

Direct Testimony and Schedules of
Kavita Maini

Before the
Minnesota Public Utilities Commission

In the Matter of Minnesota Power's Certificate of
Need and Route Permit Application for the HVDC Modernization Project

DOCKETS: E015/TL-22-611
E015/CN-22-607

February 14, 2024

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1 **I. Introduction**

2 **Q. Please state your name and occupation.**

3 A. My name is Kavita Maini. I am the principal and sole owner of KM Energy Consulting,
4 LLC.

5 **Q. Please state your business address.**

6 A. My office is located at 961 North Lost Woods Road, Oconomowoc, WI 53066.

7 **Q. On whose behalf are you testifying in this proceeding?**

8 A. I am testifying on behalf of Large Power Intervenors (“LPI”). LPI members are large
9 consumers of electricity on the Minnesota Power (“MP” or “Company”) system that take
10 service on one or more of its Large Light and Power and Large Power tariffs.¹

11 **Q. Please state your educational and professional background.**

12 A. My educational background includes a Master’s degree in Business Administration
13 (“MBA”) and a Master’s degree in Applied Economics. Prior to becoming an independent
14 consultant in 2002, I worked as a research analyst at Wisconsin Power and Light, Alliant
15 Energy’s regulated subsidiary, and conducted process and impact evaluations of the energy
16 efficiency programs, forward price curve, and asset valuation analyses. I also worked as a
17 Senior Economist at Alliant Energy Integrated Services’ Energy Consulting Division. In
18 this role, I was responsible for providing energy consulting services to commercial and
19 industrial customers in the area of electric and natural gas procurement, contract

¹ LPI is an ad hoc consortium of Large Power and Large Light and Power customers of Minnesota Power consisting for purposes of this filing of Blandin Paper Company; Boise White Paper, L.L.C., a Packaging Corporation of America company, formerly known as Boise, Inc.; Cleveland-Cliffs Minorca Mine Inc.; Enbridge Energy Limited Partnership; Gerdau Ameristeel US Inc.; Hibbing Taconite Company; Northern Foundry, LLC; Sappi Cloquet, LLC; USG Interiors, Inc.; United States Steel Corporation (Keetac and Minntac Mines); and United Taconite, LLC.

1 negotiations, forward price curve analysis, rate design, and on-site generation feasibility
2 analysis. I was also involved in strategic planning and due diligence on acquisitions.

3 Since 2002, I have been an independent consultant. In this role, I have provided
4 consulting services in the areas of class cost of service studies, rate design, resource
5 planning and revenue requirement related issues, Midcontinent Independent System
6 Operator (“MISO”) related matters, and various policy matters. I have testified before a
7 number of state regulatory commissions, including Minnesota.

8 I have represented industrial trade associations at MISO since 2006. I am currently
9 the Eligible End Use Sector representative at MISO’s Advisory and Planning Advisory
10 Committees respectively and regularly participate in transmission planning related
11 workshops and committee calls.

12 **Q. What is the purpose of your direct testimony?**

13 A. The purpose of my direct testimony is to help develop the record regarding the size, type
14 and timing issues associated with Minnesota Power’s proposed High-Voltage Direct-
15 Current (“HVDC”) Modernization Project that the Commission should consider in making
16 its determination. First, I outline the procedural posture of this proceeding and the history
17 and current functioning of the HVDC System. Second, I explain that, at great cost, this
18 proposed Project will only modernize the HVDC Converter Stations, and not the HVDC
19 Line itself and the System will require additional investments to upgrade its overall
20 capacity. Third, Minnesota Power envisions upgrading the capacity of this HVDC System
21 to as much as 3000 MW, even though it has not demonstrated any incremental need for
22 this System or explained the timing or costs of those additional upgrades. Fourth, it appears
23 the Company is expecting that this HVDC System will benefit the entire region, and not

just Minnesota Power's customers, and to the extent the Project is being constructed for future needs and to benefit other regions, the Company and other regions should bear a portion of the Project costs. Finally, I request Minnesota Power provide cost sharing proposals and Project alternatives if this HVDC Line or the HVDC technologies are not included in MISO's LRTP Tranche 2.

II. Minnesota Power's HVDC Modernization Project

Q. Please briefly describe the HVDC Modernization Project

A. Minnesota Power seeks approval to modernize its 465-mile Square Butte HVDC 550 MW transmission system. In the combined application for a Certificate of Need and Route Permit ("Application") submitted on June 1, 2023, Minnesota Power proposes to upgrade both HVDC terminals for the Square Butte HVDC System and interconnect the upgraded HVDC terminals to the existing alternating current transmission system. These HVDC terminals are currently located near the Arrowhead Substation in Hermantown, Minnesota and the Center Substation in Center, North Dakota.

The Company states that to modernize the HVDC terminals and implement the latest technology, new buildings and electrical infrastructure need to be constructed on a new site near the existing HVDC terminals. In this regard, the CON application states the following:

- In Minnesota, to connect the new HVDC terminal to the existing AC system, the Project would require the construction of a new St. Louis County 345 kV/230 kV substation located less than one mile west of the current Arrowhead Substation. The new HVDC terminal would be connected to the St. Louis County Substation by less than one mile of 345 kV LHVTL and the new St. Louis County Substation would be connected to the existing Arrowhead Substation by two parallel 230 kV LHVTLs less than one mile in length. Additionally, a short portion of the existing ± 250 kV HVDC Line in Minnesota will need to be reconfigured to terminate at the new HVDC terminal.

- 1
- 2 ▪ In North Dakota, the Project will consist of an expansion of the separately proposed
- 3 Nelson Lake 230 kV Substation to add a 345 kV/230 kV transformer and 345 kV line
- 4 entrance, a new HVDC Converter Station, a new 345 kV line from the Converter
- 5 Station to the Nelson Lake Substation, and a ± 250 kV HVDC Line Extension from the
- 6 new Converter Station to tie into the existing ± 250 kV HVDC Line.²
- 7

8 The Project, referred to as the HVDC Modernization Project is currently scheduled

9 to be placed in service between 2028 and 2030.³

10 **Q. What does Minnesota Power indicate about the need for the Project?**

11 A. Minnesota Power indicates that the HVDC Modernization Project is needed to modernize

12 the aging assets that have operated beyond their design life. In addition to the replacement

13 of the existing HVDC terminal, the new HVDC technology would be designed to provide

14 key reliability attributes including voltage regulation, frequency response and blackstart

15 capability. The Company indicates that the Voltage Source Converter (“VSC”) HVDC

16 technology implemented for the Project will be designed to provide bidirectional power

17 transfer and other capabilities, and bidirectional power transfer capability.⁴ Minnesota

18 Power has also incorporated options for future expansion to enable staged development of

19 additional HVDC capacity to meet future regional needs.⁵

20

21 **III. Commission Proceedings and Current Function of the HVDC Line**

22 **A. Procedural Posture**

23 **Q. Please describe the current procedural posture of this matter.**

² *In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/CN-22-607; In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/TL-22-611, [Application](#) p. 8 (June 1, 2023) (hereinafter “Application”).*

³ [Application](#) p. 4.

⁴ [Application](#) p. 20.

⁵ [Application](#) p. 32.

1 A. The Company filed its Certificate of Need and Route Permit Application on June 1, 2023.
2 The matter came before the Commission on July 27, 2023, and the Commission accepted
3 the applications as complete and referred the matter to the Office of Administrative
4 Hearings for record development and a summary report.⁶ The Commission also expressly
5 agreed with the suggestions of LPI and found that “certain issues relating to project size,
6 type and timing referenced in LPI’s initial comments are relevant to the analysis of the
7 need for the HVDC Modernization Project,” and therefore the Commission required ”
8 record development on such topics.”⁷

9 Shortly thereafter, on August 9, 2023, American Transmission Company LLC, filed
10 to intervene and proposed Minnesota Power interconnect at its Arrowhead Substation
11 instead of a new substation in Saint Louis County.⁸ The matter once again went before the
12 Commission on November 9, 2023. Because of the “limited record concerning the
13 workability of ATC’s proposal,” the Commission discontinued the informal Certificate of

⁶ *In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/CN-22-607; *In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/TL-22-611, [Order Accepting Application as Complete, Authorizing Joint Review Under Informal Procedure, and Requesting Summary Proceeding](#) p. 7 (August 8, 2023). Specifically, the Commission requested:

that the Office of Administrative Hearings assign an ALJ to preside over the summary proceeding process described above and will request that the ALJ (1) establish the types of filings necessary to facilitate proper record development; (2) develop a schedule for those filings through a prehearing conference; and (3) prepare a full report setting forth findings, conclusions, and recommendations on the merits of the proposed project, applying the routing criteria set forth in statute and rule, as well as any comments and recommendations on the conditions and provisions of a route permit.

⁷ *In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/CN-22-607; *In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/TL-22-611, [Order Accepting Application as Complete, Authorizing Joint Review Under Informal Procedure, and Requesting Summary Proceeding](#) p. 9 (August 8, 2023).

⁸ *In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/CN-22-607; *In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/TL-22-611, [ATC Petition to Intervene](#) (August 9, 2023).

1 Need process and ALJ summary proceedings and referred this matter to the Office of
2 Administrative Hearings for contested case proceedings.⁹ In referring the matter, the
3 Commission requested the ALJ focus record development on the viability of ATC's
4 alternative, and Minnesota Power's concerns therewith and also noted that it "expects that
5 in the course of this case the parties will develop a full record addressing the issues that are
6 relevant to the Commission's certificate of need and permit decisions."¹⁰ The Commission
7 noted it would "address whether the project is ultimately necessary and whether to establish
8 conditions on the project's construction and operation in future proceedings."¹¹

9 **Q. Is this Project related to Minnesota Power's 2021 Integrated Resource Plan?**

10 A. Potentially, yes. In the 2021 Integrated Resource Plan the Commission ordered Minnesota
11 Power to procure 400 MW of new wind.¹² On December 15, 2023, Minnesota Power filed
12 its Request for Proposal package to procure up to 400 MW of wind. As shown in attached
13 Schedule 1 attached to this testimony, the Company anticipates receiving several bids for
14 wind projects located around Center, North Dakota, near the western HVDC terminal.¹³
15

⁹ In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/CN-22-607; In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/TL-22-611, [Order Identifying Alternative Proposal for Environmental Assessment Scope, Granting Variance, and Notice of and Order for Hearing](#) p. 5 (November 29, 2023).

¹⁰ In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/CN-22-607; In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/TL-22-611, [Order Identifying Alternative Proposal for Environmental Assessment Scope, Granting Variance, and Notice of and Order for Hearing](#) p. 6 (November 29, 2023).

¹¹ In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/CN-22-607; In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County, Docket No. E-015/TL-22-611, [Order Identifying Alternative Proposal for Environmental Assessment Scope, Granting Variance, and Notice of and Order for Hearing](#) p. 4, n. 4 (November 29, 2023).

¹² In the Matter of Minnesota Power's 2021- 2035 Integrated Resource Plan, Docket No. E015/RP-21-33, [Order Approving Plan and Setting Additional Requirements](#), p. 13 (January 9, 2023).

¹³ Schedule 1, attached, Minnesota Power Response to LPI Information Request 33.

1 **B. History of the HVDC Line**

2 **Q. What is the regulatory history of this line with the Minnesota Commission?**

3 A. The Square Butte HVDC Line and its Converter Stations at the Center and Arrowhead
4 substations were released for commercial operation in 1977.¹⁴ The original purpose of the
5 HVDC Line was to bring electricity from the coal-fired Milton R. Young 2 generating
6 station in Center, North Dakota, directly to Minnesota Power's customers.¹⁵ The
7 Commission approved Minnesota Power's purchase of this line in 2009 after a contested
8 case hearing, and in 2010, the Company repurposed the line to facilitate the delivery of
9 wind power generated in North Dakota to Minnesota Power's territory.¹⁶

10 **C. Current Operation of the HVDC Line**

11 **Q. Does MISO currently operate the HVDC Line?**

12 A. No, but MISO does administer the "tariff operation" of the Line. As part of the compliance
13 filings in the 2009 Commission proceedings approving the Company's purchase of the
14 HVDC Line, Minnesota Power stated that after its acquisition, Minnesota Power
15 transferred the tariff operation of the line to MISO.¹⁷

16 **Q. How does the HVDC Line currently function?**

17 A. As described in Schedule 2, Minnesota Power currently holds all capacity rights on the
18 HVDC Line, and the Line is under its full functional control. The Company has held the
19 full capacity of the line since it acquired full ownership of the HVDC Line. Minnesota

¹⁴ [Application](#) p. 20.

¹⁵ [Application](#) p. 21.

¹⁶ In the Matter of Minnesota Power's Petition to Purchase Square Butte Cooperative's Transmission Assets and for Restructuring Power Purchase Agreements from Milton R. Young Unit Generating Station, Docket No. E-015/PA-09-526, [Order Granting Petition with Conditions](#) (Dec. 21, 2009).

¹⁷ *In the Matter of Minnesota Power's Petition to Purchase Square Butte Cooperative's Transmission Assets and for Restructuring Power Purchase Agreements from Milton R. Young Unit 2 Generating Station*, Docket No. E015/PA-09-526, [Compliance Filing](#) p. 5 (November 5, 2014).

1 Power coordinates with MISO on control of the HVDC Line under an Agency Agreement.
2 Under the terms of this Agency Agreement, MISO performs, as agent for Minnesota
3 Power, certain core transmission provider responsibilities without requiring Minnesota
4 Power to commit those facilities to MISO's full functional control.¹⁸ At present, the HVDC
5 Line capacity is 550 MW. The Company has issued three Transmission Service Requests
6 at MISO for an incremental capacity of 350 MW. The cost of the upgrades needed to
7 increase the HVDC Line capacity by an additional 350 MW would therefore be assigned
8 to Minnesota Power as per the provisions of the MISO tariff.

9
10 **IV. Customer Rate Impacts of HVDC Project**

11 **Q. What are the costs associated with the Company's proposal?**

12 A. If implemented, the HVDC Modernization Project could potentially add close to one billion
13 dollars to Minnesota Power's rate base. It appears that, as a result of the identified planned
14 investments including the HVDC Modernization Project, Minnesota Power's rate base
15 could triple over a twenty-year period from roughly \$1 billion in 2010 to approximately \$3
16 billion in 2030, all while the peak demand on its system drops from roughly 1,800 MW to
17 1,600 MW or less.¹⁹ Therefore, the rate impacts, below, while highly substantial, do not

¹⁸ Schedule 2, attached, Minnesota Power Response to LPI Information Request 20.

¹⁹ With respect to rate base, see *In the Matter of the Application by Minnesota Power for Authority to Increase Rates for Electric Service in Minnesota*, Docket No. E-015/GR-21-335, Evidentiary Hearing Transcript Vol. 1 at 37:17-38:20; cf. *In the Matter of the Application by Minnesota Power for Authority to Increase Rates for Electric Service in Minnesota*, Docket No. E015/GR-09-1151, [Compliance Filing at Sched. 1](#), p. 1 (Mar. 7, 2011), to *In the Matter of the Application by Minnesota Power for Authority to Increase Rates for Electric Service in Minnesota*, Docket No. E-015/GR-21-335, Ex. MP-4 at [Direct Schedule B-1](#), p. 1 (Nov. 1, 2021 (showing a total rate base of \$1,043,371,807 in 2011 and proposing a total rate base of \$2,113,031,861 in the 2021 rate case proceeding). With respect to peak demand, see *In the Matter of the Application by Minnesota Power for Authority to Increase Rates for Electric Service in Minnesota*, Docket No. E-015/GR-21-335, [Initial Filing Vol. IV](#) (Nov. 2, 2009) and [Application](#) p. 2 ("Minnesota Power operates a 1,600 megawatt ("MW") peak demand system.")

1 fully reflect all of the rate increases that Minnesota Power ratepayers will be expected to
2 bear in the future.

3 **Q. What are the estimated impacts of the proposed HVDC Modernization Project on a**
4 **system-wide basis?**

5 A. The first year revenue requirements provided by Minnesota Power in the CON
6 application range from \$86.4 million to \$101.86 million respectively – on a system wide
7 basis, this range represents a substantive increase of 11.6% to 13.7% respectively, when
8 compared to present rate revenues.²⁰ To provide context, the Company’s 2024 proposed
9 base rate case increase (excluding roll-in of riders) is \$89.1 million (or 12.1%).²¹

10 **Q. What is the estimated impact on LPI’s members?**

11 A. The estimated rate increase for the HVDC Modernization Project to LPI’s members ranges
12 from 9.82% to 14.01%.²²

13 **Q. Why is LPI concerned about this Project?**

14 A. Again, LPI’s members are in Minnesota Power’s large power and large light & power
15 classes. According to Minnesota Power’s estimates, these two classes are estimated to see
16 the most significant rate increases associated with the Project. LPI is therefore concerned
17 about the rate impacts of this Project, and potential rate impacts of future upgrades of the
18 HVDC Line and other infrastructure projects the Company has planned. I am advised that
19 many of LPI’s member companies consist of manufacturers that operate energy intensive
20 facilities and compete in a regional, national and international environment. Energy costs
21 are typically among the primary costs of doing business and large increases can directly

²⁰ [Application](#) p. 15, Table 2.2.3-1 (emphasis added).

²¹ In the Matter of the Application of Minnesota Power for Authority to Increase Rates for Electric Utility Service in Minnesota, Docket No. E015/GR-23-155, [Direct Testimony of Jennifer Cady](#), p. 2 (November 1, 2023).

²² [Application](#) p. 15.

1 impact the bottom line of industrial customers because in many cases, these costs cannot
2 be passed to downstream customers due to highly competitive business conditions. The
3 resulting double-digit increases associated with the HVDC Modernization project would,
4 therefore, have the potential to significantly impact the competitiveness of LPI's member
5 companies in the future. Such concerns are further heightened by the fact that C&I rates
6 in Minnesota, including those on Minnesota Power's system, are increasingly
7 uncompetitive regionally and nationally.²³

8 Moreover, it is clear Minnesota Power intends to implement additional upgrades to
9 this HVDC Line if the Commission approves this first stage of modernization of the
10 Converter Stations. In addition, Minnesota Power is requesting Commission approval for
11 a number of other transmission projects whose rate impacts are not included in the cost
12 projections above.²⁴ Consequently, LPI's members are highly concerned about the
13 Company's proposal and have a keen interest in the outcome of this proceeding.

14
15 **V. Proposed Capacity Upgrades and Future Expansion**

16 **Q. How many MWs of capacity are deliverable through the existing HVDC line and**
17 **converter station?**

²³ See *In the Matter of the Application of Minnesota Power for a Certificate of Need for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/CN-22-607; *In the Matter of the Application of Minnesota Power for a Route Permit for a High Voltage Transmission Line for the HVDC Modernization Project in Hermantown, Saint Louis County*, Docket No. E-015/TL-22-611, [LPI Initial Comments](#) (June 20, 2023) and [LPI Supplemental Comments](#) (June 30, 2023).

²⁴ See, e.g., *In the Matter of the Application for a Certificate of Need for the Big Stone South-Alexandria-Big Oaks Transmission Project*; *In the Matter of the Application for a Route Permit for the Alexandria to Big Oaks 345-kV Transmission Project in Central Minnesota*, Docket Nos. E002, E017, ET2, E015, ET10/TL-23-159; and *In the Matter of the Application of Minnesota Power and Great River Energy for a Certificate of Need and Route Permit for the Northland Reliability Project 345 kV Transmission Line*, Docket Nos. E015,ET2/CN-22-416 and E015,ET2/TL-22-415.

1 A. At present, Minnesota Power utilizes the HVDC Line to deliver up to 550 MW of power
2 from North Dakota to its load in Northeast Minnesota.

3 **Q. What is the Company's proposal regarding the HVDC converter terminals?**

4 A. As shown in Schedule 3, the Company proposes to increase the capability of the new
5 HVDC converter terminals to transfer up to 1500 MW from the current 550 MW. The
6 Company also indicates that the layout of the HVDC converter stations will be designed
7 such that it will be straightforward to add another converter to operate a second 1500 MW
8 HVDC pole, similar to the way the current bipole system operates, creating the potential to
9 increase the total capacity up to 3000 MW.²⁵

10 **Q. Has the Company identified the need for any potential upgrades at the present time**
11 **with regards to increasing the capacity on the HVDC line itself?**

12 A. Yes. As noted earlier, Minnesota Power has submitted three transmission service requests
13 to MISO with a total incremental capacity of 350 MW on the HVDC line.²⁶ Given that
14 the current capacity of the HVDC line is 550 MW, upgrades would be needed to increase
15 the capacity to 900 MW. While the Application discusses the type of equipment,
16 infrastructure and new buildings needed for replacing the converter stations, as shown in
17 Schedule 4, the upgrade to the HVDC Line to increase the capacity to the 900 MW is not
18 included and would be addressed in a separate proceeding.²⁷

19 **Q. What has the Company said regarding the future expansion of this HVDC system?**

20 A. The Company states that the Square Butte HVDC system has a significant role to play in
21 the ongoing clean energy transition and decarbonization of our region's energy resources.

²⁵ Schedule 3, attached, Minnesota Power Response to LPI Information Request 3

²⁶ As noted in response to Schedule 2 (LPI-20), the specific TSRs are 95418167 (100 MW), 90481026 (100 MW), and 91365462 (150 MW) for a total of 350 MW respectively.

²⁷ Schedule 4, attached, Minnesota Power Response to LPI Information Request 4.

1 As such, the HVDC Modernization Project is designed to accommodate future expansion
2 of the HVDC system and the interconnected AC transmission system, to support the future
3 regional transmission development that is necessary.²⁸

4 **Q. Please summarize the upgrades Minnesota Power is considering for this segment of**
5 **its transmission system.**

6 A. As shown in Schedule 5, the Company has stated that the Project will be developed to meet
7 its near-term needs, with options to incorporate future expandability to be explored as the
8 Project is designed.²⁹ Minnesota Power has outlined quite a few steps for its overall plans
9 for this system and said that overall, the expandability of the system is designed to meet
10 present maximum capacity of 900 MW with staged or modular expansion to meet future
11 regional needs of 3000 MW.³⁰ The table below sets out the upgrades Minnesota Power
12 envisions for this part of its system.

²⁸ [Application](#) p. 32.

²⁹ Schedule 5, Minnesota Power Response to LPI Information Request 5, Attachment 5.02 p. 9.

³⁰ Schedule 5, Minnesota Power Response to LPI Information Request 5 Attachment 5.01 p. 4.

Table 1: Contemplated Expansion of the Square Butte HVDC System

Proposed Upgrade	Capacity Upgrade	Part of this Proceeding	Cost
Replacement of HVDC Converter Terminals	From 550 MW to 1500 MW	Yes	\$600 - \$940 Million
Additional HVDC Converters and Second HVDC Pole	From 1500 MW to 3000 MW	No	TBA
HVDC “Targeted Transmission Line Upgrades”	From 550 MW to 900 MW; 350 MW TSRs issued by Minnesota Power	No	TBA
HVDC Transmission Line Upgrades	900 MW to 1500 or 3000 MW	No	TBA
Total Cost of Planned Upgrades for Square Butte HVDC System			Unknown

Q. If the Company has identified that it may be seeking an upgrade of 350 MW of incremental capacity on this line, why is it proposing to upgrade the system to 1500 or 3000 MW?

A. Though the costs to upgrade the system to 3000 MW has not been quantified by Minnesota Power, it is clear that the Company is expanding the converter capability by such a significant incremental amount to accommodate needs beyond the requirements for Minnesota Power’s ratepayers.

Presumably, the Company anticipates and expects that MISO would recognize the regional benefits associated with upgrading the HVDC line and accordingly incorporate it

1 in the Tranche 2 portfolio of projects as part of MISO's Long Range Transmission Plan
2 ("LRTP") effort. In June 2022, the Company indicated to MISO that it needed to make
3 several near-term decisions for the expandability of the Project scope, including choice of
4 VSC or LCC technology, monopole or bipole, and AC interconnection voltage.³¹ This
5 demonstrates to me that the Company recognized the importance of coordinating with
6 MISO's LRTP planning as it evaluated the Project scope in order to lay the groundwork
7 for future regional expansion.³²

8
9 **VI. Interplay with MISO LRTP 2**

10 **Q. What is MISO's LRTP initiative?**

11 A. MISO's LRTP initiative is meant to identify multi-state regional transmission expansion
12 solutions to address future reliability needs due to a changing resource mix and renewable
13 integration. MISO's LRTP effort consists of portfolios of transmission projects in four
14 Tranches: Tranches 1 and 2 are to consist of portfolio of projects in the North/Central part of
15 MISO's footprint (or Midwest subregion); Tranche 3 portfolio of projects would be focused
16 on MISO South; and Tranche 4 portfolio is expected to address the North/South interface limit
17 respectively.

18 The MISO Board of Directors approved Tranche 1 portfolio of projects in summer
19 2022. This portfolio consisted of 17 projects with an estimated investment of \$10.3 billion.

20 **Q. How is Minnesota Power interacting with MISO's LRTP planning process?**

21 A. As described in Schedule 6, Minnesota Power has been actively engaged, along with other
22 transmission owners, with MISO's Reliability Imperative and Long-Range Transmission Plan

³¹ Schedule 5, attached, Minnesota Power Response to LPI Information Request 5 Attachment 5.01 p. 10.

³² See also, Schedule 3 for further discussion of the value of upgrading the HVDC system in providing regional benefits beyond just customers of Minnesota Power.

Tranche 2 workshops and stakeholder meetings to ensure that MISO considers the benefits of HVDC technology and any Tariff or process changes needed.³³ The Company has stated that it anticipates significant increase in need for interregional transfer capacity in MISO,³⁴ and it aims to establish the Square Butte transmission corridor as an “essential building block for reliably moving energy across the Upper Midwest.”³⁵

Q. How are costs to be allocated for the portfolio of projects in LRTP Tranches 1 and 2?

A. MISO has designated the LRTP portfolio of projects as Multi Value Projects or MVPs. To be designated as an MVP portfolio, MISO’s tariff (attachment FF, II.C.2) requires that the regional transmission solutions support one or more of the following three criteria: enable regional public policy needs in a reliable and economic manner; provide multiple types of economic value across multiple pricing zones; and/or provide a combination of reliability and economic value across multiple pricing zones. In accordance with the MISO tariff, the MVP portfolio of projects in Tranches 1 and 2 would be eligible for 100% cost sharing across the Midwest subregion.

Q. Has MISO announced the Tranche 2 portfolio of projects?

A. No. At present, MISO is in the process of conducting analysis and has not released any specific information regarding the portfolio of projects to be included in Tranche 2, but it has targeted that the Tranche 2 portfolio would be finalized with MISO Board of Directors approval during the first half of 2024. Therefore, at the present time, it is not publicly known if and to what extent MISO may have considered Minnesota Power’s expected use of the attributes and expandability features that would be enabled by the HVDC Modernization Project.

Q. Has MISO provided any insights generally regarding the use of 765 KV and HVDC lines?

³³ Schedule 6, attached, Minnesota Power Response to LPI Information Request16.

³⁴ Schedule 5, Attachment 5.03 p. 6.

³⁵ Schedule 5, Attachment 5.04 p. 6.

1 A. In a recently updated Frequently Asked Questions document, MISO broadly stated the pros
2 and cons of using these extra high voltage lines³⁶:

3 **Why is MISO considering 765 kV and High-Voltage Direct Current**
4 **(HVDC) and what are the benefits and concerns with these**
5 **technologies?**
6

7 Higher voltage transmission like 765 kV and HVDC provide efficiency and
8 reliability benefits in the transport of electricity over long distances. As the
9 resource fleet continues to evolve, 765 kV and HVDC lines may be more
10 effective in delivering electricity from areas with a high potential for
11 renewable generation to areas of high electricity demand. MISO will
12 consider a combination of 345 kV – 765 kV and HVDC lines when studying
13 projects for Tranche 2.

14 Both 765 kV and HVDC transmission lines have much greater capacity than
15 345 kV and lower voltage transmission lines. This higher capacity results
16 in lower cost per MW of capacity and lower Right of Way (ROW) usage
17 per MW of capacity.

18 There is minimal 765 kV and HVDC infrastructure in the MISO footprint,
19 and strategies for spare equipment, redundancy during line outages, and the
20 impacts on operations must be considered before the technology is
21 implemented. Additionally, while MISO already oversees the operation of
22 765 kV lines, additional work needs to be completed for the MISO market
23 to effectively dispatch HVDC lines.
24

25 Based on the above, it is clear MISO is considering HVDC options and the merits of
26 implementing such transmission, but it has also identified a number of concerns with
27 these options.

28 **Q. Does Minnesota Power propose to include cost sharing for the HVDC Modernization**
29 **Project?**

30 A. No. It has stated that at this time it does not anticipate its proposed Project will include
31 cost sharing with others. As described in Schedule 7, Currently, the only clear way for
32 costs to be assigned to others would be if the Project meets cost allocation criteria in the
33 MISO Tariff, for example as an MVP or Market Efficiency Project (“MEP”).³⁷

³⁶ See [MISO LRTP Tranche 2 – Frequently Asked Questions](#), (last accessed February 14, 2024).

³⁷ Schedule 7, attached, Minnesota Power Response to LPI Information Request 9.

1 Minnesota Power has indicated, however, that it has initiated conversations with
2 MISO regarding potential wholesale Tariff changes to investigate ways to create a method
3 to compensate the Company for the broader system benefits the VSC HVDC technology
4 would bring to the system as MISO considers long-term reliability needs.³⁸ Minnesota
5 Power reports that these discussions are ongoing and no specific HVDC tariff changes have
6 yet been identified, but the Company agrees their customers would see cost reductions if
7 MISO tariff changes result in additional compensation for these system benefits.³⁹

8 **Q. Has the Company acknowledged the importance of MISO's LRTP planning for this**
9 **Project?**

10 A. Yes, as part of its communications with MISO the Company has stated that it intends to
11 ensure that HVDC modeling and analysis is ready to be considered as part of MISO's
12 Tranche 2 study.⁴⁰

13 **Q. What do you conclude about the Company's proposed size capability with other**
14 **features and expandability that could provide regional benefits?**

15 A. Because MISO has neither submitted Tranche 2 portfolio of projects or a related business
16 case with cost-benefit analysis, we do not know if and to what extent it intends to utilize
17 the Company's expandability and other features associated with the HVDC Modernization
18 Project. Because the design and related features of this project appear to be configured
19 with a bigger picture in mind to facilitate regional benefits, it would be best suited for
20 collaborations with MISO or other transmission owning entities. In my view, the high
21 upfront costs to modernize the use of the HVDC line would likely make the most economic

³⁸ Schedule 6.

³⁹ Schedule 6.

⁴⁰ Schedule 5, Attachment 5.04 p. 17.

1 sense if entities more than Minnesota Power were realizing the benefits and accordingly,
2 sharing in the costs.

3 Because the MISO Tranche 2 portfolio is to be finalized this year, it would be
4 insightful for the Commission to have this information at it deliberates on the Application.
5 If MISO's regional transmission solutions include maximizing the use of the HVDC
6 Modernization Project with the VSC technology, convertor terminals expandability and
7 spatial considerations to accommodate future expansion, this result would further reinforce
8 that there are future regional benefits beyond the benefit to Minnesota ratepayers that
9 would flow from this proposed Project. I request that in Rebuttal Testimony, Minnesota
10 Power explain why there would not be some sort of cost sharing for the costs associated
11 with the HVDC Modernization Project given that this project "is designed to accommodate
12 future expansion of the HVDC system and the interconnected AC transmission system, to
13 support the future regional transmission development that is necessary to successfully
14 navigate the clean energy transition."⁴¹ Because the Project would have arguably laid the
15 groundwork to enable regional transmission expansion solutions, it stands to reason that
16 portions of the Project investment that enabled the regional expansion be shared with others
17 that would potentially benefit. Put another way, Minnesota Power's ratepayers should not
18 be solely responsible for the high upfront costs of the Project if it is designed and scoped
19 with the expectation of providing regional benefits.

41 [Application](#) p. 32.

VII. Alternative Options If HVDC Solution Not Incorporated in Tranche 2

Q. What are the alternative options to consider if MISO does not include HVDC related solutions as contemplated by the Company?

A. If the HVDC related projects are not included in the MISO Tranche 2 portfolio, the following may warrant further investigation:

1. ***Market Participant Funding Project with more partners.*** Aside from the Tranche 2 effort, Minnesota Power should explain in Rebuttal Testimony if it has explored innovative partnerships to share the costs with other entities that may also realize benefits as a result of the HVDC Modernization Project.

2. ***Scale back of the project.*** Because the design and related features of this Project may be configured with a bigger picture in mind to facilitate regional benefits, it is not clear what the impact would be of the change in design and scope, and therefore, costs, if this project did not lay the foundation to facilitate or enable solutions with regional benefits. If the project will not be used for regional benefits, it is likely feasible to scale back the project and utilize less expensive technology with less spatial requirements to fulfill the need for Minnesota Power's ratepayers. It would be beneficial if the Company provided more information in this regard in Rebuttal Testimony.

3. ***Increased optionality with Tranche 1 and 2 build out.*** The Tranche 1 MVP portfolio, approved by the MISO Board of Directors in July 2022 has in-service dates between 2028 and 2030. MISO is in the process of identifying transmission solutions for Tranche 2 to further integrate substantive amounts of renewable generation, and one likely outcome of this effort would be more optionality to get

1 wind energy delivered to Minnesota Power's system. Further, since one of the
2 major benefits of the LRTP initiative is congestion and fuel cost savings, there
3 would be less congestion price risk due to the increased optionality compared to
4 the Company's historical perspective.

5 From an overarching perspective and once again, if the HVDC related solutions are
6 not included in the MISO Tranche 2 portfolio of projects, I encourage the Company to
7 explore if it could minimize costs for its ratepayers by relying on the regional solutions
8 instead of constructing expensive infrastructure that is solely to be utilized by Minnesota
9 Power for its ratepayers. I am very concerned that in the latter case, Minnesota Power
10 ratepayers would end up bearing the high costs associated with modernizing and expanding
11 the capability of the HVDC line as well as necessarily being responsible for paying for
12 their share of the socialized MVP costs associated with the Tranche 1 and 2 portfolios.⁴²
13 As noted earlier, the Tranche 1 portfolio investment was estimated at \$10.3 billion. It is
14 anticipated that the Tranche 2 portfolio related investment will likely be more costly than
15 Tranche 1. Thus, the impact to Minnesota Power ratepayers would be more significant than
16 the already high revenue requirements associated with the Company's proposal in the
17 Application and discussed earlier in my testimony.

18
19 **VIII. ATC's Alternative**

20 **Q. Do you have an opinion regarding the feasibility of the ATC Alternative?**

⁴² If the premise is that this HVDC Modernization Project is going to be the gateway for Minnesota Power to accomplish its clean energy goals, then presumably, it would be accessing the congestion free wind energy from North Dakota via the upgrades on the HVDC line for the benefit of its ratepayers in lieu of accessing other options made possible by the implementation of the Tranche 2 portfolio.

1 A. Not at this time. I will continue to evaluate information and will discuss the feasibility of
2 the ATC Alternative in my Rebuttal Testimony after further record development including
3 testimony from ATC.

4
5 **IX. Future Considerations and Conditions**

6 **Q. If the Commission ultimately approves this project, should conditions be imposed to**
7 **ensure that customers are protected from unnecessary costs and risks?**

8 A. Likely yes. LPI will continue to evaluate Minnesota Power's Application and what
9 customer protections might be necessary to protect the public interest.

10 **Q. Do you have recommendations for Minnesota Power regarding the process and**
11 **procedures used in this matter and future matters related to significant infrastructure**
12 **and investments?**

13 A. Yes, I do. As LPI has noted in this proceeding, Minnesota Power has not been transparent
14 to its customers about its intentions to propose such a large project as this one, and LPI has
15 no understanding of what future investment and infrastructure projects Minnesota Power
16 plans in the short or long term. It is worth noting that there has been little to no dialogue
17 on this Project between Minnesota Power and its large customers, yet Minnesota Power
18 previously engaged stakeholders in advance of its last resource plan and is on the verge of
19 restarting that stakeholder process for its next resource plan to be filed in 2025. Consistent
20 with this prior practice, LPI believes that Minnesota Power should deliberately engage its
21 customers to provide information about which projects are needed, the Company's
22 preferred plans for those infrastructure needs, and the mitigations they propose to minimize
23 the cost impact to customers. Minnesota Power has been actively engaged with MISO to

1 introduce the HVDC technology and its potential benefits. LPI requests Minnesota Power
2 similarly engage with its customers in a proactive manner on new technologies and
3 proposed investments. As large end users on the Company's system, LPI will pay the
4 majority of the costs for this project and a more collaborative process could lead to long
5 term efficiencies as these large projects are proposed and evaluated.

6
7 **X. Conclusion**

8 **Q. In conclusion, please summarize your testimony.**

9 A. My testimony raises concerns with the Project's costs and its proposed expansion to
10 accommodate future, not existing, need, and the accumulative effect of the Company's
11 infrastructure investments would further existing rate shock concerns, and potentially
12 result in unjust and unreasonable rates for LPI. It appears the Company is expecting that
13 this HVDC System will benefit the surrounding region, and not just Minnesota Power's
14 customers, and to the extent the Project is being constructed for future needs and to benefit
15 other regions, the Company and other regions should bear a portion of the Project costs.
16 Alternatively, if the HVDC modernization project's capabilities and technologies are not
17 included in MISO's LRTP Tranche 2, I request Minnesota Power provide cost sharing
18 proposals and Project alternatives.

19 **Q. Does this conclude your direct testimony?**

20 A. Yes.