

**DATE:** February 23, 2026

**TO:** Minnesota Public Utilities Commission

Katie J. Sieben	Chair
Hwikwon Ham	Commissioner
Audrey C. Partridge	Commissioner
Joseph K. Sullivan	Commissioner
John A. Tuma	Commissioner

**FROM:** Kyle Johnson, Minnesota Landowner, Farmer, Business Owner

**RE:** In Response to Joint Application for Certificate of Need (CN) for the "PowerOn Midwest 765 kV"

**DOCKET NO.** E002 CN-25-117

**SUBJECT: Insufficient Alternatives Analysis under Minn. Stat. § 216B.243**

### **Summary**

The "PowerOn Midwest" Certificate of Need application is procedurally flawed because it fails to provide a fair and complete look at modern alternatives. Under Minn. Stat. § 216B.243, the Commission is required to evaluate all viable options, yet the applicants chose to model an expensive 640 kV DC "strawman" while ignoring the industry-standard 525 kV HVDC technology. Furthermore, the utilities dismissed undergrounding by citing the impracticality of burying 765 kV AC lines—a non-standard practice—while ignoring the increasingly common and successful use of underground 525 kV DC cables. By omitting these highly efficient and less intrusive alternatives, the applicants have submitted a skewed record that overestimates costs and fails to account for benefits of the underground HVDC alternative. Consequently, the current application is incomplete and insufficient to support a Certificate of Need until a good-faith analysis of the 525 kV underground DC alternative is included.

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## **System Alternatives to 765 AC “PowerOn Midwest”**

The 765 kV AC line is a novel technology to the state of Minnesota. As this is a new technology, it is important that its introduction be treated with extra caution by the Public Utilities Commission. There are many concerns being voiced within the public who will potentially be impacted- Alternative options must be thoroughly considered at a level higher than that provided by the application.

Minn. Stat. § 216B.243, subd. 3 states “In assessing need, the commission shall evaluate: . . . (6) possible alternatives for satisfying the energy demand or transmission needs including but not limited to potential for increased efficiency and upgrading of existing energy generation and transmission facilities, load-management programs, and distributed generation”

This statute requires the commission to evaluate the possible alternatives. Because Dairyland and Xcel Energy have done a disingenuous investigation into these alternatives, I am providing a more detailed analysis for the commission to consider.

In the joint application for Certificate of Need by Dairyland and Xcel Energy, Section 7 addresses alternatives to the proposed 765 kV AC system. However, the applicant chooses scenarios that are easy to dismiss as they are not the most applicable choice for a possible

alternative. Specifically, the applicant chooses to discuss 600/640 kV DC systems when a 525 kV DC is more applicable. By modeling 600/640 kV DC instead of the industry-standard 525 kV DC, the applicants have created an analysis designed to fail, which violates the spirit of the statute to evaluate the most technically appropriate version of the alternative.

Additionally, the applicant dismisses underground installation by citing burying 765 kV AC lines (a non-practice) while ignoring the increasingly commonplace installation of underground 525 kV DC lines.

The applicant's basis of denial of these alternatives are "cost" and "viability" which will be debunked below. Additionally, the applicant does not address a host of issues that are problematic with the 765 kV choice that increase the viability of DC and Underground alternatives. Some of these environmental issues like health and well being from noise and EMF exposure, crossing of ecologically sensitive areas, ROW expansion pushback from landowners are very serious issues that boost credibility to an alternative choice. For reasons that will be discussed here below, the 765 kV AC line is not the best system and better system alternatives exist.

### **The High Voltage Direct Current Alternative**

Section 7.4.4 of Dairyland and Xcel Energy's Application for Certificate of Need for docket 25-121 briefly characterizes the direct current alternative. The applicant only addresses distance and cost of inverting to discard the DC option. However, the benefits of DC also include:

1. High efficiency of transmission (energy savings due to reduced line loss)
  - Satisfying MN statute preference for increased efficiency, and applicable for this long transmission corridor.
2. Reduced corona discharge in DC systems (HVAC systems have 3x corona discharge)
  - Lowering or eliminating inflammatory disease health concerns
3. Electromagnetic radiation concerns are negated in DC systems
4. Smaller ROW requirements
  - Often cited as a main driver for HVDC alternatives as public opposition to new transmission is increasingly strong

5. HVDC is better suited for renewable generation like solar, wind and storage as it more easily handles voltage volatility ,
  - Future and current generation along project in 25-117, and possibly 25-121 will be solar and wind
6. HVDC systems are regularly put underground in 3 foot wide by 5 foot deep trenches and with recent MN legislation, encouraged to be placed along roadways
  - Reducing public opposition and environmental concerns

The applicant gives the general understanding that HVDC systems are effective at long distances but did not consider savings with line loss and the above factors that can not only offset cost but ensure a safe and publicly acceptable method of transmission.

### **Distance**

In MISO's March 2023 paper discussing 765 kV and HVDC, the HVDC option is known to be the "best" for "long distance transmission capability."<sup>1</sup> While the Gopher to Badger Link is approximately 140 miles, this proposed 765 kV line is part of a larger network of proposed 765 kV lines. Such projects span the entire length of Minnesota (at least 260 miles) and beyond towards generation in South Dakota and endpoint of Columbia Wisconsin. This transmission length easily is a cost effective and ideal application of HVDC technology.

Xcel Energy's "PowerOn Midwest" (edocket 25-117) calls for 271 miles of new 765 kV transmission and the "Gopher to Badger Link" calls for 140 miles.

PowerOn Midwest is sectioned by applicant to be a 254 mile west-east line, including

- 92 Miles from South Dakota border to Lakefield Junction
- 130 Miles from Lakefield Junction to Pleasant Valley and
- 31 Miles from Pleasant Valley to North Rochester

Gopher to Badger Link calls for

- 34 Miles from North Rochester to "a point" near Marion MN
- 105 Miles from a point near Marion MN to the MN/WI border near Genoa

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<sup>1</sup><https://cdn.misoenergy.org/20230308%20PAC%20Item%20007%20Discussion%20of%20765%20kV%20and%20HVDC628088.pdf>

This line continues, to Bell Center WI and continuing to the Columbia Substation north of Madison Wisconsin

- 32 Miles from Genoa to Bell Center
- 90 Miles (Approximately) from Bell Center to Columbia Energy Center

Total Mileage for this West-East Transmission Corridor is 480 Miles. Proposed transmission in MISO's Tranche 2.1 in South Dakota and Iowa would further increase this mileage.

Line loss in the HVAC system is much greater than HVDC, one scenario of the above 480 mile segment would save about 180,000 MWhs, or about \$450 million over a 50 year period (with static energy prices- with increased prices, savings are much higher).

While the applicant identified the 765 kV as its best option for long distance transmission, this system is vulnerable to inductive and capacitive reactance, known as the Ferranti effect. Transmission distances over 120 miles destabilize current causing voltage surges requiring expensive compensation equipment every couple hundred miles (multiple stations at \$100+ million each).<sup>2</sup> Because DC current does not fluctuate, it does not "charge" the line's capacitance. This is why 525 kV DC can be buried for hundreds of miles with virtually no distance limit, whereas burying 765 kV AC is physically limited to relatively short distances before it "chokes" on its own charging current.

Underground HVDC transmission projects are common in Europe and increasingly common in the United States, such as the SOO Green line<sup>3</sup> and the recent PJM 525 kV project of 180 miles.<sup>4</sup> Below are some HVDC projects accomplishing large transmission at variable lengths.

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<sup>2</sup> "Ferranti Effect and Its Impact on Long-Distance High-Voltage AC Transmission Line Regulation - Technical Articles"

<sup>3</sup>[https://www.nema.org/docs/default-source/council-documents-library/documents/incentive-nopr-comment-s-july-2-2020.pdf?sfvrsn=1b4cdc8c\\_0&utm\\_source](https://www.nema.org/docs/default-source/council-documents-library/documents/incentive-nopr-comment-s-july-2-2020.pdf?sfvrsn=1b4cdc8c_0&utm_source)

<sup>4</sup><https://www.pjm.com/-/media/DotCom/committees-groups/committees/teac/2026/20260203/20260203-pjm-board-whitepaper-february-2026.pdf>

Project Name	Location	Length (Miles)	Voltage & Type
PJM Heritage / Mosby	VA	~185	525 kV DC (Underground)
SOO Green	IA to IL (CPKC Rail ROW)	~300	525 kV DC (Underground)
SunZia Transmission	NM to AZ	~550	525 kV DC (Overhead)
TransWest Express	WY to NV	~732	500 kV DC (Overhead/Hybrid)
Grain Belt Express	KS to IN	~800	600 kV DC (Overhead)
PJM / Project 2A	NJ to NY (Subsea/Land)	~80	525 kV DC (Underground/Subsea)
CU Line	ND to MN (Coal Creek)	~436	500 kV DC (Overhead/Hybrid)
SuedLink	Germany (Wilster to Bergtheinfeld)	~435	525 kV DC (Underground)
<a href="#">SuedOstLink</a>	Germany (Wolmirstedt to Isar)	~337	525 kV DC (Underground)
A-Nord	Germany (Emden to Osterath)	~186	525 kV DC (Underground)
SunZia	USA (NM to AZ)	~550	525 kV DC (Overhead/Hybrid)
NeuConnect	UK to Germany	~450	525 kV DC (Subsea/Underground)
Hansa PowerBridge	Germany to Sweden	~186	525 kV DC (Subsea/Underground)
NordLink	Norway to Germany	~387	525 kV DC (Subsea/Underground)

## Substation / Converter Stations

The applicant continues to state that the converter station costs make the DC option less reasonable, citing costs of \$750-\$900 million per converter station based on 600kV or 640kV lines. The 600/640kV DC line has higher capacity(3000+ MW) than the 765 kV AC (2,300MW) proposed line therefore is an unreasonable choice for cost comparison.

The 765 kV AC line is known for transmitting about 2,200-2,400 MW of power, where a 525 kV HVDC cable pair can transmit 2,000-2,600MW depending on manufacturer. Prysmian 525 kV Cables have power capacity up to 2,500 MW and NKT 525 kV Cables are rated up to 2,600 MW.<sup>5</sup> The 525 kV HVDC is the comparable alternative to the 765 kV AC, and exceeds in transmission qualities.

DC converter cost is generally known to be declining in recent years and a 525 kV DC line will not cost as much as the applicant's overstated 600/640kV. Based on figures in other HVDC projects, conversion costs "have fallen from \$300 million per GW per converter down to a conservatively estimated \$200 million per GW per converter."<sup>6</sup> Inverter costs are likely half of the applicant's estimation.

<sup>5</sup><https://na.prysmian.com/resources/press-releases/prysmian-group-awarded-900-m-soo-green-hvdc-link-project-a-key-milestone-in-building-a-us-clean-energy-grid>

<sup>6</sup> [https://nextgenhighways.org/wp-content/uploads/2023/01/NGH\\_Buried-HVDC-Cost-Competitive.pdf](https://nextgenhighways.org/wp-content/uploads/2023/01/NGH_Buried-HVDC-Cost-Competitive.pdf)

Additionally, in “Gopher to Badger Link” application, the applicant stated “Such converter stations would add significantly to the cost of the Project as the Project has three 765 kV delivery points (i.e., substations) in Minnesota and three additional delivery points outside of Minnesota.”

The application for docket 25-121 appears to be incomplete as the locations of these substations are not within the application, and yet the applicant implies these locations are “detailed in Section 1.2.1” and “the Studied Project is made up of a series of individual facilities, each providing delivery points between generation and demand.” Section 1.2.1 mentions the existence of the North Rochester Substation but does not make it clear whether the 765 kV line will be stepped up or down at this substation. The application then states that “upgrades at existing 161 kV substations within Segment 2 are expected to support operation and coordination between the new 765 kV facilities and the existing 161 kV network” and attempts to clarify this statement in section 2.4. Section 2.4 Mentions construction of a new substation in Houston County Minnesota at an unidentified location. However there is no mention of 765 kV substation capabilities.

The cloudy presentation of 765kv transformer substation plan in the Gopher to Badger Link CoN application underscores the incomplete scope and demonstrates how “The Project” is segmented into different applications to discredit the long haul transmission nature of the full project.

In “Power On Midwest” application in docket 25-117, more explanation is given, summarized in the below table.

<b>Table 2.4-1 Project Cost Estimate by Project Component</b>		
<b>Project Component</b>	<b>Base (\$2024)</b>	<b>High-Range (Base Plus Contingency) (\$2024)</b>
<b>765 KV TRANSMISSION LINES</b>		
MN/SD State Line to Lakefield Junction	\$582 million	\$756 million
Lakefield Junction to MN/IA State Line	\$115 million	\$150 million
Lakefield Junction to Pleasant Valley	\$813 million	\$1.056 billion
Pleasant Valley to North Rochester	\$196 million	\$255 million
<b>345 KV TRANSMISSION LINES</b>		
Pleasant Valley to North Rochester	\$160 million	\$207 million
North Rochester to Hampton	\$74 million	\$96 million
<b>SUBSTATIONS</b>		
Lakefield Junction Substation	\$434 million	\$564 million
Pleasant Valley Substation	\$393 million	\$512 million
North Rochester Substation	\$553 million	\$718 million
Hampton Substation	\$7 million	\$9 million
<b>PROJECT TOTAL</b>	<b>\$3.327 billion</b>	<b>\$4.323 billion</b>

Substations with 765 kV capability are projected to cost about \$500 Million each. The applicant argued against the HVDC option by referencing the three substations, citing that converter costs would be prohibitive.

Cost of DC Converters are roughly \$200 Million per GW, and would therefore be similar in cost to the above 765 kV substances if not less.<sup>7</sup>

To be clear, HVDC transmission is not just for “point to point” application. Voltage Source Converter (VSC) technology—the modern standard for HVDC—now allows for the "multi-terminal" configurations (multiple taps/substations). VSC technology acts as a grid stabilizer, controlling “active power” and “reactive power” independently and can help “black start” the surrounding AC grid.<sup>8</sup> This further solidifies the HVDC option as superior to applicants proposed 765kv AC.

<sup>7</sup> [https://nextgenhighways.org/wp-content/uploads/2023/01/NGH\\_Buried-HVDC-Cost-Competitive.pdf](https://nextgenhighways.org/wp-content/uploads/2023/01/NGH_Buried-HVDC-Cost-Competitive.pdf)

<sup>8</sup> <http://www.diva-portal.org/smash/get/diva2:1213301/FULLTEXT01.pdf#:~:text=HVDC%20technology%20is%20superior%20to%20the%20more.century%20but%20only%20in%20point%2Dto%2Dpoint%20connections%20%5B3%5D.>

## **Direct Benefits of Reduced Line Losses: Ratepayer Savings and Carbon Reduction**

The technical superiority of 525 kV HVDC—specifically its 30–40% reduction in line losses compared to 765 kV AC—is not merely a technical detail; it translates into direct economic and environmental benefits for the State of Minnesota.<sup>9</sup>

**Direct Ratepayer Savings:** Energy lost as heat during transmission (line losses) is energy that ratepayers must pay for but never receive. For a high-capacity link like "PowerOnMidwest" and "Gopher to Badger" a 3% reduction in losses across the project's 50+-year lifespan represents hundreds of thousands of megawatt-hours (MWh) of "found" energy. By failing to model the most efficient 525 kV DC alternative, the applicants are essentially proposing a "hidden and non-rewarding tax" on Minnesota consumers in the form of avoidable energy waste. Under Minn. Stat. § 216B.243, the Commission must prioritize the "potential for increased efficiency." By choosing the less efficient 765 kV AC, the applicants are essentially forcing Minnesota ratepayers to pay for the fuel and infrastructure of power that literally vanishes into the air as heat.

**Carbon Emission Mitigation:** In 2026, as Minnesota aggressively pursues a carbon-free grid, every megawatt-hour lost to inefficient transmission must be replaced by additional generation. If the 765 kV AC line is 30% less efficient than a 525 kV DC alternative, the utility must generate significantly more power to deliver the same amount to the end-user. Utilizing the 525 kV DC alternative would allow Minnesota to meet its energy needs with less total generation, directly supporting the state's decarbonization goals and reducing the overall carbon footprint of the transmission project. The 525 kV DC increased efficiency option is more consistent with Minnesota 216B.243(6).

**Avoided Generation Costs:** By maximizing transmission efficiency, the 525 kV DC alternative can defer or eliminate the need for new "peaker" plants or additional generation capacity that would otherwise be required to compensate for the higher losses inherent in 765 kV AC systems.

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<sup>9</sup><https://cleanenergygrid.org/wp-content/uploads/2014/08/High-Voltage-Direct-Current-Transmission.pdf#:~:text=Beyond%20the%20lack%20of%20skin%20effect%2C%20HVDC,HVDC%20cable%20are%20smaller%20than%20HVAC%20cables.>

## **DC technology is Superior, Safer and Not Significantly More Expensive.**

In the applications certificate of need application, table 1.5-1 gives a summary of the evaluation of alternatives. The applicant summarizes the High Voltage Direct Current alternative as rejected due to “Cost: Less cost-effective than studied Projects.” I believe I have demonstrated this to be untrue due to the applications:

1. Oversizing of DC alternative to 600/640kV DC
2. Lack of consideration and quantification of environmental costs
3. Overestimation of DC/AC converter technology
4. Costs of 765 kV transformer facilities are not considered by applicant when compared to DC converters
5. Savings by DC efficiency and significant line loss in AC option
6. Costs of land acquisition and right of way expansion
7. Vulnerability of aboveground 765 kV to weather and external damage
8. Decreased resiliency of grid by consolidating a large percent of GW transmission into one line rather than a distributed grid

The DC Alternative is a viable method of transmission and superior in many ways. The HVDC alternative is especially superior when placed underground.

## **Underground**

The table 1.6-1 on page 17 of the Power On Midwest CoN Application rejects the underground alternative for “Viability: underground 765 kV technology presently not available.” While this is technically accurate, it is contextually misleading.

The applicant does not fully consider the underground option by limiting their scope of investigation to only AC underground transmission. The 765 kV AC transmission capacity is most closely congruent with the 525 kV DC which is a viable and increasingly common method abroad in Europe, and even being utilized within MISO’s service area. The SOO Green HVDC line is a 300 mile 525 kV DC Line moving 2-3,000 MW of power from wind generation in Iowa to

an endpoint in Illinois. This line, beginning construction in 2026 will be sited along railway ROWs.

525 kV HVDC underground transmission is accomplished through a double cable of XLPE cable, allowing for efficiency transmission at costs comparable to aboveground 765 kV ac. The applicant uses a somewhat irrelevant case study to show underground transmission to be cost prohibitive, citing a 500 kV AC line buried for 3.5 miles for an estimated cost of \$70 million per mile.

Current research has shown that for a 525 kV HVDC system, “Installed cable costs have fallen from over \$3 million per GW-mile to \$1-2 million per GW-mile.”<sup>10</sup> A 2 GW capacity cable system could cost roughly \$3 million per mile installed. The applicant claims the proposed Gopher to Badger link will cost over \$6 million per mile for aboveground 765 kV AC transmission. Underground 525 kV DC has costs that are in fact reasonable, and perhaps more prudent than that applicant’s proposed above ground 765 kV AC.

### **Siting Underground HVDC**

With recent NextGen Highways legislation, MnDOT is now mandated to allow the co-location of high-voltage transmission lines within controlled-access highway rights-of-way. This policy alignment specifically favors underground 525 kV DC configurations, as they can be buried within the narrow margins of existing roadways with significantly less surface disruption than the massive footprint required for overhead 765 kV AC towers. This modern regulatory framework creates a clear path for burying high-capacity lines along roadways, directly challenging the applicants' claims that such alternatives are not "viable" or standard practice.

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<sup>10</sup><https://nextgenhighways.org/wp-content/uploads/2023/01/NextGen-Highways-Feasibility-Study-Minnesota-DOT.pdf>

## Problems Solved by Underground HVDC Option

The applicant's proposed 765 kV AC system will necessitate 150-199 foot towers causing significant impact to the landscape. The Driftless area of SE Minnesota is the most biodiverse region in the state. Additionally, farms are generally small, owner operated and lived on. For these reasons, a 765 kV AC above ground transmission line will have more impact in this region than if it were routed through other rural areas where biodiversity is less, farms are large and generally rented and operated through corporate entities and people do not live near or under these ROWs.

A major point of contention with the proposed Gopher to Badger Link is the crossing of the Upper Mississippi River National Wildlife Refuge. An underground 525 kV HVDC option would eliminate concerns for this crossing and through the sensitive Driftless area.

Feature	765 kV AC (Above Ground)	525 kV HVDC (Underground)
<b>Bird Collision Risk</b>	High; involves multiple wire levels and shield wires	Zero; all infrastructure is below grade
<b>Noise Impact</b>	Audible corona hum/crackling	Silent
<b>ROW Width</b>	Massive (250 feet)	Compact (approx. 20% of AC width) Does not require expansion
<b>Weather Resilience</b>	Vulnerable to wind, ice, and storms	Highly Resilient
<b>EMF Exposure</b>	Large, fluctuating electromagnetic fields extending well beyond the ROW.	Static magnetic fields (like the Earth's) contained by shielding and burial depth.
<b>Visual Blight</b>	Towers will exceed 150-199 feet, impacting property values and landscapes.	Invisible

## **Conclusion**

The applicants' failure to include a 525 kV HVDC configuration in their alternatives analysis constitutes a significant procedural deficiency that undermines the Commission's ability to fulfill its mandate under Minn. Stat. § 216B.243. By modeling an outlier 600/640 kV DC system—an impractical and unnecessarily expensive "strawman"—while ignoring the industry-standard 525 kV DC technology, the applicants have provided a skewed and incomplete record. This arbitrary selection prevents a "prudent and reasonable" comparison of project costs, efficiencies, and environmental impacts. Without an accurate assessment of 525 kV DC, which is the most technically viable alternative for high-capacity long-haul transmission, the applicants have failed to meet their burden of proof to demonstrate that the novel 765 kV AC technology is the superior choice for the state of Minnesota.

Furthermore, this omission results in a fundamental "failure of completeness" within the evidentiary record. The application's dismissal of undergrounding relies on the technical difficulties of burying 765 kV AC lines—a non-standard practice—while conspicuously ignoring the increasingly common and successful deployment of underground 525 kV DC lines. By omitting a feasible alternative that mitigates the specific health and environmental externalities of 765 kV AC, such as audible noise and EMF exposure, the applicants have hindered the Commission's mandatory duty to evaluate the "potential for increased efficiency" and environmental protection.

Consequently, the current application is procedurally insufficient to support a Certificate of Need. I respectfully request that the Commission stay these proceedings and compel the applicants to submit a supplemental, good-faith technical, economic and social / environmental analysis of an underground 525 kV HVDC alternative—specifically evaluating its co-location along existing transportation corridors—before any final determination is made.