Direct Testimony and Schedule
Christoper J. Shaw

Before the Minnesota Public Utilities Commission
State of Minnesota

In the Matter of the Application of Northern States Power Company d/b/a Xcel Energy for a Certificate of Need for Additional Dry Cask Storage at the Prairie Island Nuclear Generating Plant Independent Spent Fuel Storage Installation

Docket No. E002/CN-24-68
Exhibit___(CJS-1)

Resource Planning

February 10, 2025

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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND TITLE.

A. My name is Christopher J. Shaw. I am currently the Manager of Regulatory Policy for Northern States Power Company d/b/a Xcel Energy (Xcel Energy or the Company). Prior to accepting my current role, I was Director of Resource Planning for Xcel Energy Services, Inc. (XES or Service Company), which supports the Xcel Energy operating companies, including Northern States Power Company.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. I began working at Xcel Energy in November 2015, holding positions as a Principal Rate Analyst, Regulatory Policy Manager, and Director of Resource Planning. I have been in my current position since January 2025. Prior to joining Xcel Energy, I worked for the Minnesota Department of Commerce and the Minnesota Attorney General's Office. In my Resource Planning role, I oversaw the Resource Planning team working on the development of resource plans and acquisitions for the five-state integrated Upper Midwest Northern States Power Company system (NSP System), which provides electric service to customers in North Dakota, South Dakota, Minnesota, Wisconsin, and Michigan. This includes assisting the Company in making reasonable and prudent acquisition decisions regarding electric generation resources. I was involved in the preparation of the generation alternatives analysis presented in the Company's Certificate of Need Application. My statement of qualifications is provided as Exhibit___(CJS-1), Schedule 1.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY IN THIS PROCEEDING?

A. The purpose of my Direct Testimony in this proceeding is to support the Company's Application for a Certificate of Need (Application) to expand the existing Integrated Spent Fuel Storage Installation (ISFSI) at the Prairie Island Nuclear Generating Plant (Prairie Island Plant or the Plant). The Plant is currently slated to operate until 2033/34, and the proposed expansion of the Plant's ISFSI will enable the Plant to operate an additional 20 years through 2053/54. If the ISFSI is not expanded, the Prairie Island Plant would need to close in 2034, and the Company would need to replace the substantial capacity and energy it provides to the NSP System with other resources.

Q. DO YOU SPONSOR ANY SECTIONS OF THE COMPANY'S APPLICATION, FILED ON FEBRUARY 7, 2024 IN THIS DOCKET?

A. I am sponsoring the following Application sections:

- Ch. 3.3 – Resource Plan
- Ch. 4.1 – Adequacy, Reliability, Safety and Efficiency of Energy Supply (excepting sections 4.1.2- 4.1.4)
- Ch. 4.2.2 – Generation Alternatives
- Ch. 4.2.4 – No Action
- Ch. 5.1 – Socially Beneficial Uses of the Output of the Facility
- Ch. 9.3 – Generation Alternatives (Also "No Action" Alternative)

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. My testimony is organized as follows:

- *Section II*: I discuss the role of nuclear generation generally, and the Prairie Island Plant particularly, in Xcel Energy's electrical generation.

- *Section III*: I address resource planning in the context of the Company's most recent Integrated Resource Plan proceeding in Minnesota.
- *Section IV*: I discuss the Generation Alternatives to the Prairie Island Plant should the Plant's life not be extended.
- *Section V:* Conclusion

II. THE ROLE OF NUCLEAR POWER AND THE PRAIRIE ISLAND PLANT IN THE COMPANY'S ELECTRICAL GENERATION PORTFOLIO

Q. PLEASE EXPLAIN THE IMPORTANCE OF NUCLEAR GENERATION TO THE COMPANY'S GENERATION PORTFOLIO.

A. The Company's nuclear generation plants, including the Prairie Island Plant, provide critical baseload generation and fuel diversity benefits that are important for maintaining overall reliability on the NSP System. Additionally, the Prairie Island Plant provides carbon-free baseload generation, and in that respect, its continued operation is critical to achieving the Company's (and Minnesota's) carbon-reduction goals while reducing exposure to more volatile fuel and wholesale electricity prices.

Q. CAN YOU HIGHLIGHT SOME OF THE FACTORS THAT MAKE THE PRAIRIE ISLAND PLANT AN IMPORTANT BASELOAD RESOURCE ON THE NSP SYSTEM?

A. Yes. As a baseload resource, the Plant operates 24 hours a day, seven days a week for extended periods of time. The Prairie Island Plant provides 1,100 megawatts (MW) of baseload capacity and has generated over 400 million megawatt hours (MWh) since it started operating. As a synchronous generator, the Prairie Island Plant also provides a wide range of essential reliability

services to the grid. Nuclear generation is inherently more resistant to reliability events such as severe weather and fuel disruptions due to on-site fuel storage. The Plant is critical to Xcel Energy's ability to meet the ongoing, steady or base demand for electrical power. The removal of the Prairie Island Plant from the electrical supply system would create a capacity deficit of over 1,000 MWs and a several million MWh deficit in the region in 2033/34.

Q. PLEASE ADDRESS THE PRAIRIE ISLAND PLANT'S IMPORTANCE AS A CARBON-FREE GENERATION RESOURCE.

A. Since it has commenced operations, the Prairie Island Plant's generation translates into over 405 million tons of CO_2 emissions avoided. The Plant is a cornerstone of Xcel Energy's vision to achieve an 80 percent reduction in carbon emissions compared to 2005 levels by 2030 and our Company goal of providing 100 percent carbon-free electricity to our customers, the state and the region by 2050.

In 2023, Governor Tim Walz signed 2023 Minn. L. Ch. 7, mandating, among other things, that each electric utility in the state of Minnesota generate or procure 100 percent carbon-free electricity for its Minnesota retail customers by 2040. Nuclear generation will be an important component of the Company's compliance with this statutory requirement, as well as the interim carbon-free generation goals established by this new law, cost effectively. The impact of this new law on the Company's Application is discussed in greater detail in the testimony of Company witness Allen Krug.

III. THE COMPANY'S 2024-2040 UPPER MIDWEST INTEGRATED RESOURCE PLAN

Q. IS THE EXTENSION OF THE LIFE OF THE PRAIRIE ISLAND PLANT BEING CONSIDERED BY THE COMMISSION IN ANY OTHER DOCKET?

A. Yes. The Minnesota Public Utilities Commission (Commission) is considering the extension of the Plant's life as part of the Company's 2024-2040 Upper Midwest Integrated Resource Plan (2024 IRP) cycle. Hearings before the Commission in the 2024 IRP docket are currently scheduled for February 18 and 20, 2025.

Q. DID THE COMPANY SUBMIT RESOURCE PLANS IN THE IRP DOCKET THAT INCLUDED EXTENSION OF THE PRAIRIE ISLAND PLANT?

A. Yes. The 2024 IRP was filed on February 1, 2024 in Docket No. E002/RP-24-67, proposing a preferred plan that recommended extension of the Prairie Island Plant.

The Preferred Plan included an extensive discussion of the Company's forecasts of energy and capacity needs over the 2024 IRP time period, including factors that could lead to variance in those forecasts.

Q. HOW DID THE COMPANY GO ABOUT ANALYZING POTENTIAL ALTERNATIVES TO THE PROPOSED PRAIRIE ISLAND PLANT EXTENSION IN THE 2024 IRP?

A. In the course of the 2024 IRP, the Company analyzed options for replacing the capacity and energy provided by the Prairie Island Plant.

Q. ARE THOSE IRP ANALYSES USEFUL IN CONSIDERING ALTERNATIVES TO THE ISFSI EXPANSION PROPOSED IN THIS CERTIFICATE OF NEED PROCEEDING?

A. Yes. As I noted above, if the Commission does not grant the Certificate of Need allowing the Company to expand the ISFSI at the Prairie Island Plant, the Plant would need to shut down in 2033/34, and the Company would need to replace the substantial capacity and energy it provides to the system. The analysis performed in the 2024 IRP docket addressed these alternatives.

Q. PLEASE SUMMARIZE THE RESULTS OF THIS ANALYSIS.

A. The Company's 2024 IRP analysis found that, in general, extending the life of the Prairie Island Plant as part of our 2024 IRP Preferred Plan is cost effective from both a present value of revenue requirements (PVRR) and present value of societal cost (PVSC) perspective, supports achievement of our carbon reduction goals, and ensures that we maintain a robust share of firm and/or dispatchable generation relative to peak load across seasons. The analysis of replacement scenarios favored extension of the Prairie Island Plant due to the important reliability, resource diversity, and carbon-reduction benefits that the Plant provides to the NSP System. I discuss this analysis in greater detail in Section IV of my testimony.

Q. WHAT IS THE STATUS OF THE 2024 IRP?

A. On October 3, 2024, the Company filed a Settlement Agreement related to the 2024 IRP. The Settlement Agreement includes the Settling Parties' agreement that extension of the Prairie Island Plant Units 1 and 2 to 2053 and 2054, respectively, is in the public interest. The Commission will consider the Settlement Agreement on February 18 and 20, 2025. As a result, it is likely that the Commission will have made a decision on the 2024 IRP prior to the time

this present matter is resolved. I will address the current status of the 2024 IRP in my rebuttal testimony.

IV. GENERATION ALTERNATIVES

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?

A. In this section, I discuss the Company's analysis of two primary alternative scenarios. I also briefly discuss the impacts to the transmission system upon the retirements of the Company's nuclear plants, as developed in the "Nuclear Leave Behind Study" and incorporated into these scenarios. These analyses are discussed in Chapter 9 of the Application.

Q. HOW DID THE COMPANY CONDUCT THIS ANALYSIS?

A. For purposes of analyzing the Prairie Island Plant extension and the proposed Monticello Plant extension, the Company compared the Preferred Plan in the 2024 IRP, in which Prairie Island is extended to 2053/54 and Monticello is extended to 2050, to two alternative scenarios. The first scenario (Scenario 1) is the Reference Case and retires Prairie Island and Monticello at their currently scheduled retirement dates of 2033/34 and 2040, respectively. The Reference Case includes the following underlying assumptions:

- Approved resources include: Sherco Solar 1, 2, and 3; Apple River, Louise and Fillmore solar projects; Wheaton Repower;[1]
- Extension for the Company's Refuse Derived Fuel Waste to Energy Generating Plants;

[1] Subsequent to the establishment of these assumptions in the Reference Case, the Wheaton Repower was approved by the Public Service Commission of Wisconsin on June 4, 2024 in Docket No. 4220-CE-185.

- Short-term Power Purchase Agreement extensions, including: Mankato Energy Center and Cannon Falls;
- Sherco and King Tie-Line reoptimized;
- Combustion turbine (CT) allowed for selection on Sherco Tie-Line;
- Optimized without market purchases/sales; and
- Dispatched with access to MISO market.

The second scenario (Scenario 2) extends Prairie Island to 2053/54 but retires Monticello at its currently scheduled retirement date of 2040. In both Scenarios, the resource planning model was allowed to optimize replacements needed to fill the energy and capacity needs created by the retirement. In other words, we allowed the model to select the most cost-effective alternative resources to replace Prairie Island and Monticello, and we did not require the model to choose any specific resource type to replace the Plant.

In Scenario 1, firm dispatchable capacity is needed starting in 2027. Additional firm dispatchable resource additions are needed in 2028, 2030, 2032, 2033, and 2035 to meet baseload serving needs, including the additional needs as a result of the Prairie Island retirement in 2033/34. In Scenario 2, firm dispatchable capacity is still required starting in 2027. However, due to the extension of Prairie Island, the firm dispatchable additions in 2033 and 2035 in Scenario 1 are not needed in Scenario 2. Further, the extension of Prairie Island offsets the need for other resource additions including wind, solar, and storage.

As compared to Scenarios 1 and 2, the Company's Preferred Plan proposed in the 2024 IRP (Scenario 3), which extends the Prairie Island and Monticello

Plants, results in fewer additions of firm peaking capacity, solar capacity, and wind capacity.

Q. WHAT FACTORS MUST THE COMMISSION CONSIDER WITH RESPECT TO GENERATION ALTERNATIVES?

A. Generally, generation alternatives are to be evaluated on four factors: size, type and timing of the proposed facility compared to the alternatives; cost of the proposed facility and cost of energy compared to the cost of alternatives and the cost of energy that would be supplied; natural and socioeconomic impacts compared to the alternatives; and the reliability of the proposal compared to alternatives.

Q. WHAT WERE THE RESULTS OF THE COMPANY'S ANALYSIS OF POTENTIAL REPLACEMENT CASES?

A. This analysis found that extending the operational life of the Prairie Island and Monticello Plants best balances the Company's objectives regarding cost, carbon reduction, reliability and market risk outcomes, relative to both Prairie Island extension scenarios.

Q. PLEASE SUMMARIZE WHAT THE MODELING SHOWED REGARDING THE COSTS ASSOCIATED WITH CONTINUING TO OPERATE THE PRAIRIE ISLAND PLANT COMPARED TO THE REPLACEMENT CASES.

A. From a cost perspective, the Reference Case (Scenario 1) results in incrementally higher costs relative to Scenario 2 on a present value of societal costs (PVSC) basis. The additional costs to replace the capacity and energy of the Prairie Island Plant in 2033/34 relative to extending the retirement date to 2053/54 is approximately $500 million on a PVSC basis from 2024 to 2050.

When the cost of emissions is not considered in the Present Value Revenue Requirement (PVRR) sensitivity, the replacement capacity needed to replace Prairie Island at the end of extension plan in Scenario 2 significantly impacts overall cost from 2024 to 2050. This is a result of the model making significant additions of firm dispatchable resources in the late 2040s in anticipation of the Prairie Island Plant retirement, coupled with the fact that the PVRR assumptions do not take into consideration the costs of carbon emissions from these additional resources.

The Company expects that technological advancements will provide additional resource options that are not currently available by the time the Prairie Island Plant reaches the end of the extended operating license in Scenario 2. As a result, the firm dispatchable additions in the late 2040s in Scenario 2 may be overstated and therefore may not provide a reliable indication of the costs so far out in time. In comparison and using the same modeling, extension of the Prairie Island Plant results in approximately $100 million in savings as compared to the Reference Case from 2024 to 2040, when resource cost assumptions are most known, even when the benefits of avoided emissions are not included.

Further, the Company conducted numerous additional sensitivities on the baseload scenarios considered in its 2024 IRP. As shown in Appendix G of the 2024 IRP, Docket No. E002/RP-24-67, Scenarios 2 and 3 result in net benefits in nearly all sensitivities. One such sensitivity incorporated the Company's goal to generate 100 percent carbon-free energy by 2050 (100x50). When applying this sensitivity analysis to the Reference Case, Scenario 2 results in savings of approximately $1 billion on both a PVSC and PVRR basis

from 2024 to 2050. Although advances in technology will be critical to achieving the Company's 100x50 goal, the extension of the Prairie Island Plant provides critical, and certain, carbon-free generation, and the extension of the Company's nuclear fleet provides an overwhelmingly cost-effective source of carbon-free energy when compared to existing technologies. Scenarios 2 and 3 also considerably better position the Company to comply with the 2023 legislation, codified at Minn. Stat. § 216B.1691, requiring the Company to generate or procure 100 percent carbon-free electricity for its Minnesota retail customers by 2040. Currently, the Company is positioned to achieve compliance with the new legislation under the 2024 IRP Preferred Plan (Scenario 3), and extending the life of the Prairie Island Plant is crucial to meeting these requirements.

These findings are summarized in Table 1 and Table 2 below.

Table 1
Scenario PVSC/PVRR Deltas in Net Present Values (NPV) from Reference Case ($2024 millions)

PVSC Production Cost	Delta in NPV ($m) 2024-2040	NPV ($m) 2024-2040	Delta in NPV ($m) 2024-2047	NPV ($m) 2024-2047	Delta in NPV ($m) 2024-2050	NPV ($m) 2024-2050
Scenario 1 PVSC	$0	$51,037	$0	$63,635	$0	$68,788
Scenario 2 PVSC	($413)	$50,624	($437)	$63,198	($513)	$68,275
Scenario 3 PVSC	($785)	$50,252	($941)	$62,695	($1,025)	$67,762
PVRR Production Costs	Delta in NPV ($m) 2024-2040	NPV ($m) 2024-2040	Delta in NPV ($m) 2024-2047	NPV ($m) 2024-2047	Delta in NPV ($m) 2024-2050	NPV ($m) 2024-2050
Scenario 1 PVRR	$0	$34,678	$0	$44,948	$0	$48,927
Scenario 2 PVRR	($97)	$34,581	$291	$45,239	$391	$49,317
Scenario 3 PVRR	($464)	$34,215	$46	$44,994	$239	$49,166

Table 2
NPV Savings Under 100 Percent Carbon-Free by 2050 Constraint
($2024 millions)

PVSC Production Cost	Delta in NPV ($m) 2024-2040	NPV ($m) 2024-2040	Delta in NPV ($m) 2024-2047	NPV ($m) 2024-2047	Delta in NPV ($m) 2024-2050	NPV ($m) 2024-2050
Scenario 1 PVSC	$0	$50,703	$0	$62,974	$0	$70,930
Scenario 2 PVSC	($298)	$50,406	($385)	$62,589	($1,003)	$69,927
Scenario 3 PVSC	($662)	$50,041	($931)	$62,042	($1,850)	$69,080
PVRR Production Costs	Delta in NPV ($m) 2024-2040	NPV ($m) 2024-2040	Delta in NPV ($m) 2024-2047	NPV ($m) 2024-2047	Delta in NPV ($m) 2024-2050	NPV ($m) 2024-2050
Scenario 1 PVRR	$0	$34,819	$0	$46,314	$0	$54,273
Scenario 2 PVRR	($200)	$34,619	($323)	$45,991	($947)	$53,326
Scenario 3 PVRR	($612)	$34,207	($941)	$45,373	($1,865)	$52,407

Q. HOW DID THE COMPANY'S NUCLEAR LEAVE BEHIND STUDY IMPACT THIS ANALYSIS?

A. The Company conducted the Nuclear Leave Behind Study to determine transmission impacts of the retirements of the Company's nuclear plants. The study shows that the retirement of the Prairie Island Plant (and the Monticello Plant) removes inertia and voltage support that are needed to provide transmission system stability. Simply put, to maintain system stability under a system fault post-retirement of the nuclear plants, additional generation must be turned on or load shed. The study determined that significant replacement generation is needed, resulting in significant costs. Additional significant costs would be incurred due to transmission line upgrades and voltage support needed to mitigate voltage violations. The costs of these upgrades were incorporated as a component of the modeling results in Scenarios 1, 2, and 3.

Q. HOW DOES THE PRAIRIE ISLAND PLANT IMPACT THE COMPANY'S OVERALL PLAN TO CONTINUE PROVIDING RELIABLE SERVICE WHILE TRANSITIONING TO A CARBON-FREE ENERGY MIX?

A. The Company's nuclear fleet provides around-the-clock grid stability, voltage support, and overall reliability. Prairie Island is a significant baseload resource on the NSP System. The 1,100 MW Prairie Island Plant has played a critical role in the fleet of the Company's generating resources, generating over 400 million MWh of energy, which translates to over 405 million tons of avoided carbon emissions. The Plant operates at full capacity 24 hours a day, 7 days a week for extended periods of time and is used to meet the ongoing, steady or base demand for electrical power. The Plant has achieved an average capacity factor of approximately 90 percent between 2019 and 2023 (including a record-setting 99.98 percent in 2022 on Unit 2). In 2020, Prairie Island Unit 1 completed a record run of 670 days of continuous operation, and Unit 2 completed a record run of 704 days of continuous operation in 2021. No other resource in our fleet, with the exception of Monticello, provides this type of consistent, reliable, carbon-free energy and capacity. Combined with Monticello, the Plants represent nearly 30 percent of the total electric energy and 40 percent of the carbon-free energy our customers require in the Upper Midwest.

Additionally, our nuclear fleet adds important diversity to our generation portfolio and provides a hedge against not only gas price volatility but also the uncertainty of technological development, future renewable pricing, and the future of solar capacity values. No other carbon-free resource in our generation fleet can replicate this kind of reliable performance.

The continued operation of the Plant will also provide firm capacity during the 2033/2034 through 2053/2054 time period, whereas scenarios that do not include an extension of the Plant either rely on incremental gas resources to provide firm capacity or rely more heavily on variable or use-limited resources. In either case, however, we would be decreasing the diversity of generation on our system and, ultimately, making it less resilient.

Finally, as part of moving towards a carbon-free generation fleet by 2050, we have improved our operational flexibility so that we can ramp down our nuclear plants during periods of high transmission congestion and low prices, such as times when abundant renewable resources are available on our system. With flexible operations capabilities available at the Company's two nuclear plants, we can safely and efficiently flexibly dispatch as much as approximately 280 MW—or over 15 percent—of our nuclear capacity in response to the market. In fact, the Company flexibly operated our nuclear plants 14 times in 2022 and 16 times in 2023. This helps with the Company's efforts to integrate its continuing renewable additions.

In summary, nuclear power is currently the source of most of the country's—and the Company's—emissions-free energy and has long been a reliable, efficient, and job-creating energy source. Because of their comprehensive safety procedures and stringent federal regulations, nuclear plants are among the most reliable energy infrastructures. The Company needs to carefully manage the transformation of its generation portfolio in order to preserve the reliability and stability of the system while moving towards a carbon-free generation portfolio, and maintaining the Plant as a resource on our system is a key piece of that plan.

V. CONCLUSION

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

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EXPERIENCE

Xcel Energy
Director, Resource Planning
Responsible for the development of resource plans and acquisitions for the five-state integrated Upper Midwest System, including the 2024-2040 Integrated Resource Plan (IRP).
Manager, Regulatory Policy
Principal Rate Analyst
Developed strategy, coordinated subject matter expert analysis and prepared filings for the 2019 IRP, the 2016 IRP, Resource Treatment Framework (RTF), and resource acquisitions. Represented the Company at hearings on the IRP and other resource related proceedings.

Minnesota Department of Commerce-Division of Energy Resources
Public Utilities Rates Analyst
Developed and supported the recommendations of the Department of Commerce in proceedings before the Minnesota Public Utilities Commission. Performed analysis of utility regulatory filings. Appeared as an expert witness in numerous contested cases. Analyzed proposed legislation and prepared reports for the Minnesota Legislature.

Minnesota Office of the Attorney General-Anti-Trust and Utilities Division
Assistant Attorney General
Advocated for residential and small business energy consumers on behalf of the Attorney General, including advocacy in Xcel Energy's 2012 rate case.

EDUCATION

University of Wisconsin Law School, Madison, WI
J.D.

University of Wisconsin-Madison, Madison, WI
B.A.
Major: Economics-Mathematical Emphasis