

NORTH DAKOTA TRANSMISSION AUTHORITY

ANNUAL REPORT

July 1, 2022, to June 30, 2023

OVERVIEW

The North Dakota Transmission Authority (Authority) was created by the North Dakota Legislative Assembly in 2005 at the request of the North Dakota Industrial Commission. The Authority's mission is to facilitate the development of transmission infrastructure in North Dakota. The Authority was established to serve as a catalyst for new investment in transmission by facilitating, financing, developing and/or acquiring transmission to accommodate new lignite and wind energy development. The Authority is a builder of last resort, meaning private business has the first opportunity to invest in and/or build needed transmission.

By statute, the Authority membership is comprised of the members of the North Dakota Industrial Commission. John Weeda was appointed Director of the Authority in February 2018. The Director works closely with the Industrial Commission Administrative Office staff. The Authority receives no direct general fund appropriation.

SUMMARY OF ACTIVITIES

Whether the issue is project development or legislative initiatives, the Authority is actively engaged in seeking ways to improve North Dakota's energy export capabilities along with transmission capabilities within the state. To be successful Authority staff must understand the technical and political challenges associated with moving energy from generator to satisfied customer. Outreach to existing transmission system owners and operators and potential developers in order to understand the nuances of successful transmission infrastructure development is necessary. Another key element for success is working with officials at the state and federal levels to ensure that legislation and public policy are designed to support the movement of electricity generated from North Dakota's abundant energy resources to local, regional, and national markets.

NORTH DAKOTA INDUSTRIAL COMMISSION



Doug Burgum
Governor



Drew H. Wrigley
Attorney General



Doug Goehring
Agriculture Commissioner



John Weeda, Director
ND Transmission Authority



Claire Vigesaa, Deputy Director
ND Transmission Authority

NORTH DAKOTA TRANSMISSION AUTHORITY (NDTA)

STATUTORY AUTHORITY

Statutory authority for the Transmission Authority is found in chapter 17-05 of the North Dakota Century Code. Section 17-05-05 N.D.C.C. delineates the powers of the Authority, including:

- 1) make grants or loans to borrow money
- 2) issue up to \$800 million in revenue bonds
- 3) enter lease-sale contracts
- 4) own, lease, rent and dispose of transmission facilities
- 5) enter contracts to construct, maintain and operate transmission facilities
- 6) investigate, plan, prioritize and propose transmission corridors; and
- 7) participate in regional transmission organizations.

Before the Authority may exercise its power to construct transmission facilities, it must follow a process defined by statute to ensure public participation and comment. In particular, the Authority must publish a notice describing the need for the transmission project. Entities interested in construction of the facilities or furnishing services to satisfy the identified needs have 180 days to respond by filing a notice of intent. If the Authority receives a notice of intent from an interested entity, it may not exercise its power to construct unless the Authority makes a finding that doing so would be in the public interest. In making such a finding, the Authority shall consider the economic impact to the state, economic feasibility, technical performance, reliability, past performance, and the likelihood of successful completion and ongoing operation.

The Authority may finance approved projects through the issuance of bonds. Under current law up to 30 percent of the cost of a project may be financed by selling bonds that include the moral obligation of the State of North Dakota. In other words, up to \$240 million of the Authority's \$800 million total bonding authority may be sold with the moral obligation of the state. The moral obligation component enhances the marketability of the Authority's bonds.

In 2022 the NDTA, for the first time, utilized the authority granted to make loans as a support to NEXUS in purchasing the DC line from Coal Creek Station in North Dakota to Delano, Minnesota.

TRANSMISSION VALUE

Like any other product, electricity requires a path to market. Wheat farmers rely on rail and truck, crude oil counts on pipeline and rail and electric generation facilities, too, require pathways to market. Unlike wheat, oil or other commodities, electrons can't be loaded on a rail car or semi tractor. Electrons from one generator are not discernable from another and except for some minor storage, electricity is consumed in real time. Suffice to say, stellar transmission infrastructure is vital to deliver reliable electric energy; further the ability to maximize value for generation, additional capacity transmission paths enable generation to capture benefits from the power market. North Dakota's transmission network is growing but we still see areas of congestion. Importantly, continued

economic growth and prosperity will require more electric generation and transmission. So, to maximize electric generation in North Dakota, whether wind, gas, coal or solar generation, new and expanded transmission grid investments will be needed.

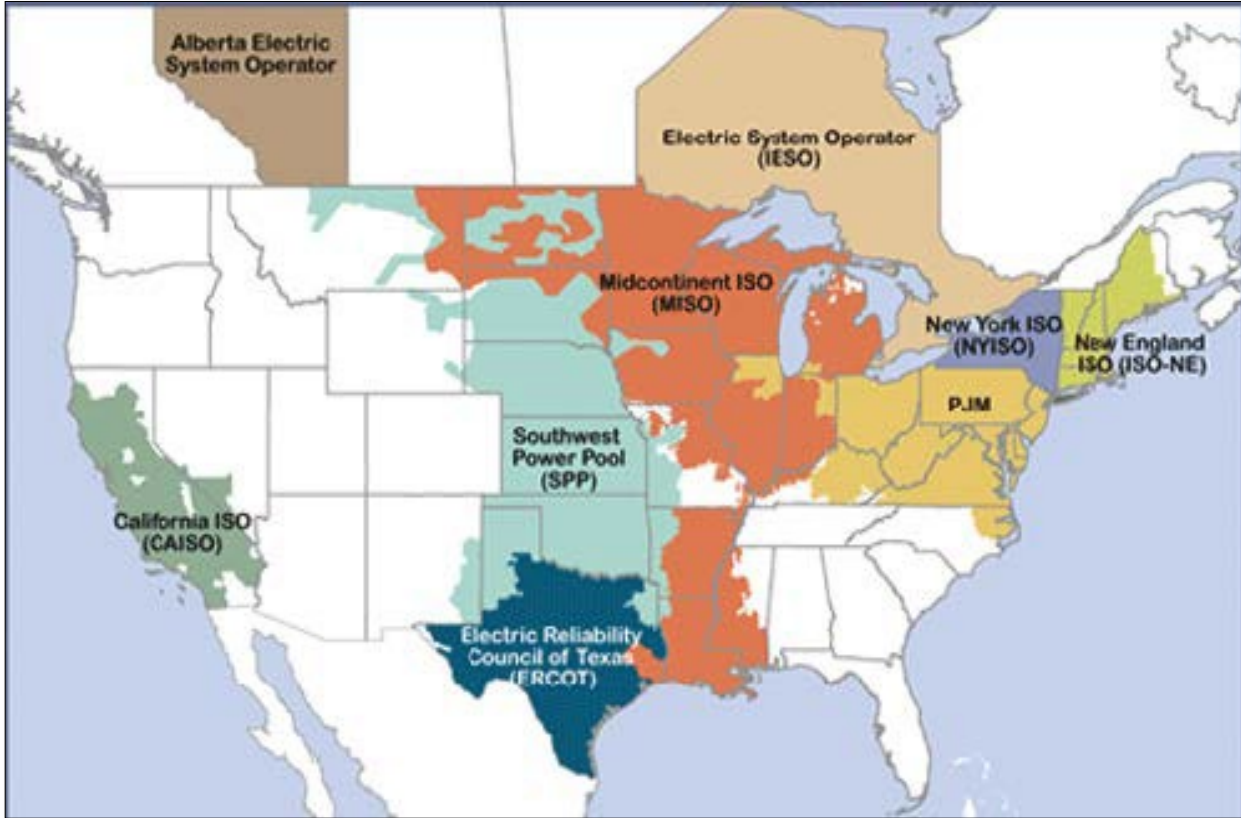
PLANNING

A major portion of the Authority's workload includes observation and achieving a high level of understanding of regional transmission planning. To accomplish this task, the Authority monitors the efforts of regional transmission organizations (RTOs) that represent North Dakota transmission developers. Authorized and recognized by the Federal Energy Regulatory Commission (FERC), RTOs oversee the efficient and reliable operation of the transmission grid. While RTOs do not own any transmission assets, they do provide non-discriminatory access to the electric grid, manage congestion, assure reliability, provide billing and settlement services, and oversee planning, expansion, and interregional coordination of electric transmission.

Many North Dakota service providers have long been participants in the Midcontinent Independent System Operator (MISO). The MISO footprint covers the service territories of Otter Tail Power (OTP), Montana-Dakota Utilities (MDU), Great River Energy (GRE), Xcel, Missouri River Energy Services (MRES), and a small amount of transmission assets owned by Upper Missouri Power Cooperative. In addition, they have an agreement with Minnkota Power Cooperative that provides them with many of the same services. In October 2015, the Western Area Power Administration (Western) and Basin Electric Power Cooperative (BEPC) officially joined the Southwest Power Pool (SPP), bringing the entire state of North Dakota under the transmission planning of RTOs. In addition, BEPC members Mountrail-Williams Electric Cooperative and Central Power Electric Cooperative, Roughrider Electric Cooperative and Mor-Gran-Sou Electric Cooperative have also joined SPP due to their transmission ownership. Combined, North Dakota utilities and transmission developers are part of an extremely complex system that oversees the transmission of over 200,000 megawatts of electricity across 100,000 miles of transmission lines so that utilities can deliver power to homes and businesses in all or part of 20 states.

MISO and SPP also operate the power markets in their respective territory. Pricing for selling electricity into the grid and for buying electricity from the grid is managed by them. This process determines which generating units will be providing generation at any point in time and which units will provide various ancillary services to sustain voltage, assure reliability, etc.

Regional Transmission Organization and Independent System Operators



*FERC-Recognized Regional Transmission Organizations and Independent System Operators
(www.ferc.gov)*

ND Transmission Authority Planning

The North Dakota Transmission Authority periodically conducts independent evaluation of factors that affect the adequacy of transmission in North Dakota. Two studies of that nature were recently completed.

GRID STUDIES

To help understand the demand for electricity in the growth area in the oil producing counties, the NDTA commissioned Barr Engineering to do an update to the Power Forecast 2019 estimating the growth over the next 20 years. The 2021 update and the full study can be obtained from the North Dakota Industrial Commission web site: Power Forecast Study - 2021 Update (nd.gov) Projections of continued growth in the Bakken Oil Field and associated industries remain consistent with the 2021 update.

The 2021 update incorporates industries that have expressed interest in locating in North Dakota through encouragement that the Clean Sustainable Energy Act provided and the abundance of natural gas available due to the increasing gas-to-oil ratio in the Bakken wells. Another important factor in the forecast is the likelihood of carbon capture and sequestration from Lignite fired power plants, ethanol plants and to pipelines bringing CO₂ to North Dakota for sequestration service.

In summary, the Power Forecast 2021 Update projects an increase of 10,000 GWhr in energy demand over the next 20 years under the consensus scenario and approximately 2200 to 2500 MW of capacity to meet demand. These projections were highly dependent on industrial development and are coordinated with a forecast used by the ND Pipeline Authority.

The timing and implementation of generation and transmission resources to meet this growing demand is a significant challenge for the utilities that have the obligation to serve. The generation options for meeting the increased capacity demand are highly biased toward wind generation and natural gas generation. As seen in the Interconnection Queues below there is a large interest in increasing wind generation options, but natural gas generation to firm up the weather dependent generation may see an increase in the queue. There are no additional generating unit retirements announced for the current fleet in North Dakota.

In 2023 the North Dakota Transmission Authority commissioned studies of the generating resource adequacy in both the MISO and SPP ISOs. The studies addressed accreditation of generation resources, projected additions, and retirements of generation resources in each ISO. A projection of potential costs on an unsubsidized basis was also included. The results of these studies will be discussed in detail in the Annual Report on Resilience of the Electric Grid to be released on September 1, 2023.

Generator Interconnection Queue and Transmission Plan Review

MISO TRANSMISSION EXPANSION PLANNING (MTEP)

Both MISO and SPP are engaged in transmission planning processes to accommodate the growth of renewable generation and the need to move that generation to the markets. The MISO Board approved the first tranche of the MISO Long Range Transmission Plan in the July 2022 Board meeting. This tranche will be included as an amendment to the MTEP 2021 to avoid delay in starting the projects. That tranche includes \$10.3 Billion of transmission expansion in the upper MISO region. Projects included are expected to have a beneficial impact on North Dakota and will enable reasonable cost for transmission interconnects as listed in the queue below.

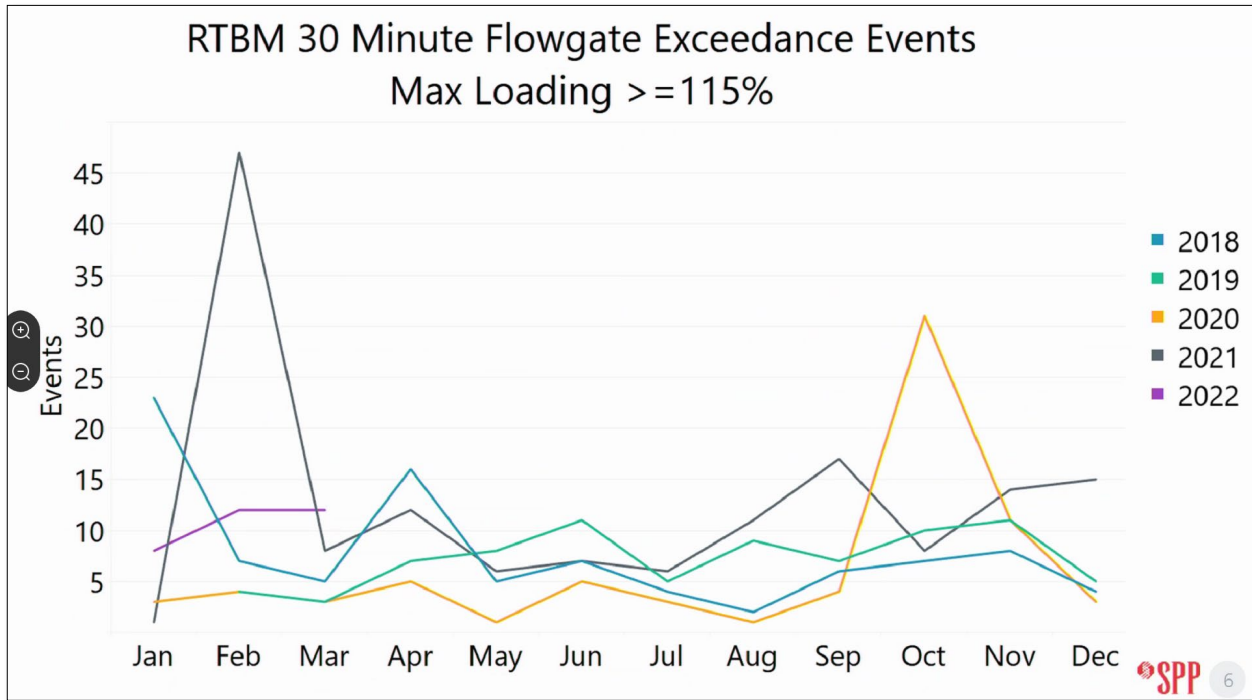
The approved tranche 1 projects include a new 345 line from Jamestown to Ellendale in North Dakota. Ottertail Power Company and Montana Dakota Utilities will jointly own and construct the line.

Additional lines in tranche 1 will provide transmission capacity in South Dakota and Minnesota to enhance the ability to move power from central North Dakota to market.

The MISO Transmission Expansion Plan (MTEP) is developed annually through an inclusive and transparent stakeholder process. MISO evaluates various types of projects through the MTEP process that, when taken together, build an electric infrastructure to meet local and regional reliability standards, enable competition among wholesale capacity and energy suppliers in the MISO markets, and allow for competition among transmission developers.

SPP Integrated Transmission Planning process (ITP)

Transmission planning is becoming increasingly complex as the generation mix transitions to a greater portion of intermittent generation resources. The changing mix coupled with redistribution of generation resource locations puts strains on existing transmission networks, potentially changing flow directions for the network. The table below demonstrates the increase in flowgate exceedance events for SPP over the last four years.



Like other Regional Transmission Organizations, SPP has increased staff resources focused on reliability and system resilience. SPP has several member groups/staff reviewing data/trends and working on new policies/procedures to address reliability and resiliency issues.

The planning process (Integrated Transmission Plan -ITP) at SPP has been overwhelmed with generation interconnections over the past few years, however SPP made adjustments to get the planning process back on track in 2022. Further, SPP has collaborated with MISO in the JTIQ study to identify mutually beneficial transmission development at the SEAMS.

As the grid system has matured and incorporated new technologies, transmission and generation operators have a tremendous amount of data to be used in the planning process. SPP staff continue to strengthen and adapt their planning models to leverage the data and to accurately apply information to develop transmission options to meet the region's need.

MISO-SPP Joint Transmission Study (JTIQ)

The Midcontinent Independent System Operator (MISO) and Southwest Power Pool (SPP) collaborated on a years-long transmission study designed to identify transmission projects with comprehensive, cost effective and efficient upgrades. Both RTOs were looking for solutions to historical challenges facing generation interconnection customers in areas where their boundaries connect, also known as seams. The study began in December 2020.

This joint study focused on solutions that the RTOs believed would offer benefits to both their interconnection customers and end use consumers of RTO member companies. While MISO and SPP had an existing Joint Operating Agreement that allowed them to work through reliability issues, existing processes did not include the simultaneous evaluation of benefits, or allocation of cost, to both load and interconnection customers.

Each RTO's existing interconnection processes will proceed as planned. The study ran parallel to those with subsequent results being incorporated at the appropriate time. Any projects identified by the joint study were approved by the Board of Directors of the respective RTOs before moving ahead.

The completion of this study is imminent, both RTOs would like to have their FERC filing(s) made by the end of year 2022. Both MISO and SPP desire to have board approval in early 2023. Several of the alternatives that were ranked well in the preliminary analysis would benefit North Dakota. The most direct impact was a proposed line from Jamestown to Ellendale. The project in the JTIQ that directly benefits North Dakota is a 345 Kv line from near Fargo to Big Stone, South Dakota. The models focused on enabling generator interconnects in that area as a primary benefit. Additional lines proposed in the Big Stone area would help reduce congestion that has impacted the market in the Ellendale area where North Dakota has a number of large wind projects, and more being proposed.

The five states that are affected by the JTIQ projects collaborate on an application to DOE for funding as an innovative solution for transmission needs.

TRANSMISSION CONSTRUCTION & IMPROVEMENTS

There have been several transmission projects completed in recent years. Currently smaller projects are underway that enhance the transmission available to North Dakota generators and their access to the energy markets. The transmission improvements are summarized below.

SPP PROJECTS

Basin Electric Power Cooperative Western North Dakota Projects

Transmission studies continue to be completed within the various Southwest Power Pool (SPP) processes to identify reliability upgrades needed in the Basin Electric service territory. Basin Electric and its members monitor the load growth in the area and submit plans for approval as violations and system needs develop. Basin Electric works closely with SPP on the various transmission tariff studies that SPP completes.

Basin Electric recently completed the Neset-to-Northshore 230-kilovolt (kV) transmission project in November 2022. This was an approved reliability network upgrade identified by an SPP process in 2020. In addition to this new 230-kV facility, three projects were approved out of SPP's 2021 Integrated Transmission Planning (ITP) process. These projects include the addition of approximately 200 miles of 345-kV transmission lines, two new substations, as well as additions to existing substations. The largest of the projects, first dubbed the East Loop project and now named the Leland Olds-to-Tande project, will extend from the Leland Olds 345-kV substation around the east end of Lake Audubon and continue up to the existing Tande 345-kV substation near Tioga, North Dakota. A new substation near Parshall, North Dakota, will also segment this line creating a load delivery point in that location which will tie in with the Mountrail-Williams 115-kV system. The second project is a new 345-kV line from Roundup-to-Kummer Ridge which will connect two existing 345-kV substations near Killdeer and Johnson's Corner respectively. An additional load-serving substation will also be constructed on the Judson-to-Tande 345-kV transmission line. That substation, called Springbrook, is expected to be completed in 2025 and tie into Mountrail-Williams 115-kV system. The Roundup-to-Kummer Ridge project is expected to come online in 2025 while Leland Olds-to-Tande is expected to have an expected completion in late 2026.

Basin Electric also has plans to construct two 230-kV lines that will increase the capacity between the United States and Saskatchewan. The first project is a new 230-kV line between the existing Wheelock substation up to Saskatchewan's Estevan substation. The second project is a new 230-kV line between the existing Tande substation up to the Estevan substation. The projects are both expected to come online in late 2027.

Though it's not new construction, Basin Electric continues to complete age and replacement projects at various substations in North Dakota. This includes the replacement of relays, breakers, and other aging equipment at substations across the footprint.

Transmission studies continue to be completed within the various SPP processes to identify reliability upgrades needed in this region. Basin Electric and its members monitor the load growth in the area and submit plans for approval as needs develop. They work closely with SPP on the various transmission tariff studies that SPP completes.

MISO PROJECTS

Minnkota Power Cooperative (North Dakota)

Minnkota projects include replacement of a high voltage transformer (230/115 kV) at Drayton, North Dakota in 2023 (\$3.2M). Various high voltage structure replacements and foundation repairs are being done as part of the HV maintenance and hardware replacement programs (\$4.7M). A new 69/230 kV substation to improve reliability is proposed for the Grand Forks area in 2023 and will include the new tap substation on the existing Prairie-Winger 230 kV line (\$9.3M). Rebuilds of existing 69 kV transmission lines and distribution substations are ongoing, as well as breaker and protective relaying replacements/upgrades. Minnkota continues to update its demand response program via a new ripple injector site near Fargo, as well as replacing equipment near Lakota, ND in 2023 (3.7M). Coordination also continues with the Fargo Diversion flood project via infrastructure modifications and relocates necessary to accommodate that project's features.

Minnkota Power Cooperative (Minnesota)

Minnkota will be involved in a series of projects to improve reliability of the NW Minnesota bulk electric system. These projects include both 230 kV transmission substation work and 115 kV line and substation work and are scheduled to be constructed in the 2023-2024 timeframe. Included in this work is a joint project with Otter Tail Power to build a new 115/230 kV interconnect substation and 7 miles of new 115 kV line north of Grand Forks by Oslo, Minnesota that interconnects the existing 230 kV and 115 kV systems in that area for better reliability in the region.

Ottertail Power Company (OTP)

Jamestown – Ellendale 345 kV Project

Otter Tail Power Company and Montana-Dakota Utilities Co. are partnering to build a new Jamestown-Ellendale 345 kV Project. The project includes approximately 90 miles of new 345 kV line built with double circuit capable structures between Otter Tail's existing Jamestown 345 kV Substation and Montana-Dakota's existing Ellendale 345 kV Substation along with the replacement of the existing Maple River 345/230 kV transformers near Fargo, North Dakota, and the addition of two 345 kV reactors at the Twin Brooks Switching Station in South Dakota. Otter Tail and Montana-Dakota are in the early stages of project development with an in-service date expected in late 2028. The Jamestown-Ellendale 345 kV Project will strengthen the connections between the existing 345 kV systems and relieve excessive loading on the existing 230 kV system across southeastern North Dakota leading to the ability to increase the transport of energy out of North Dakota, reduce congestion, improve fuel savings, and maintain the reliability of the transmission system in the future.

Big Stone South – Alexandria – Big Oaks 345 kV Project

The Big Stone South – Alexandria – Big Oaks 345 kV project, formerly known as the Big Stone South – Alexandria – Cassie's Crossing 345 kV project, includes two distinct line segments. The Big Stone South – Alexandria segment will be co-owned by Otter Tail Power Company and Western Minnesota Municipal Power Agency (Western Minnesota) and involve approximately 95-105 miles of new 345 kV

line built with double circuit capable structures between Otter Tail's existing Big Stone South 345 kV Substation near Big Stone, South Dakota and Western Minnesota's existing Alexandria 345 kV Substation near Alexandria, Minnesota. The Alexandria-Big Oaks segment will be co-owned by Xcel Energy, Great River Energy, Otter Tail Power Company, Minnesota Power, and Western Minnesota and primarily use the spare circuit position on the existing structures along Interstate 94 from Alexandria towards Monticello (i.e., the CapX2020 Fargo-Monticello line) and continue southeast a short distance to a new Big Oaks 345 kV switching station near Becker, Minnesota in Sherburne County. The co-owners are preparing to file a Certificate of Need application in Minnesota for the entire project during the third quarter of 2023. Likewise, the co-owners are also planning to submit route permit applications in Minnesota during the third quarter of 2023 for the Alexandria – Big Oaks segment and the fourth quarter of 2024 for the Big Stone South – Alexandria segment. Otter Tail and Western Minnesota will also be pursuing a South Dakota Transmission Facility Permit for the portion of the Big Stone South – Alexandria segment located in South Dakota during the same timeframe as the Minnesota routing process. MISO has proposed an in-service date in mid-2030 for the Big Stone South – Alexandria – Big Oaks 345 kV Project.

The Jamestown – Ellendale Project and the Big Stone South – Alexandria – Big Oaks Project address several loading and voltage issues in Western Minnesota, Eastern North Dakota, and Eastern South Dakota by tying two existing 345 kV systems together. In addition to providing reliability benefits, these two new projects will enable the interconnection of future generation and increase transfer capability throughout the region.

Big Stone South – Hankinson – Bison 345 kV Project

The Midcontinent Independent System Operator and Southwest Power Pool wrapped up the technical analysis for the Joint Targeted Interconnection Queue (JTIQ) study and published a final report that identifies a need for five new transmission projects. The JTIQ study was initiated to address transmission system needs along the SPP-MISO seam which are too costly for small groups of interconnection customers and result in churn and delays in processing regional generation interconnection queues. One of the five new transmission projects identified is a proposed Big Stone South – Hankinson – Bison 345 kV Project.

MISO and SPP are continuing to develop cost allocation and cost recovery mechanisms for the JTIQ projects. Tariff updates and revisions are currently underway with a plan to file the revisions with FERC in Q3 of 2023. MISO and SPP Board approvals for the proposed JTIQ transmission projects are expected to occur after the FERC filings are approved.

Otter Tail Power Company has been collaborating with MISO, SPP, other Transmission Owners, and the State of Minnesota in support of an application for funding of the JTIQ projects under the Department of Energy's (DOE) Grid Resiliency and Innovative Partnership, or GRIP Program. The full application was submitted to the DOE in May with the potential for funding to match up to 50% of the JTIQ portfolio cost. A DOE decision on the application is expected by the end of 2023.

MISO/SPP Joint Targeted Interconnection Queue (JTIQ) Study

In parallel with MISO's LRTP process that led to the first portfolio of projects, MISO and the Southwest Power Pool (SPP) also completed a technical analysis called the Joint Targeted Interconnection Queue (JTIQ) study. The JTIQ effort was initiated in mid-2020 to address transmission system needs that exist along the SPP-MISO seam which are resulting in delays in processing regional generation interconnection queues. MISO and SPP released a final JTIQ report in March 2022 that included 7

projects with an estimated cost of \$1.06 billion. One of those projects identified is the Bison (Fargo)/Hankinson to Big Stone South 345kV line, expected to cost about \$476 million. Ottertail Power Company and Xcel Energy are likely partners in this project. This project will have a new approach for cost share; 90% borne by the generator and 10% covered by the load. A “Grid Resilience and Innovative Partnerships” GRIP grant request is being sought from DOE; if successful, up to 50% of the cost could be covered through the grant.

Nexus Line High Voltage Direct Current (HVDC) Line

May 1, 2023, brought the one-year anniversary of Nexus Line ownership of the HVDC Line from Coal Creek Station, owned by Rainbow Energy Center, to the greater Minneapolis area in Minnesota. Rainbow Energy Center continues to work toward the execution of their vision for Nexus Line and Coal Creek Station, which includes the integration of renewable generation on Nexus Line through the Discovery Wind Project by Apex. Apex plans to deliver 400 MW of wind energy to Great River Energy, with Nexus Line providing transmission services to the project. The Discovery Wind project remains an important component of the vision for Rainbow Energy Center, which also includes the implementation of carbon capture on Coal Creek Station. The continued operation of Coal Creek Station long into the future retains and expands the high-paying careers through the operation of both the plant and the Falkirk Mine and brings opportunity for additional construction and operating jobs through execution of the vision.

Xcel Energy

Xcel Energy continues plans to build a gas fired generation plant in North Dakota. In addition, Xcel Energy plans to continue additional renewable generation in the region and transmission improvements to accommodate those additions.

Montana-Dakota Utilities Co. Transmission Improvements

MDU is continuing transmission projects in 2023 for North Dakota started in previous years, primarily focused on replacing aging infrastructure around the service territory in North Dakota, upgrades for new generation, and the new Jamestown-Ellendale 345 kV transmission line.

A substantial effort is being put toward replacing aging infrastructure around MDU’s North Dakota service territory. New substations are being constructed to replace existing in Beulah, ND and Tioga, ND. A new substation is being designed for Wishek, ND that will also allow the interconnection of new wind generation. MDU will be rebuilding transmission lines in the areas of Crosby, Halliday, and Watford City. The in-service dates for all these projects are near the end of 2023. The completion of the Heskett 4 Combustion Turbine in 2023 will allow completion of all the transmission upgrades required in Mandan, ND.

MDU, along with partner Otter Tail Power Co., have started planning, engineering design, and right of way acquisition for an approximately 90 mile long 345 kV transmission line connecting existing 345 kV systems at Jamestown and Ellendale. This project has been identified through the Midcontinent ISO Long Range Transmission Planning process to improve the transmission system across the region. The expected in-service date is December 2028.

Minnesota Power ALLETE High Voltage Direct Current System

Minnesota Power has launched a project to modernize its High Voltage Direct Current (HVDC) system that currently connects North Dakota (at Center) and Minnesota (near Duluth). The project will replace the technology installed in the late '70s with newer HVDC technology at the ends of the lines, increasing the capacity of the line from 550MW to 900MW. The project is advancing to the permitting stage in 2023. The project is expected to cost \$700 million.

Grid United

Grid United has been taking specific action toward building a DC line from St. Anthony, North Dakota to Colstrip, Montana. They are currently reporting that easement work is progressing nicely; they are working on project workplan “sequencing” with respect to the NEPA process, county permitting etc. Environmental and cultural resource studies are underway and WAPA signed an MOU with Grid United to be designated as the lead Federal Agency.

FUTURE TRANSMISSION CONCEPTS

SOO Green - The SOO Green Renewable Rail project (SGRR) is a 2,100 MW, 349-mile, 525 kV underground high voltage direct current (HVDC) transmission line from Iowa to Illinois, linking utility-scale renewable generation in MISO with customers in PJM.

Two powerful backers have signed on to the 2,100-megawatt transmission project to bring renewable generation from Iowa to Illinois. German energy engineering firm Siemens and Copenhagen Infrastructure Partners, a Danish fund specializing in renewables, acquired the SOO Green Renewable Rail from its developer, the *Wall Street Journal* [reported](#). Siemens will also supply the high-voltage DC equipment for the effort. The project is facing challenges including the interconnection to PJM in Chicago. NDTA did not receive an update about this project for this report.

DOE - DOE, National Renewable Energy Laboratory (NREL) and Pacific Northwest National Laboratory (PNNL) are conducting a National Transmission Planning Study to identify interregional and national strategies to accelerate cost-effective decarbonization. The Study results are scheduled for release in the third quarter of 2023.

Key capacity-expansion questions for the TRC

NORTH DAKOTA UTILITY SCALE GENERATION REPORT (all data is in calendar year)

CURRENT GENERATION RESOURCES

Renewable generation - North Dakota has 4250 MW of wind generation in service.

Solar generation - North Dakota does not currently have any utility scale generation facilities in service, although some are in the MISO and SPP queues.

Thermal coal generation - North Dakota currently has thermal coal generation in service at six locations. These sites include a total of 9 generating units. The combined capacity of the units is approximately 4,048 MW. The average capacity factor for 2022 remained high with individual units from the mid-60s to the low 90s.

Montana-Dakota Utilities retired the 44-MW coal-fired Lewis & Clark Station in Sidney, Montana at year-end 2020 and Units 1 and 2 at the 100-MW Heskett Station in Mandan, North Dakota in the first quarter of 2022. In the first half of 2023 they will be adding an additional gas fired unit at that site. Demolition of units 1 and 2 of Heskett station is underway in 2023.

Rainbow Energy closed a transaction to buy the Coal Creek Station and the DC transmission line on May 1, 2022. Their plans are to continue to operate the plant in a similar manner. They will be moving forward with the CO2 capture assessment that was started by Great River Energy. They expect to complete the study in early 2024. In addition, approximately 400 MW of wind generation is planned for that area of McLean County to utilize the capacity that will be available on the DC line.

Hydro generation - North Dakota has one hydro generation site containing 5 units with a total capacity of 614 MW. The hydro units are a valuable part of the electric grid due to their dispatchable nature and ability to ramp when load varies. The volume of water flowing in the river has been a limiting factor in hydro generation during drought years but was improved in 2022-2023.

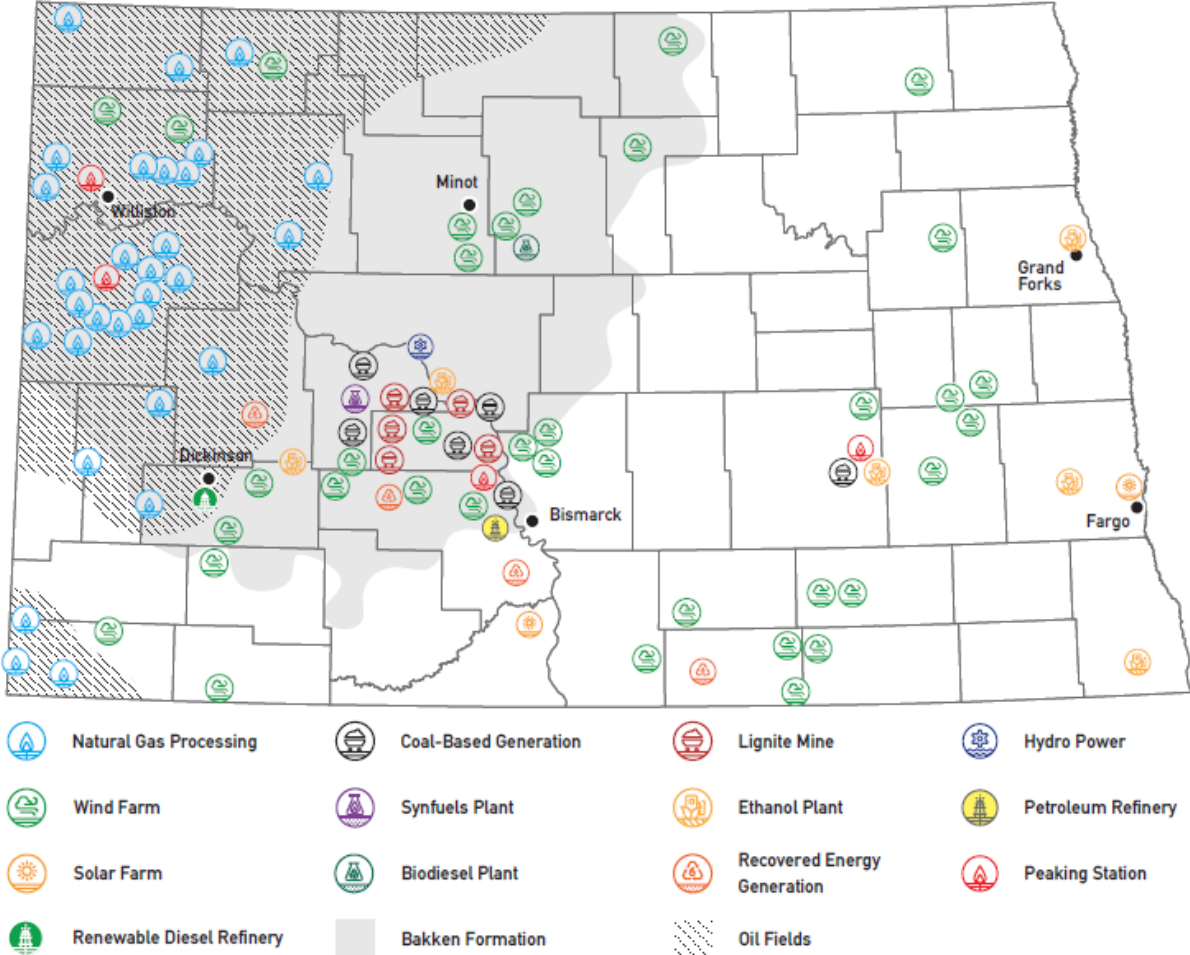
Natural gas generation - North Dakota has three sites for electric generation utilizing natural gas. These three sites contain 21 generating units with a total capacity of 596.3 MW. These units are reciprocating engines and gas turbines. There is a variation in summer capacity due to the performance of gas generators in hot weather. The two locations in western North Dakota have been running at much higher capacity factors than a typical natural gas peaking plant. This is driven by the low cost of natural gas in the Bakken region and the high and uniform demand. The unit at Mandan on the other hand operates a limited amount to respond to peak demand. Total generation in North Dakota using Natural gas for 2022 was 1.445 GWhr. This amount has been steady from 2019 through 2022. Basin Electric Power Cooperative is currently constructing additional gas fired capacity at Pioneer station northwest of Williston.

Total Generation - The combined total of all types of utility scale generation is approximately 8,863 MW. The 4,250 MW of wind generation receives a reduced capacity accreditation in the ISO of

approximately 600 MW since it is intermittent. The ISOs are changing accreditation formulas in an effort to match actual performance closer. MISO recently implemented a seasonal construct which has a different accreditation value for each of the four seasons. This change has been made also in response to the experience of tight generation reserves even in the fall and spring.

CURRENT GENERATION & ENERGY RESOURCES

energy sites of
NORTH DAKOTA



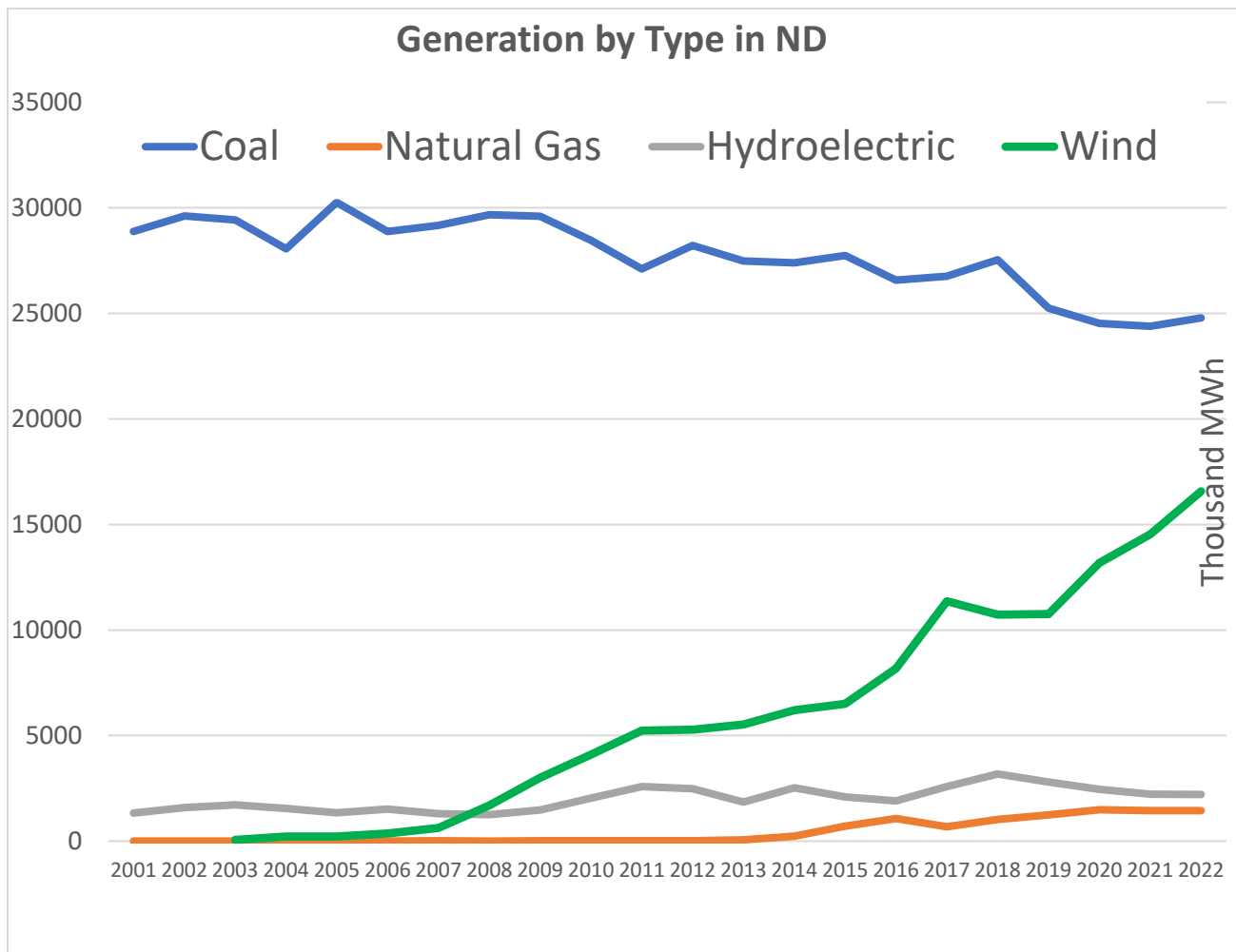
+ Map courtesy of Bismarck State College National Energy Center of Excellence.

ELECTRIC GENERATION MARKET & UTILIZATION

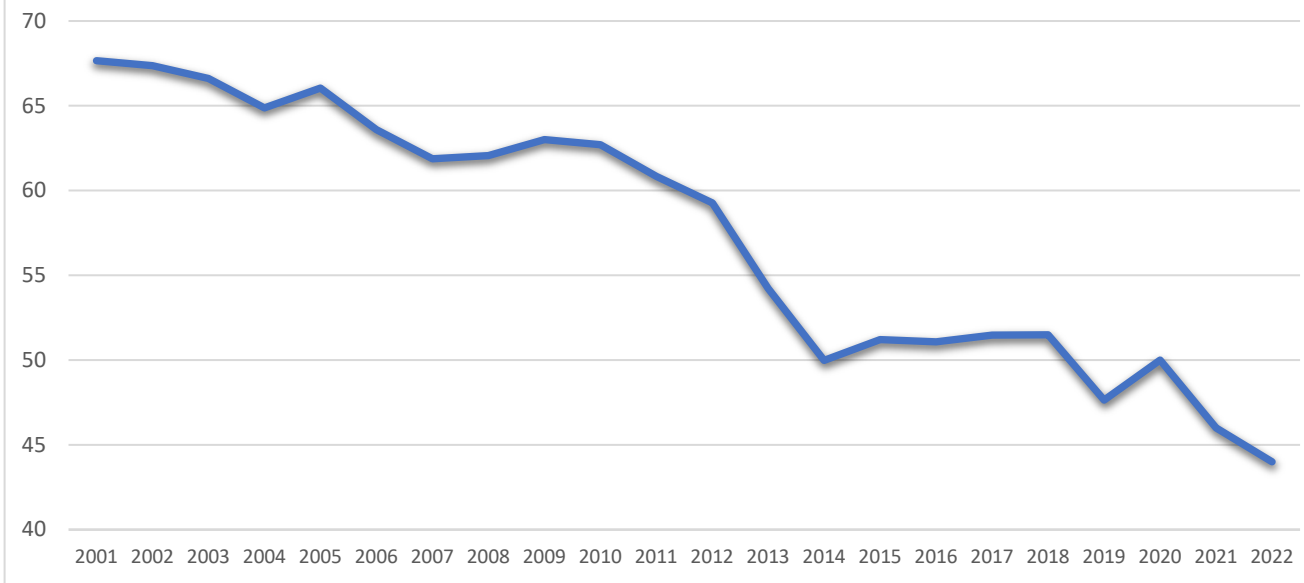
Electric energy utilization

North Dakota has been a major exporter of electricity since the development of thermal lignite generation in western North Dakota beginning in the 1960s. Transmission was developed along with the generation to export the electric generation primarily to markets to the east. In more recent years North Dakota has become noted as an excellent source of wind generation and additional transmission development has taken place to accommodate getting the additional generation to market.

The Energy Information Administration provides data on electric generation for the United States. The information below is derived from their data. In 2020 a total of 42,705 MWhr was generated from all sources in North Dakota. Of that total 46% was exported outside of the state. Wind generation in 2020 was 31% of total generation for North Dakota. Industrial/Demand in North Dakota grew by nearly 11%.

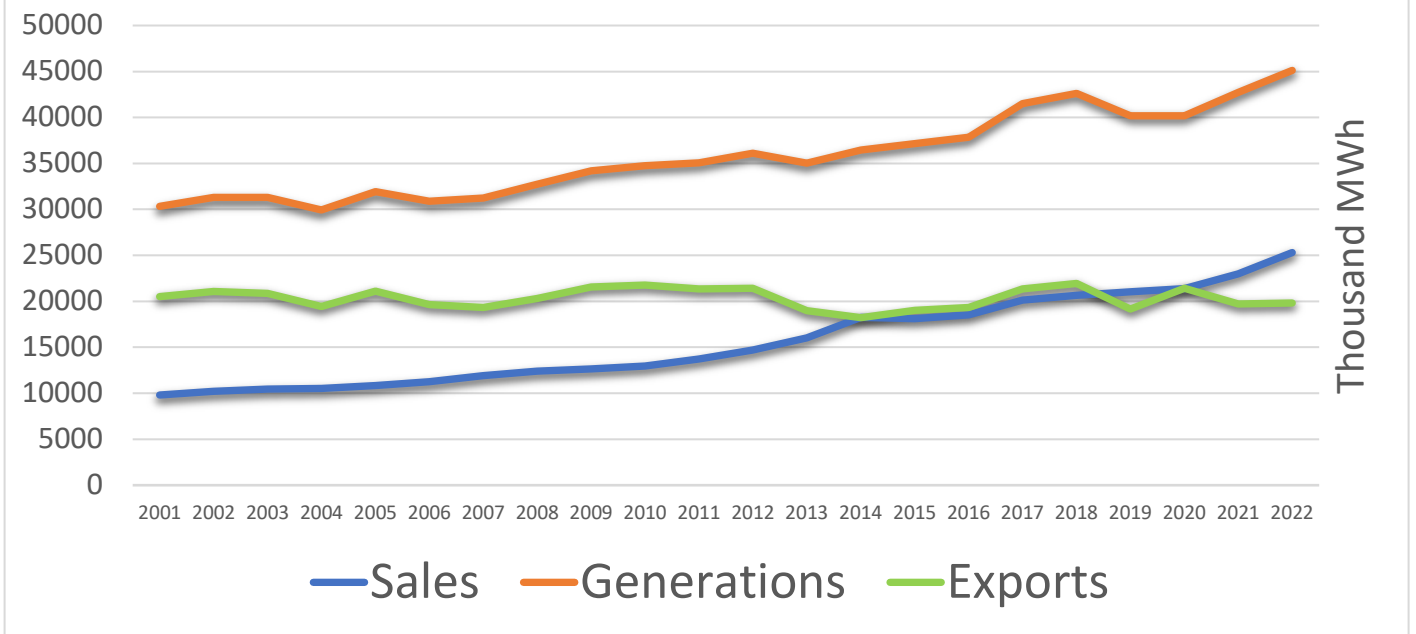


Percent of Generation Exported from ND

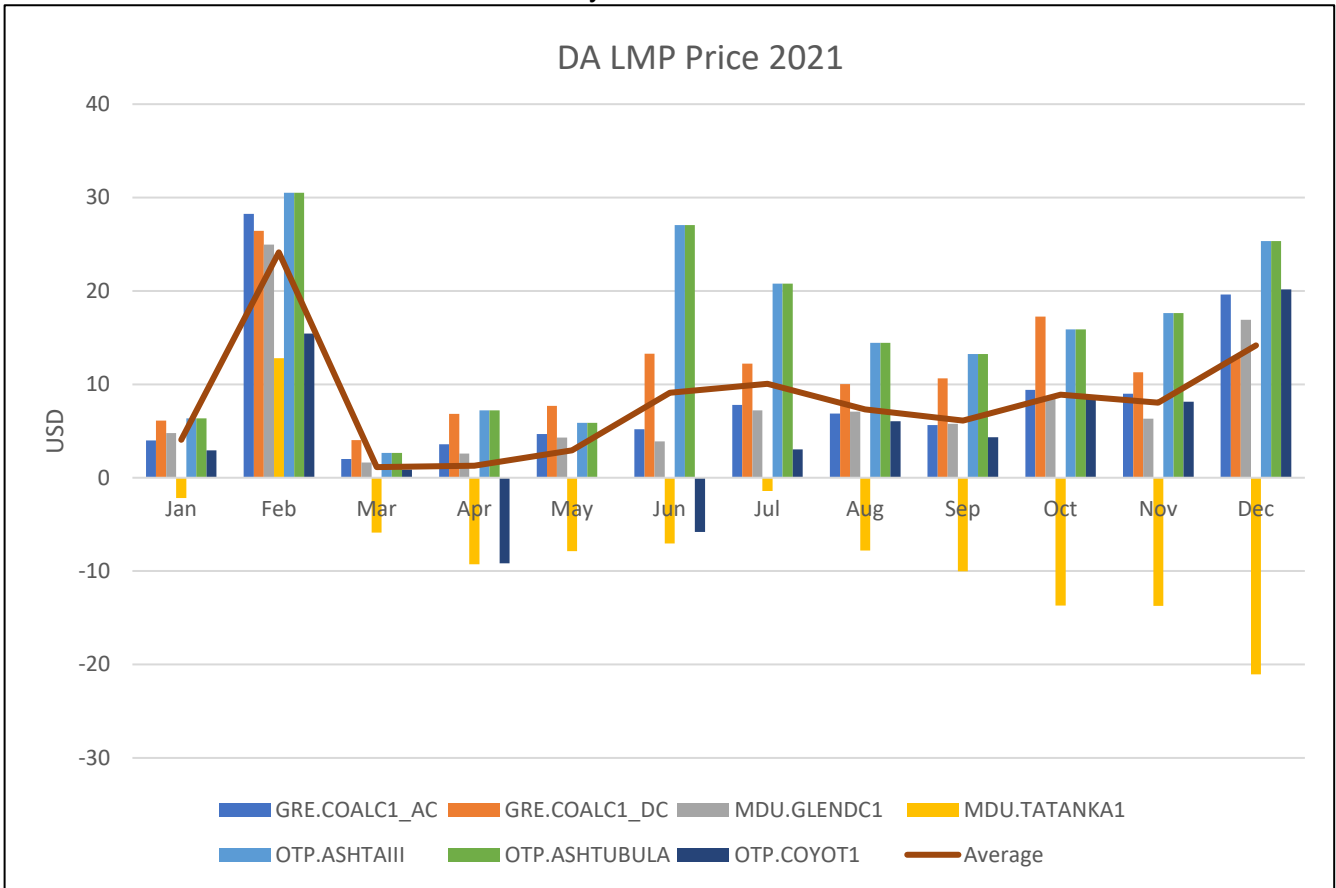


While demand in markets outside of North Dakota and in all but the western part of North Dakota has remained quite flat in recent years, the growth of demand in the Bakken region has been notable. Growth of total generation in the last 16 years has grown from 29,936 MWhr to 42,705 MWhr. Retail sales have grown from 10,516 MWhr to 22,975 MWhr due in large part to growth associated with Bakken oil development. Industrial consumption in North Dakota grew over 11% over 2020 and the power forecast projects a steady increase.

ND Sales, Generations, and Exports



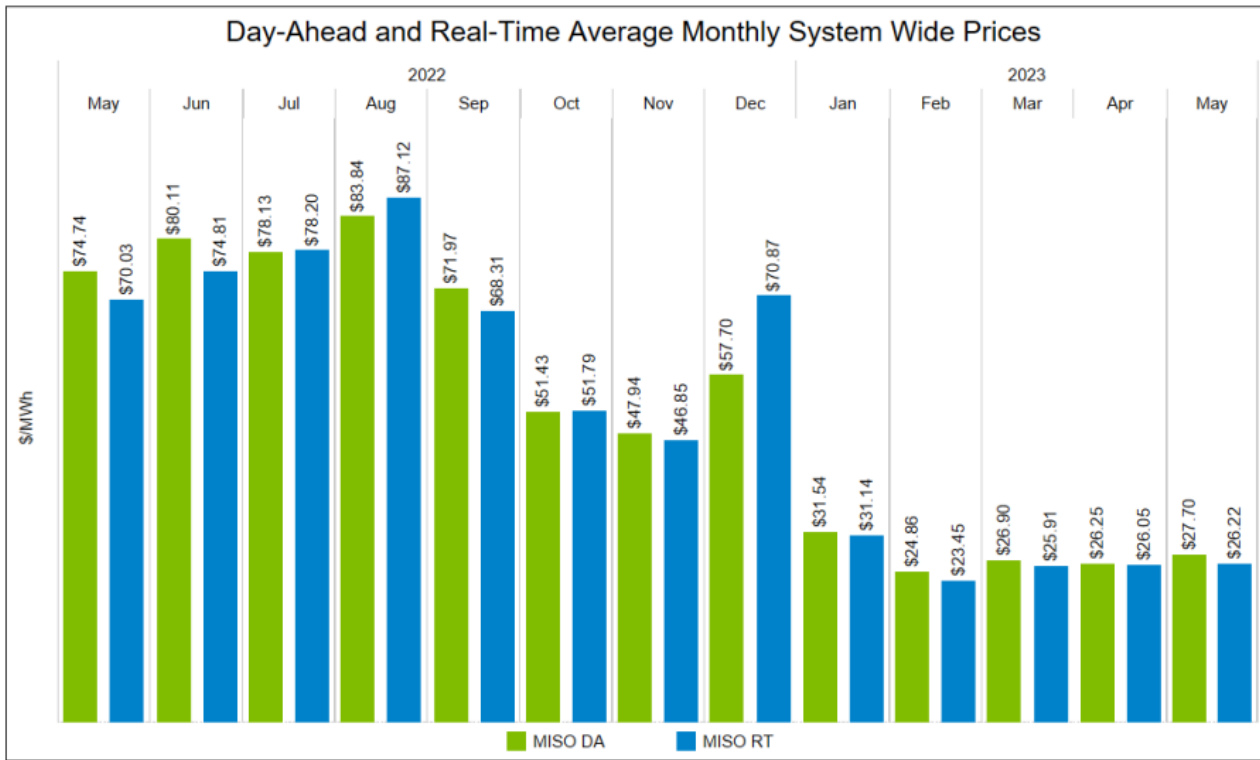
Wholesale Electric Market - With North Dakota being a net exporter of electricity, the wholesale market price is important to the generators in the state. The graphs below reflect the market price for a variety of locations into which North Dakota electricity is marketed both in the MISO and in the SPP areas.



The market strengthened at the end of 2021 and continued in 2022. The graph below shows a much lower market in the first months of 2023, but it is typical that prices rise through the summer. The price of natural gas has a major influence on the electricity market, so summer 2023 will likely be lower due to lower natural gas prices.

Periodic review of real time Locational Marginal Prices (LMP) on the MISOenergy.org website shows a spread in pricing between North Dakota and other states to the south and east especially during times of high demand. Adequate transmission capacity between locations would tend toward more equal pricing as generating resources can be moved through transmission to locations of demand.

MISO System-wide Day-Ahead and Real-Time Locational Marginal Pricing



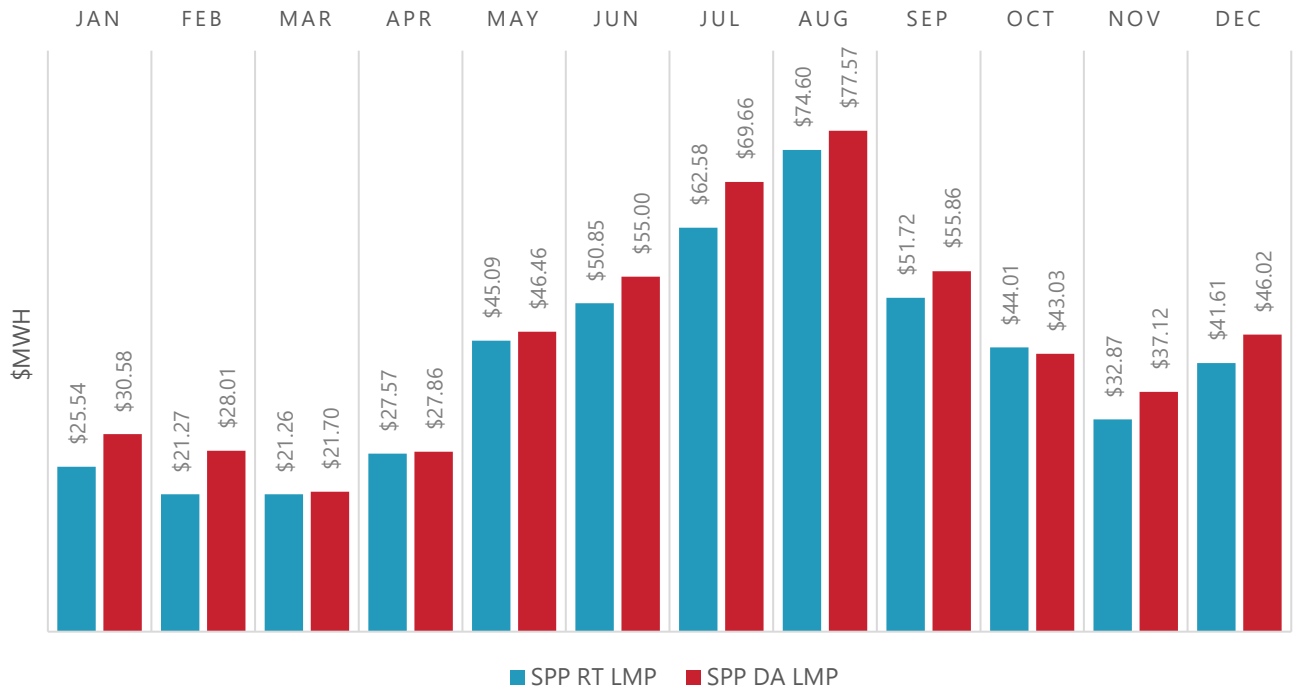
8

Note: MISO System-Wide price is based on the monthly hourly average of the active hubs
 Source: MISO Market and Operations Analytics Department

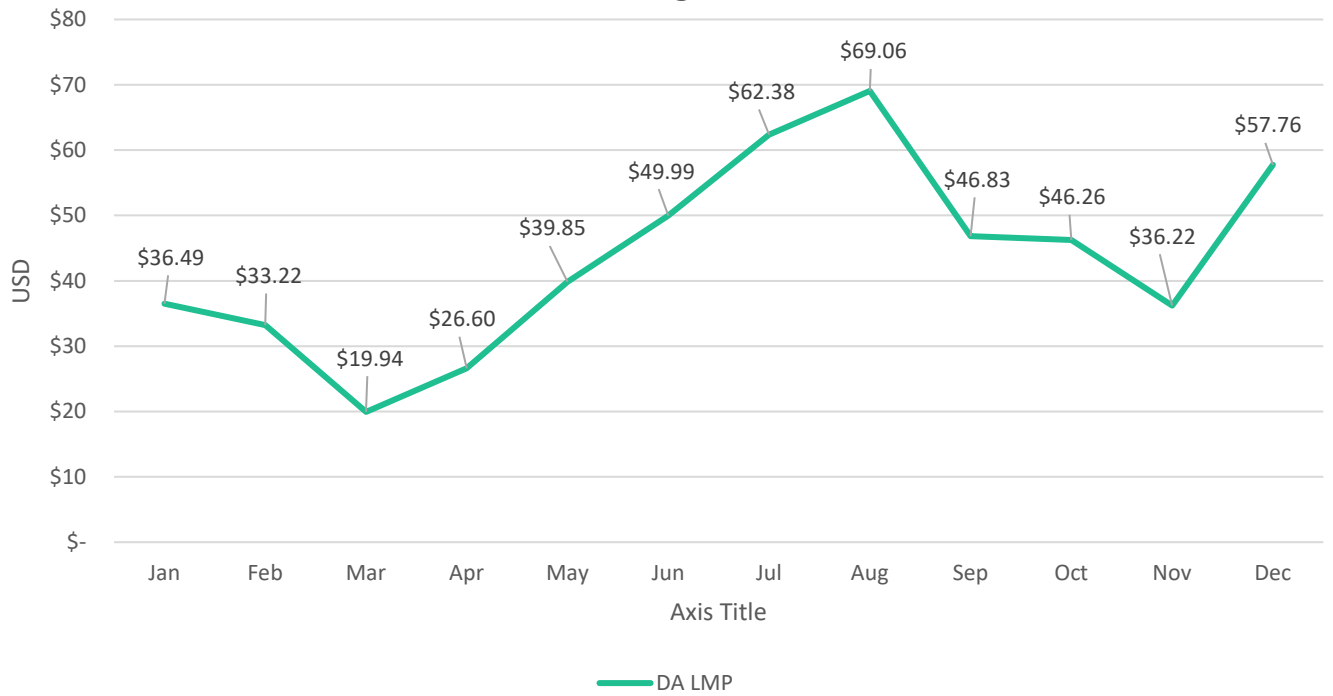


The two tables below show SPP’s 2022 pricing; the first is the SPP system wide day ahead and real time monthly average prices and the second graph demonstrates the average day ahead Locational Marginal Prices for North Dakota SPP points. The average LMP prices in North Dakota are favorable for generators in North Dakota. Since prices vary throughout every hour of the day, off peak (nighttime) pricing is often not adequate to cover the cost at some generating units but they must keep operating in order to be available the next day.

DAY-AHEAD AND REAL TIME MONTHLY AVERAGE SYSTEM-WIDE LMP



ND Average DA LMP 2022



GRID RESOURCE ADEQUACY

Both the MISO and SPP grid operators have issued warnings in 2023² about the adequacy of the generation resources on the grid to meet demand in peak situations. During 2022 it has become increasingly apparent that the pace of change desired is not matching the pace of change achievable. Take for example that prior to 2016, MISO didn't have any grid events that required them to activate the use of its emergency procedures. Since 2016, MISO has had 41 MaxGen events requiring the use of emergency procedures. Many in the industry are projecting that realistic goals will still have us 50% dependent on fossil fueled energy in 2050. Fossil fuel resources can be decarbonized to a large extent by that time, but the ability to be 100% carbon free by that date is becoming more and more unlikely. It is especially unrealistic to project 100% renewable energy by that time as most renewable options are weather dependent and technology for storage is still projected to be very expensive and not available in the massive amount that would be required. Many of the technologies needed to achieve a high level of decarbonization of the electric grid are still in the research and development stages. History has shown that the technologies we currently use took one to three decades to achieve commercial availability.

Governor Bergum issued a challenge goal for North Dakota to be carbon neutral in our combined energy and agriculture industries by 2030. His vision is to achieve that goal thru innovation and not mandates. This initiative attracted the attention of several interests that would like to bring industries and technologies to North Dakota in support of that goal. The initiative would also encourage retaining conventional generation in North Dakota by leading through carbon capture and sequestration technologies. Agriculture practices, enhanced oil recovery, sequestration of CO₂ from ethanol production and several other technologies are leading the way toward that goal.

Energy Information Administration (EIA) has conducted studies and issued reports on the energy future called Annual Energy Outlook 2023 and available on the [eia.gov](https://www.eia.gov) website.

[Narrative 2023 - U.S. Energy Information Administration \(EIA\)](#)

The ISOs will clearly state that they are not responsible for resource adequacy. Instead, they point to states being responsible for capacity through their public utility commissions regulating load serving entities. In many states that is a fallacy because entities such as rural electric cooperatives are not regulated by the public utility commission so therefore resource decisions have no oversight either on the state level or the ISO level. Even utilities that are regulated by state commissions do not have clear signals from either the state or their ISO on what is needed for resources to maintain a reliable grid. Both MISO and SPP have been looking carefully at generation accreditation, planning reserve margins and market design as means to incent capacity decisions by members.

Max Gen Declarations have become more common over the past 6 years

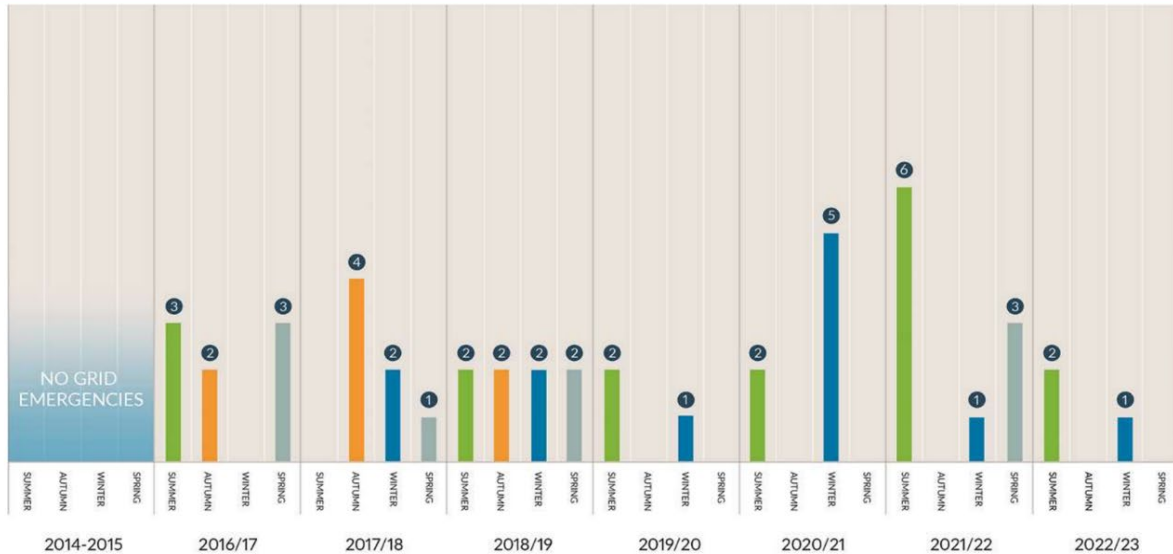


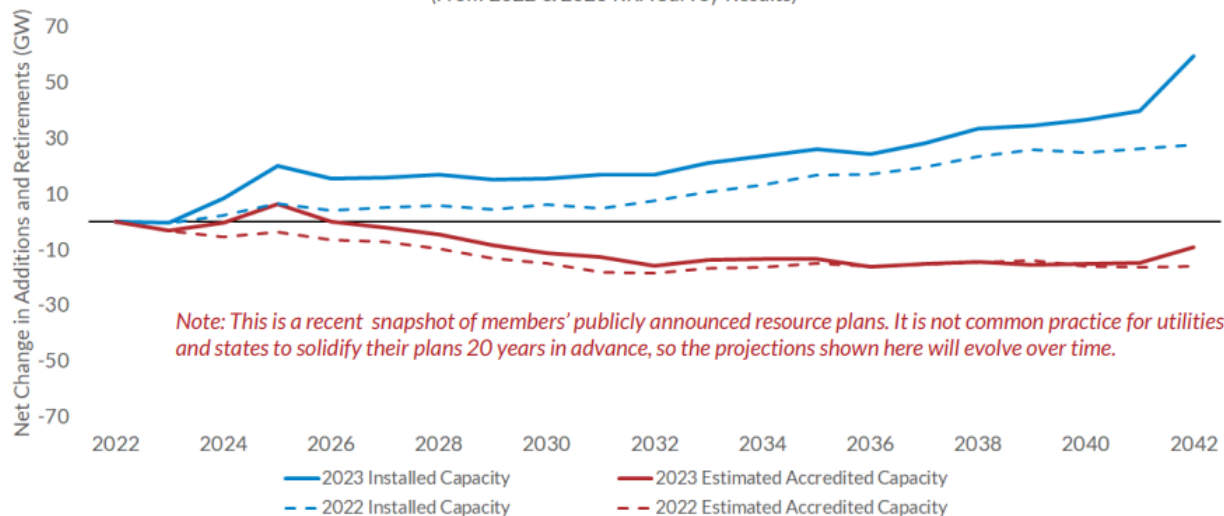
Chart indicates the number of days under a max gen alert, warning or event.



MISO Capacity projections

The region's aggregate capacity picture is improved when compared to last year's RRA Survey, but estimated accredited retirements continue to outpace additions

Projected Capacity Change Based on Member-Announced Plans: 2023 - 2042
(From 2022 & 2023 RRA Survey Results)



Note: This is a recent snapshot of members' publicly announced resource plans. It is not common practice for utilities and states to solidify their plans 20 years in advance, so the projections shown here will evolve over time.

*Estimated Accredited Capacity values based on the 2022 RRA summer-season findings: Nuclear and battery at 95%, coal and gas at 90%, and wind at 18.1%. Solar starts at 50% for the first four years, then declines linearly to 20% by 2033, and is held constant thereafter.
Note: Accreditation assumptions in RRA should not be taken as indicative of the outcomes of the accreditation reform effort underway



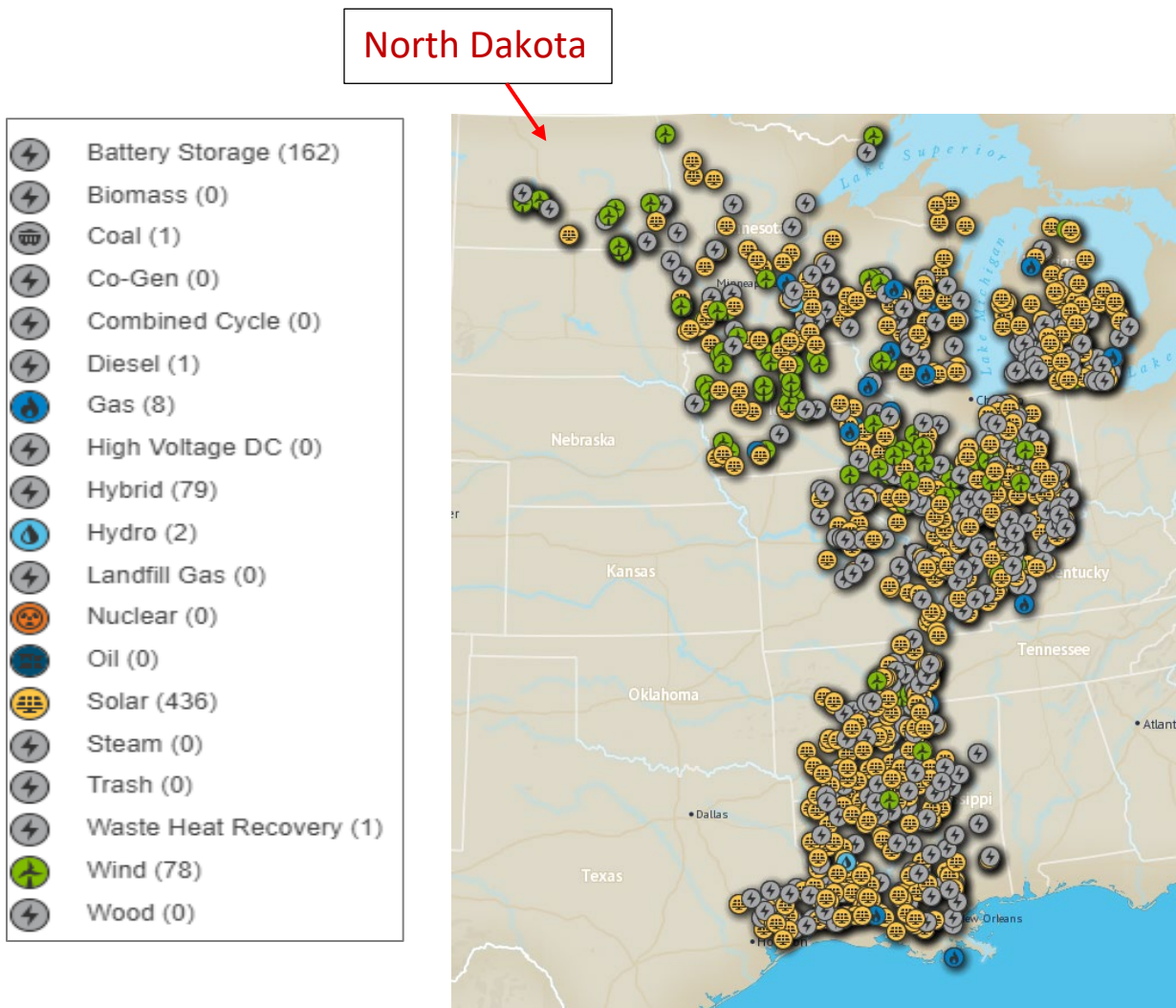
QUEUES FOR TRANSMISSION ACCESS

A good measure of potential for growth in the industry and future demand for transmission expansion is reviewing the projects in queue at MISO, Minnkota Power Cooperative and SPP. The projects in queue include both wind generation and utility scale solar generation.

MISO QUEUE

The MISO queue includes 3225 MW of new generation capacity. The Wind generation total is 1990 MW, the solar generation is 1085 MW and battery storage is 200 MW. The wind component is similar to recent years. There is an increase in solar generation and battery storage is new. The MISO Queue is currently not accepting new applications while the Queue process is revised and submitted for FERC approval.

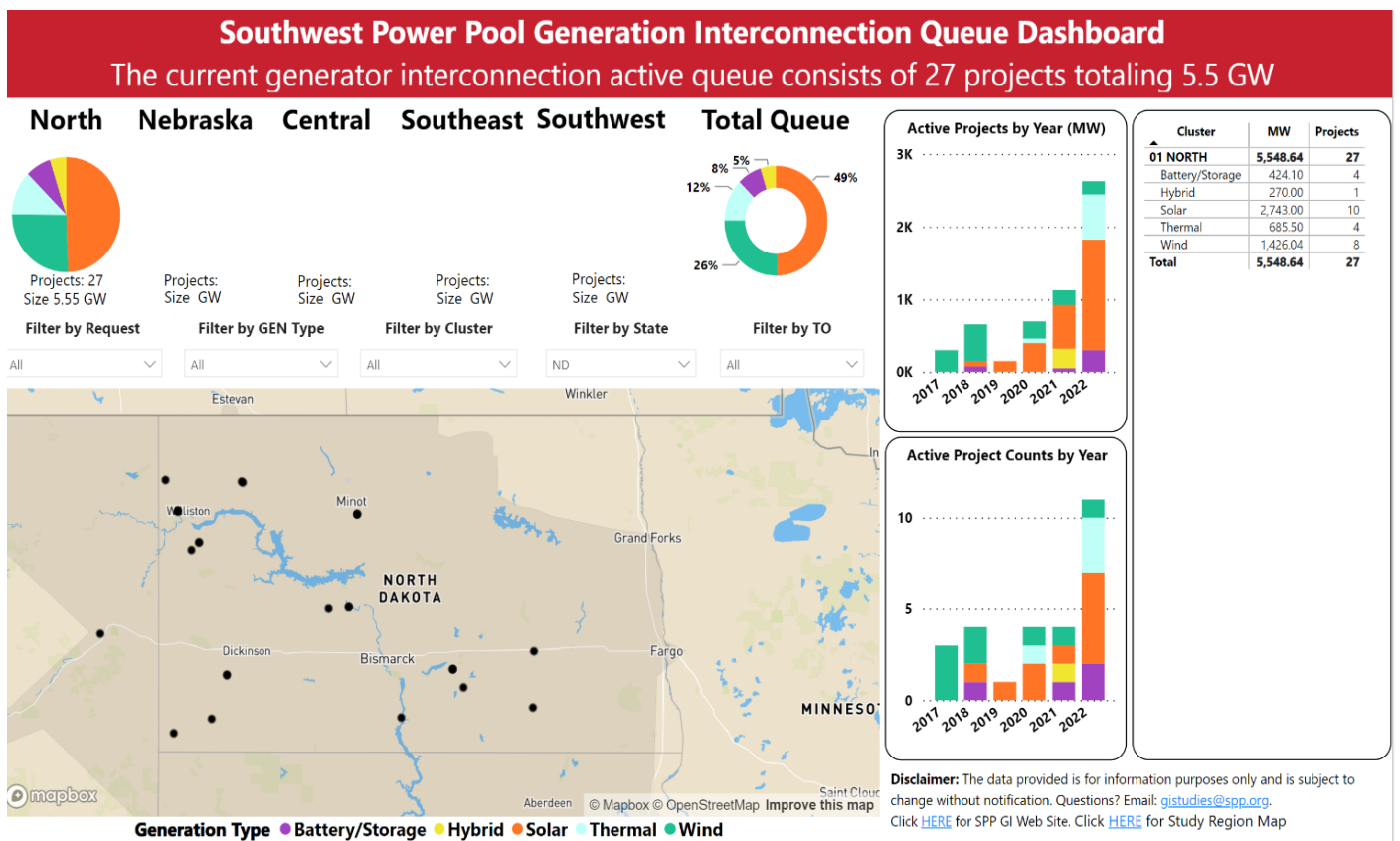
The graphic below demonstrates the magnitude of generation interconnection projects in the MISO queue, systemwide.



Get updated excel spreadsheet from MISOenergy.org website: [GI Interactive Queue \(misoenergy.org\)/planning/generator-interconnect/GI_Queue/gi-interactive-queue/](https://GIInteractiveQueue(misoenergy.org)/planning/generator-interconnect/GI_Queue/gi-interactive-queue/)

SPP QUEUE

SPP total queue for North Dakota is twenty-seven projects totaling 5,548.64 MW. This queue is very large, but does show some diversity. A total of 685.5 MW of thermal generation are in the queue. These are fully dispatchable. A total of 424.1 MW are storage which is dispatchable for at least short periods of time. There are 1,426 MW of wind, 2,743 MW of solar and 270 MW of hybrid solar/storage in the queue. The SPP dashboard demonstrates the placement of the projects; specifics follow in the table.



Disclaimer: The data provided is for information purposes only and is subject to change without notification. Questions? Email: gistudies@spp.org. Click [HERE](#) for SPP GI Web Site. Click [HERE](#) for Study Region Map

Last Update	5/3/2023																		
Generation	County	State	In-Service Date	Com Operation Date	Capacity (MW)	Generation Fuel Type	Substation or Line												
GEN-2023-	Burke	ND	12/31/2024		170	Battery/Storage	Tande 345 kV Substation												
GEN-2022-	Kidder	ND	3/1/2028	9/15/2028	375	Solar	Leland Olds (Secondary) - Groton 345 kV line												
GEN-2022-	Kidder	ND	3/1/2028	9/15/2028	342	Solar	Leland Olds (Secondary) - Groton 345 kV line												
GEN-2022-	Kidder	ND	3/1/2028	9/15/2028	200	Battery/Storage	Line tap of existing Leland Olds (Secondary) - Groton 345 kV line												
GEN-2022-	Stark	ND	3/6/2026	5/30/2026	250	Solar	Miles City to Dawson 230 kV Line												
GEN-2022-	Williams	ND	6/1/2025	11/1/2025	250	Thermal	CTG	Judson Substation 345 kV											
GEN-2022-	Bowman	ND	1/1/2025	10/1/2028	180	Solar		Rhame-Bellfield 230 kV											
GEN-2022-	Williams	ND	4/1/2025	12/31/2025	181	Wind		Pioneer 115 kV Substation											
GEN-2022-	Stark	ND	6/1/2024	12/31/2025	100	Battery/Storage		Daglum 230kV Substation											
GEN-2022-	Stark	ND	6/1/2024	12/31/2025	374	Solar		Daglum 230kV Substation											
GEN-2022-	Williams	ND	7/1/2023	6/1/2025	250	Thermal		Judson Substation 345 kV											
GEN-2022-	Williams	ND	7/1/2023	6/1/2025	125	Thermal		Judson Substation 345 kV											
GEN-2021-	Mercer	ND	9/15/2026	10/19/2027	50	Battery/Storage		Leland Olds 345kV substation											
GEN-2021-	Mercer	ND	6/1/2026	12/1/2027	600	Solar		345kV Transmission Line from Antelope Valley to Leland Olds Substation											
GEN-2021-	LaMoure	ND	10/22/2026	12/22/2026	203.04	Wind		WAPA 230kV Jamestown Substation											
GEN-2021-	McKenzie	ND	5/9/2026	10/19/2027	270	Hybrid	Solar/Storage	345kV Bus at BEPC Patent Gate Substation, McKenzie County, ND											
GEN-2020-	McKenzie	ND	11/2/2025	11/19/2026	150	Solar		Patent Gate Substation 345 kV											
GEN-2020-	Sioux	ND	11/30/2023	12/31/2025	235	Wind		Leland Olds-Chapelle Creek 345kV line											
GEN-2020-	Alexander	ND	6/17/2021	10/18/2021	60.5	Thermal	Gas	Lonesome Creek 115kV											
GEN-2020-	Bowman	ND	11/1/2023	12/31/2026	250	Solar		Bowman 230kV substation											
GEN-2019-	Mercer	ND	12/1/2023	11/19/2024	150	Solar		Leland Olds 345kV substation											
GEN-2018-	Williams	ND	10/30/2020	10/30/2026	255	Wind		115kV Strandahl sub											
GEN-2018-	LaMoure	ND	12/31/2020	12/31/2028	72	Solar		Edgeley 115kV substation											
GEN-2018-	Montrail	ND	12/1/2021	12/31/2025	74.1	Battery/Storage		Neset 230kV Substation											
GEN-2018-	McIntosh	ND	9/30/2021	6/1/2025	252	Wind		Groton-Leland Olds 345kV Line											
GEN-2017-	Ward	ND	12/1/2020	12/30/2026	50	Wind		Logan 230kV Substation											
GEN-2017-	Ward	ND	12/1/2020	12/30/2026	50	Wind		Logan 230kV Substation											
GEN-2017-	Ward	ND	12/1/2020	12/30/2026	100	Wind		Logan 230kV Substation											
GEN-2017-	Ward	ND	12/1/2020	12/30/2026	100	Wind		Logan 230kV Substation											
GEN-2017-	Ward	ND	12/1/2020	12/30/2026	100	Wind		Logan 230kV Substation											
GEN-2017-	Williams	ND	8/30/2024	12/31/2025	300	Wind		Neset 230 kV Substation											
GEN-2017-	Bowman	ND	10/31/2022	12/12/2025	200.1	Wind		Rhame 230 kV Sub											
GEN-2016-	Burke	ND	9/15/2019	12/22/2020	202	Wind		Tande 345kV											
GEN-2016-	Mercer	ND	9/15/2019	12/31/2022	202	Wind		Leland Olds 345 kV											
GEN-2016-	Barnes	ND	12/31/2018	12/31/2024	100.05	Wind		Valley City 115 kV											
GEN-2016-	Oliver	ND	10/5/2022	12/31/2025	202	Wind		Basin Electric 230 kV											
GEN-2015-	Hettinger	ND	12/31/2017	12/29/2016	150	Wind		Brady 230kV substation											
GEN-2015-	Williams	ND	12/1/2017	5/27/2021	300	Wind		Tande 345kV											

MINNKOTA QUEUE

The Minnkota Power Queue includes 7 projects. Two are solar for 342 MW and 5 are wind.

Minnkota Queue Position	Interconnect Request	Generation Type	POI Location County / State	Point of Interconnection
MPC03600	195.5	SOLAR	Richland, ND	Frontier-Wahpeton 230 kV
MPC03700	146.6	SOLAR	Richland, ND	Frontier-Wahpeton 230 kV
MPC03800	230.0	WIND	Eddy, ND Wells, ND	Center-Prairie 345 kV
MPC03900	140	WIND	Eddy, ND Wells, ND	Center-Prairie 345 kV
MPC04100	204	WIND	Grand Forks, ND	Prairie 230 kV
MPC04300	400	WIND	Steele, ND	Center-Prairie 345 kV
MPC04400	200	WIND	Grand Forks, ND	Center-Prairie 345 kV

1516.1

Capacity factors for Wind Generation in the region- North Dakota has the highest capacity factor in the region. The investment dollars for wind generation will get a better return on investment if the transmission capacity is available to get the generation to market. Since the market demand is primarily to the east that is where the transmission capacity need is the greatest. Wisconsin, Michigan, Illinois, and Indiana are states where renewable energy is in demand and where planners would like to be able to transfer generation from North Dakota. Developers weigh the higher return available and the higher prices at the eastern market nodes against the cost of transmission to reach those markets. Currently, however, the high transmission costs are preventing development in North Dakota with market focus on that region. Resolving that transmission barrier is a focus of the NDTA.

In the SPP area the path to market is not as clear, but the size of the queue shows a strong interest by developers. So far high interconnection costs have not resulted in projects being cancelled in large numbers.

RENEWABLE ENERGY CERTIFICATES

Each unit of electricity generated from a renewable source such as wind or solar carries with it a Renewable Energy Certificate (REC). The REC program is authorized by the United States Environmental Protection Agency (USEPA) to encourage renewable generation. The REC is a separate commodity from the electron delivery. The RECs can be utilized as evidence that the party that “retires” the REC as they utilize electricity supports renewable generation. The REC does not carry a time of day, season, or transmission obligation. As such, RECs are used to meet pledges to utilize renewable energy beyond the ability of the grid to deliver on a real time basis.

Many companies are using the RECs as evidence of their commitment to renewable energy. The challenges of grid attributes needed as we move toward a higher level of renewable energy on the grid are not addressed by the use of RECs so it is important to recognize that a commitment beyond the use of RECs will be required in the near future.

The most challenging aspect of operating the grid is maintaining a proper balance of generating resources, maintaining proper voltage at all locations, adjusting the VARs that the grid requires to keep the combination of motors and other types of load operating properly and balancing the transmission lines to avoid overload and other congestion issues. Since RECs bypass all these very real operating challenges, they do not contribute to solving our most challenging issues and arguably could be a delaying factor in getting the grid right.

GOVERNMENT ACTION

Another function of the Authority staff is to act as a resource for elected officials and policymakers and provide the necessary information to help make informed decisions. Whether the issue involves working on state energy policy regarding transmission development, or commenting on federal transmission legislation and regulations, the Authority serves as a resource for decision-makers. In the last year the Authority was involved on several fronts working with the following entities: The EmPower ND Commission, Governor’s Office, the North Dakota Legislature, Attorney General’s Office, Department

of Commerce, the ND Public Service Commission, the Bank of North Dakota, and the ND Congressional Delegation.

- **EmPower ND Commission** - The Authority was an active participant in the EmPower ND Commission work. Authority activities included briefing the Commission on transmission issues in North Dakota and participating in development of Commission goals.
- **North Dakota Legislature** - the 2023 legislative session was deeply involved in energy issues for which they sought NDTA input. Issues surrounding transmission ranged from right-of-way easements, grid reliability to resource adequacy.
- **Interagency Coordination** - As important as everything else discussed in this report, is the coordination of efforts among the various government entities with oversight, or interest in transmission development. Regular meetings are held with the representatives from the Public Service Commission to discuss transmission issues and receive updates from RTOs.
- **ND Pipeline Authority** – Coordinate energy forecasts, oil field demand, new technologies and other developments that will impact the grid from a demand or supply standpoint.
- **Clean Sustainable Energy Authority (CSEA)** – Participate in the technical review committee and provide input to the CSEA members on the potential benefit of projects to North Dakota and their relationship to the electric grid.
- **WIND** - NDTA works with the group of developers through their trade association to collect information about renewable projects and to share activities of the NDTA.
- **Midwest Governors Association (MGA)** - NDTA has worked closely with the Governor’s office to monitor and participate in activities of MGA. Even though North Dakota is not officially as member of MGA the interaction has been helpful in bringing the North Dakota message to the region.

The Public Service Commission, the Governor’s staff and the NDTA participated in the Midwest Governors association work on setting goals for grid modernization. The goal of a carbon neutral North Dakota has an impact on the conversation. The MGA states are expressing interest in learning more about how the goal can be achieved. A seminar was held in August 2021 to present the vision.

CONCLUSION

The electric transmission system in North Dakota is operating well and serving the load reliably with the current generation under average conditions but peak demand times are becoming uncertain. The growth in demand in western North Dakota is challenging the suppliers in that area of the state. They are pursuing both transmission improvements and generation additions to keep pace with the demand. The increase in conservative operations notices, max generation events and emergency procedures is

a concern as demand grows. In addition, the seasonal reliability reports issued by the North American Reliability Council have become increasingly concerning about the ability of the grid to be reliable in extreme weather events. Transmission congestion is affecting North Dakota generation resources negatively and wholesale prices are more volatile.

The combined Queues of the three entities are 9,115MW. Nearly all of the projects in the Queues are wind and solar. The ISOs need a balance of resources to keep the grid resilient under all conditions. The efforts of the ISOs and states need to be coordinated to assist the generators and transmission owners to meet that objective.

The pace of change to the grid is a cause of concern to many in the industry. North Dakota has made a clear declaration the “all of the above” energy resources are embraced and supported. The present situation encourages us to continue that path in the electric industry as well. There is a lot of opportunity in North Dakota for increased generation if it is done in a manner that complements the resources that provide the ISOs with resources that can meet the needs at all times and in all weather conditions.

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Thanks for the Energy Information Administration (EIA), Southwest Power Pool (SPP), Midcontinent Independent System Operator (MISO), area utilities and WIND and their members especially.

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