “rate go live.” This welcome survey will be yet another chance to collect key baseline data points from participants prior to them having any significant time on the new rate. Additionally, if recruitment performs poorer than planned, the consultant will conduct a ‘non-taker’ survey of customers that declined to opt-into the rate for which they were recruited. Figure 2 illustrates the consultant's planned survey and interview activities that go above and beyond Xcel Energy's initial intake survey.



Figure 2. Customer Data Collection Activities



Item H

“Identification and control procedures for the impacts from unique pre-pilot usage patterns of individual customers”

Before assessing energy and demand impacts, the consultant will first review the customer interval data provided by Xcel Energy and prepare it for analysis. We will process the data to assess its accuracy, completeness, and appropriateness for analysis. Using our library of R and Python code, as well as Power BI, the consultant will perform initial data quality assessments and better understand the raw data through visualizations and summary metrics (e.g., mean, median, standard deviations). The consultant will review the outputs of this process to ensure that the data received is complete, and to identify anomalies in the data. Based on what we learn, we will engage in follow-up conversations with Xcel Energy to confirm that the dataset is accurate and complete, and/or will address issues through data cleaning.



The consultant will apply the following data cleaning checks and steps before using a customer's interval meter data for analysis:

- Removing perfect duplicates, in which all fields in a record are identical;
- Confirming data completeness, for example understanding the volume and pattern of missing reads per meter, including determining if there is sufficient pre and post-intervention data overall and by season;
- Confirming that every record contains a date and timestamp;
- Reviewing usage values:
 - Addressing near duplicates, in which only the kWh values in a record differ;
 - Identifying and dropping outliers;
 - Removing records with zero or null usage values; and
 - Flagging and exploring negative usage values.

As discussed in the response to Item D, we will consider modeling savings separately for very large premises to avoid biasing impact estimates. In addition, we will endeavor to model and/or present results by customer segment in order to highlight differing impacts depending on customer size, industry, and other factors.

Redline

Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401

MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26

Section No. 5
~~3rd~~^{4th} Revised Sheet No. 35

FUEL CLAUSE

Bills are subject to the adjustments provided for in the Fuel Clause Rider.

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RESOURCE ADJUSTMENT

Bills are subject to the adjustments provided for in the Conservation Improvement Program Adjustment Rider, the State Energy Policy Rate Rider, the Renewable Development Fund Rider, the Transmission Cost Recovery Rider, the Renewable Energy Standard Rider, and the Mercury Cost Recovery Rider.

ENVIRONMENTAL IMPROVEMENT RIDER

Bills are subject to the adjustments provided for in the Environmental Improvement Rider.

SURCHARGE

In certain communities, bills are subject to surcharges provided for in a Surcharge Rider.

LOW INCOME ENERGY DISCOUNT RIDER

Bills are subject to the adjustment provided for in the Low Income Energy Discount Rider.

The following are terms and conditions for service under this tariff

LATE PAYMENT CHARGE

Any unpaid balance over \$10.00 is subject to a 1.5% late payment charge or \$1.00, whichever is greater, after the date due. The charge may be assessed as provided for in the General Rules and Regulations, Section 3.5.

BILL PROTECTION

Billing charges considered for bill protection will include customer and energy charges, fuel cost charges, and if applicable, system and distribution demand charges. Bill protection will be considered only for customers that have been pilot participants for 12 months at the same business location based on the first 12 months of participation in the pilot program. Any Pilot program billing charge in excess of 10 percent of the corresponding billing charge that would have been applied had the customer not been a pilot participant will be credited to the customer's account, including any applicable taxes. The bill protection in this paragraph will terminate after the first 12 months of participation in the pilot program. The bill protection in this program will not terminate after the first 12 months of participation in the pilot program for energy consumed by operators of public transit systems to charge electric vehicles that are used to transport transit riders.

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(Continued on Sheet No. 5-36)

Date Filed: ~~01-18-22~~⁰³⁻³¹⁻²³ By: Christopher B. Clark Effective Date: ~~02-01-23~~
President, Northern States Power Company, a Minnesota corporation
Docket No. E002/M-20-86 Order Date: ~~02-01-23~~

**GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26**

Section No. 5
9th10th Revised Sheet No. 36

CRITICAL PEAK PRICING EVENTS

Customer taking service under Rate Code A26 will be subject to critical peak pricing events where energy rates will be increased to the critical peak pricing energy rate. Up to 75 event hours can be called during any calendar year. The decision to call actual control events will be based on economic, capacity, and contingency criteria. The Company will attempt to provide 24-hour notice of an event, but at a minimum the Company will alert customers no less than 12 hours ahead of an event. Pre-event notifications will include the event start time, planned duration of the event, and event end time. Notifications will be sent to the participating customer's designated contacts via email, text, voice message, or combination as specified by the customer. Customers are responsible for ensuring contact information is kept current and notifying the Company if any changes are necessary.

DETERMINATION OF DISTRIBUTION DEMAND

The distribution demand will be the greatest 15-minute load, occurring at any time during the past the 12 months, ending with the current billing month, not adjusted for power factor, and rounded to the nearest whole kW. Unusual incremental demand amounts incurred after a failure on the Company's distribution system will be excluded from distribution demand billing in kW at the Company's discretion.

DEFINITION OF PEAK PERIODS

The peak period is defined as those hours between 3 p.m. and 8 p.m. Monday through Friday, except the following holidays: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. When a designated holiday occurs on Saturday, the preceding Friday will be designated a holiday. When a designated holiday occurs on Sunday, the following Monday will be designated a holiday. The base period is defined as all hours not defined as peak period or off-peak period. The off-peak period is defined as those hours between midnight (12:00 a.m.) and 6:00 a.m. every day.

DETERMINATION OF PEAK PERIOD DEMAND

The actual peak period demand in kW shall be the greatest 15-minute load for the peak period during the month for which the bill is rendered. The adjusted demand in kW for billing purposes shall be determined by dividing the actual peak demand by the power factor expressed in percent but not more than 90% multiplying the quotient so obtained by 90%, and round to the nearest whole kW. In no month shall the peak period demand to be billed be considered as less than the current month's adjusted peak period demand in kW, or 50% of the greatest monthly adjusted peak period demand in kW during the preceding 11 months. In no month shall the peak billing demand be greater than the value in kW determining by dividing the kWh sales for the billing period month by 100 hours per month.

The greatest monthly adjusted peak period demand in kW during the preceding 11 months shall not include the additional demand which may result from customer's use of standby capacity contracted for under the Standby Service Rider.

MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

**GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26**

Section No. 5
~~9th~~10th Revised Sheet No. 37

DETERMINATION OF BASE PERIOD DEMAND

The actual base period demand in kW shall be the greatest 15-minute load for the base period and the peak period during the month for which the bill is rendered round to the nearest whole kW. The adjusted demand in kW for billing purposes shall be determined by dividing the actual base period demand by the power factor expressed in percent but no more than 90% multiplying the quotient so obtained by 90%, and round to the nearest whole kW. In no month shall the base period demand for billing purposes be considered as less than the current month's actual base period demand in kW, or 50% of the greatest monthly actual base period demand in kW during the preceding 11 months. In no month shall the base billing demand be greater than the value in kW determining by dividing the kWh sales for the billing period month by 100 hour per month.

The greatest monthly adjusted base period demand in kW during the preceding 11 months shall not include the additional demand which may result from customer's use of standby capacity contracted for under the Standby Service Rider.

POWER FACTOR

For three phase customers with services above 200 amperes, or above 480 volts, the power factor for the month shall be determined by permanently installed metering equipment. For all single phase customers and three phase customers with services 200 amperes or less, a power factor of 90% will be assumed

COMPETITIVE SERVICE

Competitive Service is available under this schedule subject to the provisions contained in the Competitive Response Rider.

STANDBY SERVICE

Standby Service is available under this schedule subject to the provisions contained in the Standby Service Rider.

MINIMUM DEMAND TO BE BILLED

The monthly minimum peak period billing demand shall not be less than provided above.

SPLIT SERVICE

When approved by the Company, customer's service may be split between General Service and General Time of Use Service Pilot rates. Only Company approved storage space cooling and storage space heating equipment qualifies for the General Time of Use Service Pilot portion of a split service installation. The thermal storage equipment shall be permanently wired, separately served and metered, and at no time connected to the general service portion of the split service installation. Each portion of customer's split service installation will be considered separately for all other rate application purposes.

(Continued on Sheet No. 5-38)

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Northern States Power Company, a Minnesota corporation
Minneapolis, Minnesota 55401

MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

**GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26**

Section No. 5
4th Revised Sheet No. 35

FUEL CLAUSE

Bills are subject to the adjustments provided for in the Fuel Clause Rider.

RESOURCE ADJUSTMENT

Bills are subject to the adjustments provided for in the Conservation Improvement Program Adjustment Rider, the State Energy Policy Rate Rider, the Renewable Development Fund Rider, the Transmission Cost Recovery Rider, the Renewable Energy Standard Rider, and the Mercury Cost Recovery Rider.

ENVIRONMENTAL IMPROVEMENT RIDER

Bills are subject to the adjustments provided for in the Environmental Improvement Rider.

SURCHARGE

In certain communities, bills are subject to surcharges provided for in a Surcharge Rider.

LOW INCOME ENERGY DISCOUNT RIDER

Bills are subject to the adjustment provided for in the Low Income Energy Discount Rider.

The following are terms and conditions for service under this tariff

LATE PAYMENT CHARGE

Any unpaid balance over \$10.00 is subject to a 1.5% late payment charge or \$1.00, whichever is greater, after the date due. The charge may be assessed as provided for in the General Rules and Regulations, Section 3.5.

BILL PROTECTION

Billing charges considered for bill protection will include customer and energy charges, fuel cost charges, and if applicable, system and distribution demand charges. Bill protection will be considered only for customers that have been pilot participants for 12 months at the same business location based on the first 12 months of participation in the pilot program. Any Pilot program billing charge in excess of 10 percent of the corresponding billing charge that would have been applied had the customer not been a pilot participant will be credited to the customer's account, including any applicable taxes. The bill protection in this paragraph will terminate after the first 12 months of participation in the pilot program. The bill protection in this program will not terminate after the first 12 months of participation in the pilot program for energy consumed by operators of public transit systems to charge electric vehicles that are used to transport transit riders.

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(Continued on Sheet No. 5-36)

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MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

**GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26**

Section No. 5
10th Revised Sheet No. 36

CRITICAL PEAK PRICING EVENTS

Customer taking service under Rate Code A26 will be subject to critical peak pricing events where energy rates will be increased to the critical peak pricing energy rate. Up to 75 event hours can be called during any calendar year. The decision to call actual control events will be based on economic, capacity, and contingency criteria. The Company will attempt to provide 24-hour notice of an event, but at a minimum the Company will alert customers no less than 12 hours ahead of an event. Pre-event notifications will include the event start time, planned duration of the event, and event end time. Notifications will be sent to the participating customer's designated contacts via email, text, voice message, or combination as specified by the customer. Customers are responsible for ensuring contact information is kept current and notifying the Company if any changes are necessary.

DETERMINATION OF DISTRIBUTION DEMAND

The distribution demand will be the greatest 15-minute load, occurring at any time during the past the 12 months, ending with the current billing month, not adjusted for power factor, and rounded to the nearest whole kW. Unusual incremental demand amounts incurred after a failure on the Company's distribution system will be excluded from distribution demand billing in kW at the Company's discretion.

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DEFINITION OF PEAK PERIODS

The peak period is defined as those hours between 3 p.m. and 8 p.m. Monday through Friday, except the following holidays: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day. When a designated holiday occurs on Saturday, the preceding Friday will be designated a holiday. When a designated holiday occurs on Sunday, the following Monday will be designated a holiday. The base period is defined as all hours not defined as peak period or off-peak period. The off-peak period is defined as those hours between midnight (12:00 a.m.) and 6:00 a.m. every day.

DETERMINATION OF PEAK PERIOD DEMAND

The actual peak period demand in kW shall be the greatest 15-minute load for the peak period during the month for which the bill is rendered. The adjusted demand in kW for billing purposes shall be determined by dividing the actual peak demand by the power factor expressed in percent but not more than 90% multiplying the quotient so obtained by 90%, and round to the nearest whole kW. In no month shall the peak period demand to be billed be considered as less than the current month's adjusted peak period demand in kW, or 50% of the greatest monthly adjusted peak period demand in kW during the preceding 11 months. In no month shall the peak billing demand be greater than the value in kW determining by dividing the kWh sales for the billing period month by 100 hours per month.

The greatest monthly adjusted peak period demand in kW during the preceding 11 months shall not include the additional demand which may result from customer's use of standby capacity contracted for under the Standby Service Rider.

(Continued on Sheet No. 5-37)

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MINNESOTA ELECTRIC RATE BOOK - MPUC NO. 2

**GENERAL TIME OF USE SERVICE PILOT PROGRAM
(Continued)
RATE CODE A25, A26**

Section No. 5
10th Revised Sheet No. 37

DETERMINATION OF BASE PERIOD DEMAND

The actual base period demand in kW shall be the greatest 15-minute load for the base period and the peak period during the month for which the bill is rendered round to the nearest whole kW. The adjusted demand in kW for billing purposes shall be determined by dividing the actual base period demand by the power factor expressed in percent but no more than 90% multiplying the quotient so obtained by 90%, and round to the nearest whole kW. In no month shall the base period demand for billing purposes be considered as less than the current month's actual base period demand in kW, or 50% of the greatest monthly actual base period demand in kW during the preceding 11 months. In no month shall the base billing demand be greater than the value in kW determining by dividing the kWh sales for the billing period month by 100 hour per month.

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The greatest monthly adjusted base period demand in kW during the preceding 11 months shall not include the additional demand which may result from customer's use of standby capacity contracted for under the Standby Service Rider.

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POWER FACTOR

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