EXECUTIVE SUMMARY

Xcel Energy (the Company) has pioneered the clean energy transition for decades, with industry-leading energy efficiency and renewable energy efforts. In 2018, the Company took its leadership to a new level, announcing a goal of reducing carbon emissions by 80 percent from 2005 levels by 2030 and becoming the first utility in the nation to state its intention to serve customers with 100 percent carbon-free electricity by 2050. The Company's recently proposed Upper Midwest Resource Plan accelerates this already ambitious goal. Specifically, our modeling now shows potential carbon reductions of up to 88 percent by 2030, even as we forecast increased customer load from electrification and other sources. And last year Minnesota implemented its new "100 x 2040" law,[1] which requires that the Company produce enough carbon-free energy by 2040 to equal its total retail electric sales.

Figure E-1
Xcel Energy's Nuclear Fleet: Prairie Island and Monticello Plants

Photo: Aerial views of the Prairie Island Nuclear Generating Plant (left) and the Monticello Nuclear Generating Plant (right). These plants provide important baseload generation for a carbon-free future.

As we work to achieve these goals and move toward a portfolio that is carbon-free, our nuclear units, shown in Figure E-1 above, will be vital to our ability to reliably serve our customers with a diverse portfolio of cost-effective generation. Simply put, the Company must maintain a significant amount of baseload and firm dispatchable generation in order to protect the adequacy and reliability of energy supply for our customers during this transition. With the closure of our coal fleet, the Company's only remaining baseload generation will be provided by its nuclear fleet, including the Prairie Island Nuclear Generating Plant (Prairie Island Plant or Plant), which altogether provides approximately 1650 MW in baseload net summer peak capacity

[1] Codified as Minn. Stat. § 216B.1691 Subd. 2g.

of carbon-free generation. And while the Plant provides important baseload power, we have also developed the flexibility to ramp its output up and down to respond to market prices and renewable production. In fact, the Plant reduced power 16 times in 2023 during periods of high transmission congestion and low prices, giving this traditionally baseload resource some of the additional benefits of a firm dispatchable unit. Figure E-2 below is a photo of the Prairie Island Plant.

Figure E-2
Prairie Island Nuclear Generating Plant

Photo: Prairie Island Plant on a cool fall morning in October 2021.

In 2033, the Prairie Island Plant will exhaust its storage capacity for spent nuclear fuel within the Plant and at the existing Independent Spent Fuel Storage Installation (ISFSI) located on site. Without additional storage capability, the Prairie Island Plant would need to be shut down. Figure E-3 below shows an aerial view of the current status of the Prairie Island Plant ISFSI.

Figure E-3
Aerial View of the Prairie Island Plant ISFSI

Photo: Prairie Island Plant ISFSI with 50 TN-40/40HT Dry Fuel Storage (DFS) systems stored on 3 concrete pads. Photo taken by Nuclear Innovation Team drone, July 2023.

For these reasons, the Company submits this application for a Certificate of Need (CN) to the Minnesota Public Utilities Commission (MPUC or Commission) for authority to add additional storage at the existing ISFSI, which would allow for the continued operation of the Plant from 2033/2034 until 2053/2054. This Executive Summary provides an overview of the main points of the CN Application, a description of the Project, and highlights the critical role of this Project in our energy future. Specifically, as discussed in this Executive Summary and through this CN Application, the Company urges the Commission to grant a CN for the following reasons:

- ***Continuing to Operate the Plant Enables Significant Carbon Reduction:*** Nuclear power is a key component of the Company's vision to be 100 percent carbon-free by 2050 and currently provides approximately forty percent of our existing carbon-free generation and thirty percent of our total generation in the Upper Midwest. The Company simply cannot achieve the aggressive levels of carbon reduction desired by both Xcel Energy and the State of Minnesota at an

affordable price without nuclear generation on our system. Our resource plan modeling shows that when the nuclear units are retired, the model chooses a combination of resources in their place that is less cost effective.

- ***Operation of the Plant Maintains Reliability and Grid Stability:*** Our nuclear fleet provides around-the-clock grid stability, voltage support, and overall reliability. Nuclear plants have up to 24 months of fuel on site and thus are not subject to fuel supply disruptions. They also are not subject to pipeline limitations during the winter season, and they have a very strong operating history during cold and hot weather events. Additionally, our nuclear units provide vital stability for the transmission system. The "Nuclear Leave Behind Study Report" (Appendix I) discussed below 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, particularly as other baseload generation (including our own coal generation) retires throughout the region. Without these plants, additional generation must be turned on or load-shed to maintain system stability under a system fault. Based on the dynamic analysis results performed in the study, significant replacement generation is needed.

- ***Nuclear Power is Safe:*** The Plant has maintained high levels of safety performance, achieving top marks on the industry's rigorous safety evaluations. In addition to these ongoing requirements, the NRC will evaluate the Company's Prairie Island Subsequent License Renewal (SLR) following submittal late in 2026, including the Generic Environmental Impact Statement prepared for SLRs. This level of regulatory attention will help to ensure that the Plant is operated safely and in compliance with applicable regulation through 2053/2054.

- ***Energy Produced from the Plant is Economical for Customers:*** Our resource modeling shows that extending operation of the Plant is beneficial and least-cost when compared to other alternatives. Specifically, the Plant extension yields over $500 million of benefits on a present value of societal costs (PVSC) basis in comparison to the reference case that assumes the Prairie Island Plant operates until end of current life (EOCL) and the Monticello Plant to 2040. Were operation of the Plant not extended, we would need to build three incremental new firm dispatchable units by 2035 and replace the carbon-free energy produced by the Plant with incremental renewable resources. In addition, steady state and dynamic stability analysis performed in our Nuclear

Leave Behind Study Report indicates that we would incur significant additional costs for transmission stability modifications to avoid voltage violations.

- ***The Plant Provides Good-Paying Jobs and Supports Energy Workforce Transition:*** Our nuclear facilities directly employ approximately 1,100 people, including our contract security force, in and around the Monticello and Red Wing communities. The Prairie Island Plant specifically employs approximately 550 workers. Significantly, an additional approximately 700 workers, primarily from local union halls, are employed at each plant to complete scheduled refueling outages on an annual cycle, typically one month in duration. The two photos in Figure E-4 show contract outage employees working on different refueling outage projects.

Figure E-4
Contract Employees Working the 2021 Fall Refueling Outage at Prairie Island Plant

- ***The Plant Supports Fuel and Resource Diversity:*** Our nuclear fleet adds important diversity to our generation portfolio and provides a hedge against gas price volatility, MISO market prices, the uncertainty of technological development, future renewable pricing, and the future of solar (and other resource) capacity values. Maintaining a diverse portfolio of resources is critical to ensure that our service remains affordable and reliable throughout the clean energy transition. In addition to fuel diversity, operational and resource diversity attributes provide important benefits. We need a mix of large and small plants with their different operational attributes to maximize production and reduce risk.

- ***The Plant Delivers Meaningful Community Contributions:*** Our nuclear plants are an important source of tax base for their host communities, resulting in a combined total of approximately $41 million in state and local taxes annually. The Prairie Island Plant accounted for 45 percent of the tax base for the City of Red Wing in 2023.[2] In total, the Company's nuclear operations contribute approximately $1 billion in annual economic benefits throughout the state (Nuclear Energy Institute (NEI), 2017 study).[3] An updated cost-benefit analysis will supplement the record in the 2024 IRP and this proceeding in the upcoming months pursuant to Order Point 23E of Docket No. E002/RP-19-368.[4]

The Company has also engaged extensively with the Prairie Island Indian Community (PIIC) since the last IRP was approved. The agreement reached with the PIIC on annual payments going forward represents a major accomplishment with respect to our ongoing partnership with the PIIC.[5] This will ensure that the PIIC will receive annual payments comparable to those received by other communities hosting nuclear power plants, which receive payments through property taxes paid by the Company. The Company and PIIC maintain a partnership through regular meetings with the Tribal Council and community to discuss key issues on legislation, strategic vision, and plant performance.

In addition to striving to develop and maintain a healthy partnership with our closest neighbor, we also have long-standing partnerships with the City of Red Wing and Goodhue County. Our employees live and work in these areas, and we support the communities by providing vital tax base; supporting local nonprofits through grants,

[2] https://www.redwingreportcard.org/taxes.
[3] Nuclear Energy Institute, "The Impact of Xcel Energy's Fleet on the Minnesota Economy," April 2017.
[4] ORDER APPROVING PLAN WITH MODIFICATIONS AND ESTABLISHING REQUIREMENTS FOR FUTURE FILINGS, Docket No. E002/RP-19-368, April 15, 2022 (2019 IRP Order).
[5] Laws of Minnesota 2023, Chapter 60-H.F.No. 2310, Section 15.

volunteering, and board service; and supporting economic development. The Company's leadership meets regularly with local city officials and at least semi-annually with county officials. Red Wing community breakfasts are held annually, typically at a location within the PIIC, and include school administrators, local elected officials, the Sheriff, PIIC tribal council members and other community members, and other members of the Red Wing community. Throughout the year, we meet with various community groups and organizations to share open dialogue regarding our objectives as well as the objectives and interests of our local communities. These types of events provide an opportunity for the Company to be transparent with our strategic vision – including the future of the Plant – and hear directly from community leaders and other stakeholders throughout the region. Figure E-5 highlights our key local community partnerships.

Figure E-5
The Company's Key Community Partnerships

In addition to striving to develop and maintain a healthy partnership with the PIIC, we also have long-standing partnerships with the City of Red Wing and Goodhue County. Our employees live and work in these areas, and we support the communities by providing vital tax base; supporting local nonprofits through grants, volunteering, and board service; and supporting economic development. Company leadership meets regularly with local city officials and at least semi-annually with county officials. Red Wing community breakfasts are held annually, typically at a location within the PIIC, and include school administrators, local elected officials, the Sheriff, PIIC Tribal Council members and other community members, and other members of the Red Wing community. Throughout the year, we meet with various community groups and organizations to share open dialogue regarding our objectives as well as the objectives and interests of our local communities. These types of events provide an opportunity

for the Company to be transparent with our strategic vision – including the future of the Plant – and hear directly from community leaders and other stakeholders throughout the region.

Because we believe the expansion of spent fuel storage capacity at the ISFSI is needed and the least cost and best alternative for our customers, the state, the environment, and the communities we serve, we ask that the Commission approve our CN Application.

I. THE PRAIRIE ISLAND PLANT AND THE COMPANY'S IRP

The Prairie Island Plant, as well as our Monticello nuclear plant, is a cornerstone of our plan to serve our customers with affordable, reliable, carbon-free energy. The Plant provides our system with approximately 1,100 megawatts (MW) of capacity and produces energy 24 hours a day, seven days a week for extended periods of time. In the Company's 2024 IRP, we modeled several scenarios testing different retirement dates for our nuclear plants. Through the course of that modeling, we determined that a scenario in which our remaining coal units continue to be retired by 2030, the Monticello Plant would be extended another 10 years to 2050,[6] and the Prairie Island Plant would be extended to 2053/2054, would be the most prudent path forward to achieving our clean energy goals while also maintaining affordability and reliability.[7]

As demonstrated in our Preferred Plan, the extension of both our nuclear plants is the least-cost baseload scenario, with the extensions resulting in approximately $1 billion in modeled present value of societal costs (PVSC) savings for our customers when compared to the reference case. In addition, our nuclear plants provide three crucial elements of system value, all with zero carbon emissions: accredited capacity; system stability; and portfolio diversity and reliability. Should the Prairie Island Plant be extended to 2053/2054 and Monticello is retired in 2040, our modeling shows PVSC cost savings of over $500 million. Even when the cost of avoided emissions is not included, the Prairie Island Plant extension provides benefits of approximately $100 million through 2040 on a present value of revenue requirements (PVRR) basis.

Additionally, the Nuclear Leave Behind Study Report details the steady state impacts and dynamic resources required on the transmission system as a result of retiring the

[6] Should the MN PUC approve a 10-year Monticello Plant extension in the 2024-2040 IRP, Xcel Energy would pursue a certificate of need application for a Monticello Independent Spent Fuel Storage Installation (ISFSI) expansion in support of the 10-year extension (from 2040-2050).
[7] The Company's Preferred Plan is detailed in the 2024 IRP Docket No. E002/RP-24-67, filed on February 1, 2024.

Monticello and Prairie Island Plants. A significant amount of natural gas generation would need to be turned on to support retirement of the nuclear plants, therefore resulting in significant costs. Additional significant costs would be incurred due to significant line upgrades and voltage support needed to mitigate voltage violations.

A. Carbon-Free Generation

Carbon-free nuclear generation has been a cornerstone of our generation fleet for 50 years, and maintaining this valuable resource on our system is critical to ensuring that we continue to make progress in reducing our carbon emissions and meeting the Company's and the State of Minnesota's carbon-free targets. Our nuclear facilities provide a substantial amount of carbon-free resources for our system and our customers. Since it began operating in 1973 (Unit 1) and 1974 (Unit 2), the Plant has generated over 400 million megawatt hours (MWh) of zero carbon electricity, which translates to over 405 million metric tons of avoided carbon dioxide emissions. In fact, the Monticello Plant and the Prairie Island Plant together avoid 12.5 million metric tons of carbon emissions annually – the equivalent of removing approximately 2.8 million gas-powered cars from the roads.[8]

To achieve our carbon-free energy vision, the Company plans to retire all of our coal plants in the Upper Midwest by 2030. Together, our coal units have provided our system a combined capacity of 2,400 MW.[9] Their retirements will therefore create a significant loss of our energy and capacity resources. At the same time that we are planning to retire our remaining coal fleet, we also have nearly 1,700 MW of power purchase agreements (PPAs) with other capacity resources set to expire between 2025 and 2028. With these losses of baseload and dispatchable resources, approval of this CN and extending the useful life of the Plant is critical to our ability to continue meeting our customers' electricity needs reliably and affordably.

The Plant is a critical part of our carbon-free generation portfolio, providing approximately 1,100 MW of capacity and approximately 8.7 million megawatt-hours of energy each year. In order to achieve our goal of an 80 percent reduction of carbon emissions by 2030 and continue to reduce emission in the future, we need to retire our coal-fired generation, replace those assets with low-or no-carbon resources, and preserve the carbon-free generation that is already part of our system.

[8] 2022 Nuclear Energy Institute data is used for Monticello Plant and Prairie Island Plant metric tons of carbon dioxide emissions avoided. Equivalent vehicle approximation comes from August 2023 Environmental Protection Agency vehicle emissions data (www.epa.gov).
[9] This includes capacity from Sherco 2, retired in 2023.

We also see the Plant as having a role in the difficult task of reducing the last 10-20 percent of carbon emissions from our system—which is not yet possible to do affordably and reliably with technologies that are commercially available. We are working with policy makers and other innovative technical industries to explore new technologies to eliminate the need for carbon-intensive resources. One example of our efforts is the hydrogen production project we are piloting at the Plant. The Company has been awarded a grant to build the first of its kind high temperature steam electrolysis hydrogen production unit at a nuclear plant. Production of hydrogen will begin this summer in 2024. The production will be small scale and will provide data for research and development only; however, the results may someday support an opportunity for a larger scale hydrogen production facility. As this project shows, we see a path for our nuclear units to play an even bigger part in reducing our carbon emissions in the future.

B. Reliability, Diversity, and Stability

In addition to generating carbon-free electricity, the Plant is one of our system's most reliable generation resources. The Plant contributes to the balance and diversity of resources the Company has available and provides important grid-supporting attributes such as stability, voltage support and overall reliability as the Company retires its other baseload power plants. And it provides these attributes, as well as energy and capacity, with remarkable dependability. The Plant operates 24 hours a day, seven days a week for extended periods of time. In fact, the Plant operated a record-setting 670 days at Prairie Island Unit 1 from 2018 to 2020, and a record-setting run of 704 days on Unit 2 from 2019 to 2021. The Plant has operated at an average capacity factor of 95 percent between 2020 and 2022, including a record-setting 99.98 percent in 2022 on Unit 2, a non-refueling year. Combined with the Monticello Plant, the Prairie Island Plant represents nearly 30 percent of the total electric energy (and 40 percent of the carbon-free energy) our customers required in 2022, making it a critical component of our overall generation fleet. Additionally, our nuclear fleet adds important diversity to our generation portfolio and provides a hedge against gas price volatility, MISO prices, 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 reliability of nuclear generation, and its continued inclusion in our diverse resource mix, is especially important during extreme weather. For example, our three nuclear units performed extremely well throughout both the 2019 polar vortex and the February 2021 cold spell. Additionally in 2022, our nuclear fleet operated at 96

percent capacity factor. This was critical in December 2022 when a historic winter storm crossed the Dakotas, Minnesota and Wisconsin, creating extreme winter conditions that included blizzards and record cold temperatures that impacted not just our region, but the majority of the United States and parts of Canada. Nuclear plants are built to withstand extreme weather and have demonstrated their ability to continue operations during hurricanes and severe weather as just described. With severe weather events on the rise and reasonably expected to occur again, maintaining a diverse generation mix that ensures we can meet our obligation to provide reliable electric service in all conditions, including extended durations of extreme weather, is critical. Nuclear provides a level of stability and predictability that other generation resources cannot match.

The continued operation of the Plant will also help us to maintain a healthy ratio of firm capacity to peak demand during the 2033/2034 through 2053/2054 time period, whereas a scenario in which extension of the Plant is not included relies either on incremental gas resources to provide firm capacity or relies 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 notably less resilient.

We have also enhanced the capabilities of our nuclear facilities to better integrate renewable resources, which are an essential component of our future generation portfolio. This allows us to maintain a more stable, reliable, and diverse energy mix. 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 all three nuclear units, 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, as we make future resource planning decisions, it is important to consider overall system, fuel, and resource diversity and the important benefits offered by nuclear power. Currently, nuclear power is the source of most of the country'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 resources. 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.

C. Continued Operational Efficiency

Both O&M and total production costs at our nuclear plants have decreased considerably in recent years. While some in the general public and media have subscribed to the narrative that nuclear is an expensive form of generation, this is not the case for our facilities. Instead, we have worked diligently to maintain low operational costs, and these efforts have paid off for our customers.

Between 2019 and 2023, we have consistently maintained production costs at $31.25 per megawatt-hour (MWh) or less, which is a decrease of more than 20 percent when compared to 2013 production costs. As discussed in our currently pending IRP, the Company's commitment to driving efficiency improvements, specifically focusing on process refinement and the integration of technology, has substantially contributed to these results. While we have and will continue to see production costs fluctuate from year to year, we anticipate that the lower costs we have achieved will be maintained or further reduced over the next five years.

And while some other forms of energy may be lower cost from time to time, the Company's nuclear power plants provide an important hedge against changes in resource availability, fossil fuel prices, and future emissions regulations. The Company principally utilizes a mixture of mid-range and long-term nuclear fuel[10] contracts to minimize effects from short-term market impacts which benefits our customers.

D. Safety and NRC Oversight

The safety of our employees and communities is a key Company value, and our nuclear plant employees make industrial and nuclear safety their highest priority. The Plant has maintained high levels of safety performance, achieving top marks on the industry's rigorous safety evaluations. The Nuclear Regulatory Commission (NRC) Reactor Oversight Process classifies U.S. nuclear reactors into various nuclear safety "Columns," which range from 1 (best) to 5 (worst). Both of the Company's nuclear plants are Column 1 plants with all green safety performance indicators. We also continue to be recognized in the industry by the Institute of Nuclear Power Operations (INPO) as a high performing plant among our peers. As a result, the

[10] The fuel assemblies in each nuclear unit's reactor contain the equivalent energy of approximately six million tons of coal used to produce electricity.

Company has been asked for advisement on various topics by a number of utilities, various state energy committees, and advanced reactor developers.

The Plant, like all nuclear facilities, is subject to rigorous oversight by the NRC, both under its license requirements and all existing and new NRC rules and regulations. In addition to these ongoing requirements, the NRC will evaluate the Company's Prairie Island Plant Subsequent License Renewal (SLR) application following submittal late in 2026. This level of regulatory attention will help to ensure that the Plant is operated safely and in compliance with applicable regulation through 2053/2054. Additionally, strict security regulations are imposed by the NRC. The ISFSI has a locked fenced perimeter and is monitored by security equipment and personnel. Only security-escorted access is allowed inside the fence. Similarly, the NRC imposes strict security regulations inside the Plant's protected area. Security personnel are strategically positioned and trained to respond to various events and are periodically evaluated by the NRC.

Over many years, our employees have continually adopted new technologies to reduce risk and improve safety. Notably, the Company's Nuclear Innovation Team has contributed to improving safety by using robotics in ways that reduce the risks to humans. Throughout the nuclear fleet in 2023, 32 robotic missions were executed in ways that removed human risk and improved task efficiency. In one example at the Plant, a drone was used to inspect a lightning arrestor, eliminating work at heights. Additionally, there are two examples from 2021 and 2023 at the Plant in which a submersible device was used to inspect equipment in intake bays that would otherwise have required a diver to perform. These are just a few of the examples of how the Company and its employees are pursuing the use of technology to improve worker safety.

E. Community Impact

The Prairie Island Plant provides a source of good jobs and economic benefits to the local community and region. The Company currently has approximately 550 employees working in or directly supporting the Prairie Island Plant. The number of people employed by the Plant increases by approximately 700 workers during refueling outages. These are good-paying jobs for this region, but the economic impact of the Plant goes well beyond the wages for these employees. In a 2017 NEI report,[11] "*The Impact of Xcel Energy's Nuclear Fleet on the Minnesota Economy*," NEI states

[11] An updated comprehensive cost-benefit analysis of continued operation of the Plant through 2053/2054, which will include potential environmental and economic impacts to the neighboring communities, will be filed in the coming months of 2024 to supplement the 2024 IRP and this CN application pursuant to MPUC order in Docket No. E002/RP-19-368, Order 23 E.

that, in 2016, "Xcel Energy's nuclear facilities were estimated to contribute $595 million to Minnesota's gross state product (GSP)." In addition, the report finds that "…for every dollar of output from Xcel Energy's nuclear operations, the state economy produces $1.98." That same study noted that our nuclear fleet collectively generates $1 billion in economic activity each year. The Company's nuclear fleet also generates substantial tax revenue for the state, contributing an estimated $42 million in state and local taxes annually with approximately $22 million generated by the Prairie Island Plant. Further, given the retirement of the Company's coal plants, a significant number of existing and potential energy-related jobs will be lost within the next decade.[12] Retiring the Prairie Island Plant on top of these other changes in 2033/2034 would exacerbate these job losses.

F. Modeling Results

The IRP modeling demonstrates that the continued operation of the Prairie Island Plant is both cost effective and expected to result in customer benefits. Our Preferred Plan includes a 20-year license extension of the Prairie Island Plant Units 1 and 2 (expiring in 2053 and 2054) and an additional 10-year extension on the operation of the Monticello Plant (through 2050). In conducting the analysis for our IRP, we considered three scenarios as shown in Table E-6 below. Table E-7 shows the resulting PVSC and PVRR costs and savings.

Table E-6
Baseload Scenarios

Plant Retirement Dates		
Scenario Name and Description	**Prairie Island Plant Unit 1/Unit 2**	**Monticello Plant**
Scenario 1 – Reference Case Maintain current planned retirement dates	2033/2034	2040
Scenario 2 – Prairie Island Plant Extension Extend Prairie Island Plant 20 years; maintain Monticello Plant retirement date	2053/2054	2040
Scenario 3 – Preferred Plan – Extend All Nuclear Extend Prairie Island Plant 20 years; extend Monticello Plant 10 additional years	2053/2054	2050

[12] Appendix O1: 2023 Workforce Transition Plan from the 2024 IRP, Docket No. E002/RP-24-67 details each step of the planning and transition process.

Table E-7
2024 IRP Modeling PVSC and PVRR Costs and Savings

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)	**$67,762**
PVRR Production Cost	**Delta in NPV ($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 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**

Our analysis shows that extending the operation of all our nuclear plants (Scenario 3) is beneficial and least-cost when compared to other scenarios. The extension of both our nuclear plants, which is reflected in our Preferred Plan, is the least-cost baseload scenario. This scenario results in approximately $1 billion in PVSC savings for our customers when compared to the Reference Case. In addition, our nuclear plants provide three crucial elements of system value, all with zero carbon emissions: accredited capacity; system stability; and portfolio diversity and reliability. We address each of these elements in more detail in Chapters 4 and 9.

Likewise, Scenario 2, in which the Prairie Island Plant is extended and Monticello Plant is closed at its current retirement data of 2040 shows substantial benefits from the Reference Case—albeit less than Scenario 3. Specifically, Scenario 2 shows PVSC savings for our customers of more than $500 million.

The modeling results reflect the significant benefits of avoided carbon emissions as well as impacts of avoided replacement generation. When the plants retire, there are significant additions needed to replace the benefits that our nuclear facilities currently provide. Under the Reference Case, using existing commercial technologies for replacement generation, modeling results show that retiring Monticello in 2040 and Prairie Island in 2033/2034 would require nearly 4,700 MW of incremental generating capacity over the modeling period, in addition to the resource additions identified in our Preferred Plan of the 2024 IRP. Specifically, extending the lives of both nuclear plants offsets the need for more than 120 MW of standalone storage, 2,800 MW

of wind, 876 MW of solar, and 896 MW of firm peaking capacity *in addition* to the significant additions proposed in our IRP. This would be costly to our customers and difficult to implement.

Additionally, our nuclear units provide vital stability for the transmission system. As noted above, the Nuclear Leave Behind Study Report shows that the retirement of the Prairie Island Plant and the Monticello Plant would necessitate significant costs in replacement generation and system upgrades to mitigate the resulting thermal violations on the transmission system during peak summer months.

II. THE PROJECT

For the reasons explained above, it is in the interest of our customers, the State, our employees, and communities to continue operating the Prairie Island Plant through 2053/2054. To allow for continued operation of the Plant after 2033/2034, the Company must obtain two approvals – approval of this CN for additional storage capacity for spent nuclear fuel, and a SLR from the NRC.[13]

The current ISFSI consists of a lighted area, approximately 720 feet long and 340 feet wide, roughly 5.5 acres in size, located inside an earthen berm just southwest of the plant. The site and Dry Fuel Storage (DFS) systems are monitored with cameras, other security devices, and pressure sensors.

Within the storage area, spent fuel is currently stored in 50 vertical bolted-lid casks (TransNuclear America LLC models TN-40 and 40HTs) that sit on three reinforced concrete support pads. Five additional TN-40HTs will be loaded and installed in the ISFSI between 2024 and 2025. Ten new technology DFS systems are anticipated to be loaded and installed in the ISFSI in 2026. The new DFS systems hold 37 spent fuel assemblies as opposed to the existing TN-40/40HTs which hold 40. The Plant is currently authorized for 64 DFS systems to be stored in ISFSI to support the current operating license through 2033/2034, however due to the new technology and associated change in spent fuel assembly capacity, we will have a total of 65 DFS systems stored in the ISFSI to support our current operating license. The amount of spent fuel stored in the 65 DFS systems will be equivalent to the same as the amount that would have been stored in 64 TN-40/40HTs.[14]

[13] Xcel Energy plans to apply for an SLR with the NRC in late 2026 to extend the operation of the Prairie Island Plant to 2053/2054.

[14] Xcel recently signed a contract with Orano (Orano - TN Americas) in November 2023 to store future spent fuel assemblies in the NUHOMS EOS37PTH welded canisters starting in 2026. The change in

The Company proposes to increase the capacity of the existing ISFSI by loading additional welded canister DFS systems and placing them on a fourth and potentially fifth concrete support pad that would be constructed within the existing facility. The existing facility was constructed with sufficient space to add the necessary additional storage modules with minimal environmental or other impacts. The proposed ISFSI expansion is shown in Figure E-8 below. The aerial photo depicts the locations of where the new concrete pad(s) could potentially be located within the existing ISFSI fence line. Additional project detail is discussed further in Chapter 8.

Figure E-8
Aerial Photo of Prairie Island Plant ISFSI with a Depiction of Potential New Concrete Pad(s) Locations

technology was authorized by the MNPUC in August 2022 for the Company to use an NRC-approved spent nuclear fuel storage system certified for dual-use as storage and transportation under 10 CFR § 72.212(b). The application and decision is filed under Docket No. E002/CN-08-510 along with the Company's request for proposal (RFP) evaluation criteria and results.

A. Construction of Additional Pad

The Project involves construction of a fourth and likely fifth pad and modular concrete storage system (hereinafter referred to as expansion facilities) within the existing ISFSI to support additional DFS systems, which will store sufficient spent fuel to allow the Prairie Island Plant to continue operating until 2053/2054. The exact number of casks needed will be determined by the specific amount of nuclear fuel required to run an additional 20 years, from 2033/2034 to 2053/2054, how much fuel is loaded each cycle, inventory management of the spent fuel pool, and the capacity of the DFS system. We estimate that we will need approximately 34 additional DFS systems to store approximately 1,200 fuel assemblies. This can be accomplished without expanding the perimeter of the existing ISFSI.

B. Cask Technology

The Company will also need to purchase additional DFS systems to store the spent fuel needed to run the facility for an additional 20 years. The Company recently completed a competitive bidding process to select a new DFS system technology. This process resulted in the Company signing a contract with Orano TN Americas in November 2023 to use the NUHOMS EOS37PTH horizontal welded canister DFS system. The current contract scope includes provision of sufficient DFS systems needed to support operation through the EOCL. It is anticipated that the same technology would be used to store spent fuel resulting from the continued operation through 2053/2054 should the Plant's operating licenses be extended.

The NUHOMS EOS37PTH system consists of a welded, sealed canister for confinement that is stored in a horizontal concrete modular construction to provide additional radiation shielding and protect the sealed canister from external hazards. For transportation offsite, the canisters will be transferred to a certified transportation overpack system licensed by the NRC without the need to move the fuel to a new container.

We are requesting that the Commission approve the additional storage necessary to support an additional 20 years of plant operation (approximately 1,200 spent fuel assemblies).[15] The Company will not use the expanded ISFSI to accommodate the storage of spent fuel generated after the end-date specified in the CN absent additional Commission approval.

[15] We anticipate with the approximate 34 additional DFS systems loaded and stored in the ISFSI to support a license extension, there will be a total of 99 DFS systems stored within the IFSI at the end of this extended operating period (2053/2054).

C. Radiological Impacts

Dose rates from loading approximately 34 additional DFS systems in support of extending the Plant's licenses another 20 years were analyzed by a third party.[16] At the time of the analysis, it was not known which technology would be selected other than knowing the expansion would use a welded canister DFS system licensed by the NRC for both storage and transportation. As part of the change in technology competitive bidding process, three potential technologies and vendors were considered. A bounding dose rate analysis was performed using the most conservative data available to ensure that no matter the technology selected, the cumulative dose rates would be below the NRC federal dose rate limits. The analysis showed that the theoretical, conservative level calculated will continue to be well below normal background levels and below NRC federal dose rate limits. Further, the dose rate will constantly decrease due to the radioactive decay of the spent fuel.

D. Environmental Impacts

Because the Project is an expansion of an existing facility in an already-disturbed area, the environmental impacts of the construction will be minimal. Additionally, because the Plant has been in operation for 50 years, there is little negative environmental impact associated with the continued operation of the plant for another 20 years.

As noted above, there is a significant environmental benefit associated with the continued operation of the Plant, as it will significantly help in meeting the Company's and state's carbon emissions reduction goals.

III. ALTERNATIVES ANALYSIS

In assessing the need for additional spent fuel storage at the Prairie Island Plant, the Company considered both generation alternatives, in which the Plant is assumed to be shut down in 2033/2034, and storage alternatives, in which the Plant is assumed to run through 2053/2054, but additional spent fuel is not stored at the ISFSI. Based on this analysis, we conclude that expanding the ISFSI for additional spent-fuel storage is the best solution for the Company and our customers.

[16] Sargent and Lundy "Dose Study to Support ISFSI Certificate of Need," SL-018015, Rev. 0, September 22, 2023, Appendix B.

A. Alternatives to Generation

The Company considered alternatives to facilitating the extension of the life of the Plant because a denial of the CN for expanded ISFSI would mean that the Prairie Island Plant will shut down in 2033/2034. If that occurs, the capacity and generation of Prairie Island Plant will need to be replaced. As previously discussed, the Company modeled various scenarios, and that modeling demonstrated that the Project and extending the life of the Plant provides cost benefits, compared to replacement scenarios on a PVCS basis. The model allows for lowest cost replacement generation alternatives and therefore, should the Plant retire in 2033/2034, there are additions of firm dispatchable resources to our system, which are modeled as gas combustion turbines. Finally, while sophisticated modeling can examine and compare various combinations of resources that could replace the capacity and energy of the Plant, modeling alone cannot paint a complete picture. Factors to be considered in determining whether and how to replace a large baseload central station facility such as the Prairie Island Plant should also include: the impact on the Company's ability to reach its goal of carbon-free generation by 2050 and the impact on the State's ability to meet its own carbon reduction goals; the reliability of the electricity provided to the Company's customers; diversity of resources; affordability of power; and other societal issues, such as economic benefits generated by the provision of hundreds of high paying jobs and substantial tax revenues and other benefits to the community. All of these aspects of replacing the Prairie Island Plant with alternative generation resources must be considered, and that full consideration supports approval of the Project and continued operation of the Plant beyond 2033/2034. As previously stated, an updated cost-benefit analysis will supplement this CN filing and the 2024 IRP pursuant to Order Point 23E of Docket No. E002/RP-19-368 to further substantiate this discussion.

B. Storage Alternatives to ISFSI Expansion

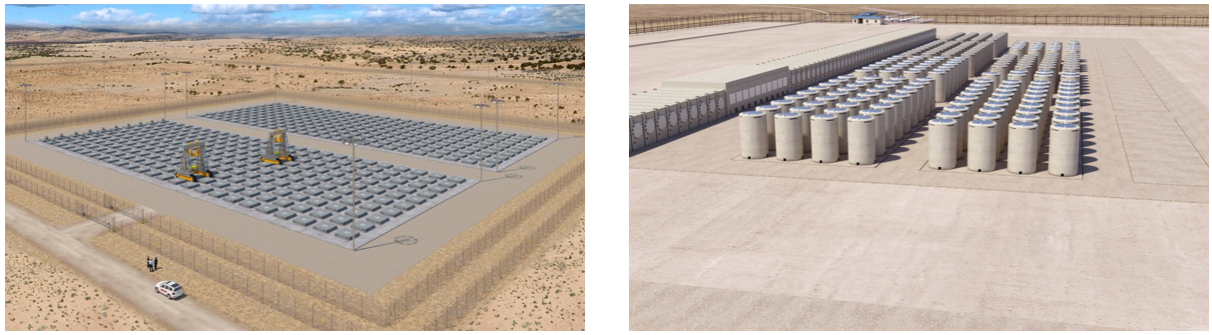
In considering alternatives to storing fuel in an expanded ISFSI, we looked at a variety of options including off-site storage, reprocessing and recycling the spent fuel, and storing the fuel in locations on-site other than the ISFSI. At the present time, there are no viable alternatives to continuing to store spent fuel at the Plant itself. And, of the options for storing spent fuel at the Plant, expanding the ISFSI makes the most sense.

1. Off-Site Storage Alternatives

While the federal government retains the obligation to provide a permanent repository for spent nuclear fuel, efforts to establish such a repository at Yucca Mountain in Nevada have been stalled indefinitely, and the Company does not see this as a viable solution for permanent off-site storage at this time.

Two private centralized interim storage facilities have received NRC licensure, the Holtec HI-STORE Consolidated Interim Storage Facility (Holtec International Inc.), proposed to be located in southeastern New Mexico, and the Interim Storage Partners (ISP) Storage Facility proposed to be located in Andrews County, Texas. However, legislative and legal challenges in both states have stalled progress with these facilities. The below photos in Figure E-9 depict Holtec's HI-STORE (left) and ISP's storage facility (right) as they could potentially be constructed.

Figure E-9
Holtec HI-STORE and ISP Storage Facility Construction Depictions



Should these interim storage solutions successfully navigate these challenges, there are a number of additional requirements that will need to be met before either of these facilities are able to accept spent fuel. After receiving the NRC license, each facility will need to work with their respective states on permitting issues and will need to develop a viable business model for operations prior to construction.

In addition, the Department of Energy is moving forward with a consent-based siting program. Last year, it awarded $26 million in grants to 13 consortiums to assist in the process of defining consent, focusing on the needs and concerns of people and communities.

While we believe the centralized interim storage facilities proposed by Interim Storage Partners (ISP) and Holtec International Inc. meet all NRC regulatory requirements and would be a positive development in the management of spent nuclear fuel, we do not consider it a viable alternative to the Monticello or Prairie Island Plants' ISFSIs at this time due to ongoing legislative and legal challenges. We will continue to follow and assess these projects such that if they progress successfully through these challenges, we will bring proposals forward to move fuel if beneficial to our customers and the public.

2. Reprocessing and Recycling Spent Fuel

Reprocessing of spent nuclear fuel by private companies was banned by President Jimmy Carter in 1977. While this ban was eventually lifted, no reprocessing facilities have been licensed and constructed to date in the United States because of the economics of reprocessing spent fuel have not compared favorably to fabrication of new fuel, and the political uncertainty surrounding reprocessing.

Oklo Inc., an energy company focused on designing and deploying advanced nuclear power plants, submitted a licensing project plan to the NRC citing plans in support of its future intended license application for a fuel recycling facility. Oklo Inc. has been awarded grant money from the Department of Energy (DOE) to determine the financial viability of constructing a facility. While there is increased incentive and interest in the industry to look at recycling spent fuel with advanced nuclear reactors on the horizon, there is uncertainty with respect to the results of such consideration. Any licensing, permitting and construction activities will take years, if not decades. As a result, reprocessing and recycling of spent nuclear fuel is not a viable alternative to establishing onsite dry storage at the Prairie Island Plant.

3. On-Site Storage Alternatives

The Company has evaluated increasing the capacity of its pool storage on site through one of three means: consolidation, re-racking, or a new storage pool. None of these provide a more reasonable and prudent alternative than additional dry cask storage.

The Company has attempted to consolidate its pool storage to increase capacity, without success. Specifically, NSP conducted a fuel rod consolidation demonstration project at the Prairie Island Nuclear Generating Plant in 1987. The demonstration project was not successful – as the Department of Energy noted in a 2001 report to Congress, "these demonstrations encountered numerous and varied difficulties, which

were not easily resolvable."[17] The Company is not aware of any recent industry initiatives or design advances that would lead to consolidation being a viable spent fuel handling option.

The Company has also concluded that re-racking its spent fuel is not a viable option. Re-racking the existing spent fuel storage pool would consist of installing different racks to create additional space for spent fuel. This process would require a lengthy NRC approval process and, more importantly, would not create enough space to store spent fuel over the next 20 years of operation. Therefore, re-racking is not a viable alternative.

Finally, building an additional spent fuel storage pool is not a viable alternative to the project. Creating a new spent fuel pool and building would take approximately five years for approval and construction. It would lead to an approximate three-fold increase in the time fuel assembles would need to be handled because fuel would need to be removed from the transfer cask to be placed into the new pool; currently, spent fuel that is transferred to the ISFSI need not be removed from the cask once it is loaded – it can be shipped offsite in the cask. Additionally, the cost of a new pool and building would be prohibitively expensive at today's costs. More detail on storage alternatives is discussed in Chapters 4 and 9.

IV. CONCLUSION

As explained above, the Project is required to allow the Prairie Island Plant to operate through 2053/2054. The Company's analysis shows that this continued operation is in the best interest of our customers, the State, and other stakeholders.For the reasons detailed in this application, the Company's proposal here satisfies the CN requirements set forth in Minn. R. 7855.0120, and the Company respectfully requests that the Commission grant the CN requested here.

[17] *Spent Fuel Management Alternatives Available to Northern States Power Company Inc. and the Federal Government for the Prairie Island Nuclear Plant Units 1 & 2* (DOE, 2001).