Energy Policy and Conservation Quadrennial Report, 2024

Pursuant to Minnesota Statutes § 216C.18

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REPORT PREPARED BY

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Data presented in this report were accessed from February to June 2024. These data, to the extent possible and practicable, are through the end of December 2023. When more data were available through a later date in 2024, the later date is specified therein. Figures are consistent with data that were available as staff prepared this report. Energy data are constantly being updated, and users may find that data that underlie figures in this report have been updated and may no longer reflect the information presented here.

Satisfying the statute

Minnesota Statutes section 216C.18, subdivision 2, requires that a draft of the *State Energy Policy and Conservation Report* be issued to the Minnesota Environmental Quality Board (EQB) and a public meeting be held prior to the finalization of the report. This section details those requirements:

The *2024 State Energy Policy and Conservation Report* was an item on the Environmental Quality Board's May 15, 2024, meeting agenda, where board members learned about the report in advance of receiving the draft. Commerce provided a draft of the report to EQB via email on June 12, 2024.

Commerce held a virtual public meeting for the draft *2024 State Energy Policy and Conservation Report* on June 12, 2024, with over 60 attendees. A draft version of the report was provided to all meeting registrants on June 11 and June 12, 2024, depending on when people registered for the meeting. Recipients had until June 19, 2024, to comment on the draft report. Appendix 1 to this report includes a list of comments received verbally during the public meeting and received in written format by June 19, 2024. Commerce provided notice of the public meeting to each regional development commission via the Commerce GovDelivery system.

Minnesota Department of Commerce

With You Every Day

Wherever you are in Minnesota, the Department of Commerce ("Commerce") is with you every day. Whether you're filling up on gas, purchasing a home, working to reduce energy consumption, or rebuilding after a disaster—we are with you, no matter what.

Mission:

For more than 150 years, Commerce and its predecessor agencies have served Minnesotans. Our mission is to protect and assist consumers; to ensure a strong, competitive, and fair marketplace; and to engage people and communities across the state.

Our Strategic Priorities:

- Protect the public interest through consumer protection, consumer education, assistance to consumers, safety, health, and financial security, and lowering inequities.
- Serve as a trusted public resource for consumers and businesses by listening and learning from the Minnesotans Commerce serves, being effective stewards of public resources, advocating for Minnesota consumers, and develop a policy, programmatic, and regulatory environment that meets their needs.
- Reduce economic barriers within Commerce regulatory oversee and reduce disparities within those of all races, ethnicities, religions, economics statuses, gender identities, sexual orientations, (dis)abilities, and zip codes.
- Ensure all, especially historically disadvantaged Minnesotans, are resilient to Minnesota's climate and engaged in advancing efforts to mitigate climate change.
- Ensure a strong, competitive, and fair marketplace for Minnesotans.

For more information about the Department of Commerce: mn.gov/commerce. For more information about Commerce's work with energy: mn.gov/commerce/energy

Partner Agencies

These state agencies prepared and reviewed portions of this report that fall under their regulatory authority.

Minnesota Public Utilities Commission

The Minnesota Public Utilities Commission (PUC) regulates energy rates, resource planning, distributed energy, and interconnection standards, along with playing a part in the build-out of smart grid and electric vehicle infrastructure. The PUC also reviews requests by utilities and non-utilities that want to build large energy infrastructure projects like transmission lines, power plants, solar farms, wind farms, and pipelines.

Minnesota Pollution Control Agency

Through the authority of state and federal statutes and guidelines, the Minnesota Pollution Control Agency (MPCA), focuses on preventing and reducing air, land, and water pollution, while improving human health and fostering strong economic growth. MPCA also leads Minnesota's efforts to protect against the effects of climate change, so the agency collaborates with Commerce to address greenhouse gas emissions from the energy, buildings, and transportation sectors.

Minnesota Department of Administration

The Minnesota Department of Administration (Admin) oversees and manages the administrative functions of other executive branch state agencies, from contracting to facilities management and more. Admin's Office of Enterprise Sustainability guides efforts to lower the energy and water use and greenhouse gas emissions of the enterprise's facilities and vehicle fleets while increasing sustainable procurement and the diversion of solid waste.

Minnesota Department of Labor and Industry

The Minnesota Department of Labor and Industry (DLI), oversees a variety of labor and code-related areas, from labor standards and occupational safety and health to construction codes and licensing. In this report DLI's building codes and energy conservation subject matter experts contributed to the sections about buildings and electric vehicle charging stations.

Minnesota Department of Transportation

The Minnesota Department of Transportation (MnDOT), works to create a multimodal transportation system that maximizes Minnesotans' health and Minnesota's environment and economy. In this report MnDOT's electric vehicle infrastructure subject matter experts contributed to the transportation section.

Table of Contents

Table of Figures 11

Key to Acronyms 14

Chapter 1: Energy State of the State 17

What's in the Report? 17

Overview of Minnesota's Energy Landscape 18

Energy Overview 19

Progress Towards Reaching Minnesota's Energy Standards & Goals since 2020 20

Carbon-free Electricity Standard 20

Renewable Electricity Standard 20

Solar Electricity Standard 21

Energy Savings Goals 22

Preference for Renewable Energy in Resource Planning 24

Renewable Energy Goal for Total Energy Use 25

Greenhouse Gas Emissions Reduction Levels 26

2020–2023 Federal Energy Policy Changes 27

Synopsis of Acts: 27

2020–2023 Minnesota Energy Policy Changes 31

The 2020 Legislative Session 31

The 2021 Legislative Session 32

The 2022 Legislative Session 34

The 2023 Legislative Session 34

Chapter 2: Minnesota Energy Leadership 45

Energy Reduction Activities of State Agencies 45

Energy Intensity for Minnesota Agencies 45

Energy, Water, and Greenhouse Gas Workgroup 47

Supporting Community-Led Efforts 47

Community Energy Collaborative 47

Clean Energy Resource Teams (CERTs) 48

GreenStep Cities, Tribal Nations, and Schools 49

Climate-Smart Municipalities 50
Solar for Schools 51
Solar on Public Buildings 52
Community Solar Gardens 52
Partnering with Tribal Nations 53
Assisting Business-Led efforts 55
Minnesota Climate Innovation Finance Authority (MnCIFA) 56
Public-private partnerships 56
Clean Energy Jobs 57
Chapter 3: Minnesota Utility Rates 60
Minnesota Retail Utility Rate Policy and Design 60
Background 60
Cogeneration & Small Power Production and other Distributed Generation 60
Minnesota State Energy Policy in Minn. Stat. § 216C.05 68
Chapter 4: Minnesota Resource Permitting, Planning, and Reliability 76
Site and Route Permitting 77
Activity and Policies 78
Looking Forward 79
Resource Planning 82
Activity and Policies 83
Emerging Trends and Issues 85
Energy Reliability, Security, and Response 87
Background 87
Energy Security Planning and Response 87
Reliability 88
Planning Ahead 92
Chapter 5: Power Generation, Consumption, and Energy Projections in Minnesota 94
Power Generation Transition 94
History of power generation and progress towards related statutes 94
Emissions Reduction Progress 98

Electricity generation ... 101
Biofuels ... 116
Emerging Fuels ... 117
Energy Storage ... 118
Hydrogen as a Source of Clean Energy ... 120
Energy Consumption ... 122
Demographic and Energy Use Trends ... 125
Projections ... 128
Planning for Carbon-Free Electricity ... 129
Projections for Energy Use ... 132
Supply Chain Disruptions ... 134
Chapter 6: Energy Efficiency and Affordability ... 138
Energy Conservation and Optimization Program ... 138
Regulatory Requirements ... 139
Energy Savings Requirements ... 139
Program Spending Requirements ... 140
Activity and Policies ... 141
Projections ... 149
Energy Affordability Efforts ... 152
Reducing Energy Burden for Low-Income Minnesotans ... 152
Low-Income Home Energy Assistance Program ... 154
Low-Income Weatherization Assistance Program ... 156
New federal and state funding for home energy efficiency ... 162
Chapter 7: Energy Reduction Efforts in Buildings, Water, and Transportation Sectors ... 165
Building Energy Use ... 165
Policies for New Construction ... 165
Sustainable Buildings 2030 Performance Standards ... 167
Policies for Existing Buildings ... 169
Local Governments ... 170
Building End Uses ... 171

Recommendations for Commercial Building Energy Use 172
Public Water System Energy Use 173
Opportunities for financing water infrastructure 173
Activities and Policies since 2020 174
Emerging Trends 175
Transportation 177
Light-Duty Vehicles 177
Medium- and Heavy-Duty Vehicles 178
Electrifying Minnesota's School Buses 180
Charging Infrastructure 180
Looking forward 183
Appendix 1 186

Table of Figures

Figure 1-A: MISO North Electricity Generation Mix (2023)
Figure 1-B: Minnesota's solar generating capacity has grown rapidly since 2015.
Figure 1-C: ECO Electric Results 2011–2021
Figure 1-D: ECO Natural Gas Results 2011–2021
Figure 1-E: Utilities are planning to transition to an energy mix that is over 80% carbon free by 2035.
Figure 1-F: In 2022, 13% of all energy consumed in Minnesota came from renewable sources.
Figure 1-G: Minnesota will likely miss its goal of 25% of total energy use from renewables by 2025.
Figure 1-H: Joint Targeted Interconnection Queue
Figure 1-I: Energy-related IIJA Grants to Minnesota Governments
Figure 1-J: State Competitiveness Grants funding, FY2024–2025
Figure 2-A: Energy Use Intensity (2017–2022)
Figure 2-B: Total Energy Use by Source (2017–2022)
Figure 2-C: Minnesota's Cumulative K-12 Solar Schools
Figure 2-D: Xcel Energy Solar Garden Subscription Metrics
Figure 2-E: Clean Energy Jobs in MN between 2019 and 2022
Figure 3-A: Annual and Cumulative Distributed Energy Resource Interconnections, 2012–2023
Figure 3-B: Cumulative Installed Distributed Energy Resource Capacity (MW), 2012–2023
Figure 3-C: Comparison of Minnesota Statutes and Rules related to Public Utility Regulatory Policies Act (PURPA) for Distributed Energy Resources
Figure 3-D: Emissions by Minnesota Economic Sector (Carbon dioxide Equivalent (CO_2e) tons)
Figure 3-E: Minnesota Average Electric Rates by Customer Class compared to National Averages
Figure 3-F: Estimated Typical Cost Recovery Minnesota Residential Electric Bill
Figure 3-G: Energy Utility Riders for Cost Recovery Approved in Minnesota Statute
Figure 4-A: U.S. Electric Power Regions
Figure 4-B: Minnesota PUC Permitting Process
Figure 4-C: Minnesota PUC Permitting Actions (2020–2023)
Figure 4-D: Minnesota Utility Resource Planning Processes (2017–2024)
Figure 4-E: Minnesota Four Energy Regulatory Processes
Figure 5-A: Utility Renewable Electricity Standard Compliance Outlook
Figure 5-B: Minnesota's GHG Emissions by Activity (2005–2020)
Figure 5-C: United States Electricity Generation Mix (2003 and 2023)
Figure 5-D: Average Emissions by Utility
Figure 5-E: Minnesota Capacity Additions and Retirements (2012–2022)
Figure 5-F: MISO North Electricity Generation Mix (2023)
Figure 5-G: Midwest Power Grid Subregions
Figure 5-H: Electricity Generated in Minnesota (2003 vs. 2023)
Figure 5-I: Minnesota Renewable Electricity Generation (2003–2023)

Figure 5-J: Minnesota and U.S. Renewable Electricity (2003–2023)
Figure 5-K: Minnesota and U.S. Coal Electricity (2003–2023)
Figure 5-L: Minnesota and U.S. Carbon Intensity of Electricity (2003–2022)
Figure 5-M: Economic and Seasonal Dispatch of Coal
Figure 5-N: Upcoming Retirements of Coal-Fired Power Plants in Minnesota
Figure 5-O: Power Generation Transition in Minnesota (2020–2023)
Figure 5-P: Monthly Henry Hub Natural Gas Spot Price (Past 60 Months)
Figure 5-Q: Natural Gas Volatility in Electricity Generation
Figure 5-R: Minnesota Electricity Generation—Total and Renewables
Figure 5-S: MISO Active Queue by Study Area
Figure 5-T: MISO Queue Historical Trend
Figure 5-U: Levelized Cost of Energy Comparison
Figure 5-V: Minnesota Wind Power Capacity (2007–2023)
Figure 5-W: Minnesota Annual Solar Installations (2013–2022)
Figure 5-X: Minnesota Solar Power Capacity (2013–2023)
Figure 5-Y: Cumulative Storage Capacity
Figure 5-Z: The hydrogen color spectrum and indications for carbon emissions
Figure 4-AA: Heartland Hydrogen Hub as initially planned
Figure 5-BB: Renewables as % of Minnesota's Total Energy Supply (2003–2022)
Figure 5-CC: Minnesota Total Energy Consumption by Source (2003–2022)
Figure 5-DD: Minnesota Total Energy Consumption by Source (2003 vs. 2022)
Figure 5-EE: Minnesota's Total Energy Consumption from Renewables (2003–2022)
Figure 5-FF: Minnesota Electricity Use by Customer Type (2015–2021)
Figure 5-GG: Minnesota Per-Customer Electricity Use by Customer Type (2015–2021)
Figure 5-HH: Minnesota Natural Gas Use by Customer Type (2015–2021)
Figure 5-II: Heating Degree Days in the West North Central Census Division (2015–2021)
Figure 5-JJ: Weather Normalized Natural Gas Use by Customer Type (2015–2021)
Figure 5-KK: Energy Generation by Source (2023–2033)
Figure 5-LL: Generation Capacity Changes by Sources (2023–2033)
Figure 5-MM: Utilities are planning to transition to an energy mix that is over 80% carbon free by 2035
Figure 5-NN: Projected CO2 Emissions under Minnesota's Climate Action Framework
Figure 5-OO: Projected Electricity Use in Minnesota
Figure 5-PP: Projected Electricity Use in Minnesota by Customer Type
Figure 5-QQ: Projected Gas Use in Minnesota
Figure 6-A: CIP/ECO Program History
Figure 6-B: ECO Electric Results 2011–2021
Figure 6-C: ECO Natural Gas Results 2011–2021
Figure 6-D: 2022 Electric Income-eligible ECO Spending (Total $6.4 million)
Figure 6-E: 2022 Natural Gas Income-eligible ECO Spending (Total $10.5 million)

Figure 6-F: 2022 Electric Income-eligible ECO Savings (Total 5.1 GWh)
Figure 6-G: 2022 Natural Gas Income-eligible ECO Savings (Total 36,979 Dth)
Figure 6-H: Electric Savings Program Potential by End Use (2029)
Figure 6-I: Natural Gas Savings Program Potential by End Use (2029)
Figure 6-J: Energy Burdens for Low-Income Minnesota Households by County
Figure 6-K: Change in Energy Burden for Households Receiving Energy Assistance by Heating Fuel Type (Program Year 2023)
Figure 6-L: Minnesota Energy Assistance Program service providers and territories (2021)
Figure 6-M: Minnesota Weatherization Service Providers (2023)
Figure 7-A: Improvement in Residential and Non-Residential Model Energy Codes (1975–2022)
Figure 7-B: GHG Emissions in Minnesota Cities (2020)
Figure 7-C: Estimated Residential Energy Consumption by End Use
Figure 7-D: Estimated Commercial Energy Consumption by End Use
Figure 7-E: Overview of EV chargers: power output, plug type, and charge time for light-duty vehicles

Key to Acronyms

Acronym	Definition
ACEEE	American Council for an Energy-Efficient Economy
AFC	alternative fuel corridors
AIR	Asbestos Insulation Removal
ARR	applicable retail rate
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
B3	Buildings, Benchmarks, and Beyond
BIL	Bipartisan Infrastructure Law, see also IIJA
Btu	British thermal units
CARD	Conservation Applied Research and Development
CEC	Community Energy Collaborative
CEJST	Climate and Economic Justice Screening Tool
CERTs	Clean Energy Resource Teams
CIP	Conservation Improvement Program (now ECO)
CO_2	carbon dioxide. Byproduct of combustion and other industrial processes. One of the main greenhouse gases that contribute to climate change.
CO_2e	carbon dioxide equivalent
C-PACE	Commercial Property Assessed Clean Energy
C&S	codes and standards
CEJST	Climate and Economic Justice Screening Tool
CSB	clean school bus
CSG	community solar garden
CWRF	Clean Water Revolving Fund
DCFC	direct current fast charging
DER	distributed energy resource
DERA	Diesel Emissions Reduction Act
DLI	Minnesota Department of Labor and Industry
DOE	U.S. Department of Energy
Dth	dekatherms = 1 million Btu = the approximate energy content of 1,000 cubic feet of natural gas
EAP	Energy Assistance Program
ECO	Energy Conservation and Optimization (formerly CIP) program
EERA	Energy Environmental Review and Analysis
EIA	U.S. Energy Information Administration
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EV(s)	electric vehicle(s)

Acronym	Definition
FERC	Federal Energy Regulatory Commission
FY	fiscal year
GHG	greenhouse gas
GPR	Green Project Reserve
GW_{AC}	gigawatts alternating current
H_2	hydrogen molecule
HEAR	Home Electrification and Appliance Rebate program
HH2H	Heartland Hydrogen Hub
HOMES	Home Efficiency Rebate program
HVAC	heating, ventilation, and air conditioning
IECC	International Energy Conservation Code
IIJA	Infrastructure Investment and Jobs Act, see also BIL
IOU	investor-owned utility
IRA	Inflation Reduction Act
IRP	integrated resource plan
IRS	U.S. Internal Revenue Service
ITC	investment tax credit
JTIQ	Joint Targeted Interconnection Queue
K-12	Kindergarten through 12^{th} grade
kBtu	kilo British thermal units = 1,000 Btus
kW	kilowatt; 1,000 watts or 0.001 of a MW
kWh	kilowatt-hour: 1 kilowatt (1,000 watts) of power expended for 1 hour
LED	light-emitting diode
LIHEAP	Low-Income Home Energy Assistance Program
LMI	low- and moderate-income
MDH	Minnesota Department of Health
Minn. Stat. §	Minnesota Statute section
MISO	Midcontinent Independent System Operator
mmBtu	one million Btus
MnCIFA	Minnesota Climate Innovation Financing Authority
MN DIA	Minnesota Distributed Energy Resource Interconnection Agreement
MN DIP	Minnesota Distributed Energy Resource Interconnection Process
MnDOT	Minnesota Department of Transportation
MnTAP	Minnesota Technical Assistance Program
MPCA	Minnesota Pollution Control Agency
MSRP	manufacturer's suggested retail price
MW	megawatt; 1,000,000 watts or 1,000 kW
MWh	megawatt-hours; 1 megawatt of power expended for 1 hour

Acronym	Definition
NASEO	National Association of State Energy Officials
NEVI	National Electric Vehicle Infrastructure program
NGIA	Natural Gas Innovation Act
OERS	Office of Energy Reliability and Security
PACE	property assessed clean energy
PFA	Minnesota Public Facilities Authority
PPA	power purchase agreement
PTC	production tax credit
PUC	Minnesota Public Utilities Commission
PURPA	Public Utilities Regulatory Policies Act
PV	photovoltaic
RDA	Renewable Development Account
RDO	Regional Development Organization
REC	renewable energy credit
RES	Renewable Electricity Standard
RNG	renewable natural gas
RTO	regional transmission organization—such as MISO
SB 2030	Sustainable Building 2030
SCF	Minnesota State Competitiveness Fund
SES	Solar Electricity Standard
SESP	State Energy Security Plan
SFS	Solar for Schools
SHOPP	State Heating Oil and Propane Program
SIR	savings-to-investment ratio
SPP	Southwest Power Pool
SPPA	St. Paul Port Authority
sq ft	square foot
SRDC	Southwest Regional Development Commission
TACE	Tribal Advisory Council on Energy
TIIR	technical interconnection and interoperability requirements
TRM	technical reference manual
VOS	value of solar
WAP	Weatherization Assistance Program
WWTP	wastewater treatment plant

Chapter 1: Energy State of the State

In accordance with Minnesota Statutes § 216C.18, the Minnesota Department of Commerce (Commerce), with input from other state agencies, organizations, and the Minnesota Public Utilities Commission (PUC), produces a State Energy Policy and Conservation Report every four years. Informally referred to as the Quadrennial or Quad Report, it documents status and major emerging trends and issues in Minnesota's energy supply, consumption, conservation, and costs.

What's in the Report?

The report predominantly covers 2020 through 2023, though information for 2024 is also included where feasible. It is organized into several chapters. The topics discussed include:

Chapter 1: This chapter provides a high-level introduction to Minnesota's energy landscape, as well as the statutes and mission that drive Commerce's energy work and the *Climate Action Framework* guiding the state's work. Chapter 1 also includes status updates about Minnesota's progress towards various energy statutes, and summaries of new energy-related legislation passed since 2020.

Chapter 2: This chapter highlights Minnesota's energy leadership within the state enterprise and through support of and collaboration with communities, businesses, Tribal Nations, and workers within the energy economy.

Chapter 3: This chapter, authored by the PUC, discusses the rates set for Minnesotans' energy and policies affecting energy rates.

Chapter 4: This chapter discusses many topics related to Minnesota's utilities and energy transmission, including resource planning, permitting of energy sites and routes, and energy reliability and security.

Chapter 5: This chapter provides an in-depth update on the state of energy generation and utilization within Minnesota, growth and progress towards statutes, supply chain interruptions, and future projections. Energy sources discussed in the chapter include new topics such as energy storage and hydrogen, as well as fossil fuels, solar, wind, biofuels, and emerging fuels.

Chapter 6: This chapter discusses energy conservation efforts within Minnesota, both their history and growth since 2020. This includes utility conservation and optimization programs, research and development, and energy and weatherization assistance, as well as up-and-coming state and federally funded programs.

Chapter 7: This chapter discusses energy consumption within several high-usage sectors—including buildings, public water, and transportation—and projections for energy use in these areas.

Overview of Minnesota's Energy Landscape

- Evaluating electric and gas utilities' rate increase requests and evaluating utility plans to add new power generation, power lines, or natural gas distribution pipelines;
- Serving as an advocate for the public interest in PUC proceedings to assure that utilities provide reliable, cost-effective, and environmentally sound service to ratepayers;
- Assuring that utilities achieve Minnesota's 2040 Carbon-free Electricity Standard and Renewable Electricity Standard through improved planning procedures, regular tracking of utility progress towards the mandates, and support for investment in zero-emitting resources;
- Assuring that utility energy conservation programs are cost-effective and help Minnesota consumers achieve energy savings through energy efficiency;
- Directing all aspects of environmental review and permitting of large energy projects;
- Administering the federally funded Low-Income Home Energy Assistance Program, Low-Income Weatherization Assistance Program, and Inflation Reduction Act's Energy Rebate Programs, as well as state-funded energy programs, to help resource-constrained families with their energy bills and to make their homes healthier and more energy efficient;
- Maintaining state emergency energy planning and recovery plans;
- Maintaining the Energy Information Center, an energy data repository for the state and free resource for all Minnesotans to access scientifically sound information about how to save energy through conservation and efficiency improvements, and providing technical assistance on options to access renewable energy resources;
- Monitoring liquid fuel supplies, including petroleum and biofuels;
- Providing technical assistance to state agencies, local governmental units, non-government organizations, businesses, and citizens.

Commerce is dedicated to ensuring that Minnesota has a reliable energy system well into the future—an energy system that provides energy resources at affordable costs, meets the state's economic needs while transitioning to carbon-neutral energy, minimizes environmental impacts from production and consumption, and is prepared for and resilient to climate change. Commerce works to assure Minnesota's current and long-term energy reliability, including the long-term adequacy of supply, as well as the security, quality, and sufficiency of the electricity transmission grid and electricity, natural gas, and petroleum distribution systems.

Minnesota is on the leading edge of innovative and impactful energy and environmental policies. Recent state laws ensure continued prioritization of clean, reliable, and affordable energy that positively impacts quality of life, addresses inequities to increase energy justice, and supports Minnesota workers and businesses. From the ECO Act in 2021 to the 100% carbon-free electricity standard and other energy laws passed in 2023 and described herein, Minnesota leads by example through effective policy, program, and regulatory design and implementation.

Energy Overview

Minnesota is part of a larger network in the delivery of energy across the Midwest and beyond, with about 30% of all U.S. crude oil imports flowing through Minnesota on the way to refineries in the state and to other U.S. markets. Minnesota consumes about 25% of the natural gas from interstate pipelines that cross the state.[i]

Minnesota also consumes more electricity than is generated within the state. Over the past decade, total electricity sales in Minnesota have been roughly 15% higher than total electricity generated in the state, meaning Minnesota is a net importer of electricity within its state borders.[ii, iii] However, utility service territories span across state boundaries (i.e., utilities based in neighboring states provide energy to Minnesotans, and vice versa), so there are power generating facilities located outside Minnesota that are owned by utilities that serve Minnesotans and which Minnesota ratepayers help fund. With the interconnected electric grid operated by the Midcontinent Independent System Operator (MISO) and Southwest Power Pool (SPP), Minnesota's retail electric sales don't necessarily need to be generated within the physical boundaries of our state.

Overall, MISO and SPP ensure utilities have sufficient resources to meet their load across their service territory through the Resource Adequacy Market. The generation mix supplied by MISO in 2023 is shown at right.

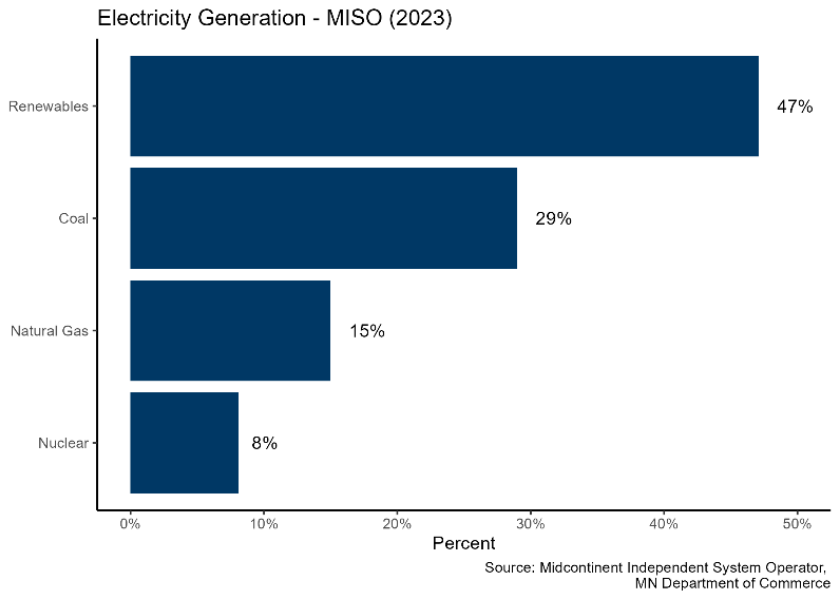

Figure 1-A: MISO North Electricity Generation Mix (2023)

Figure 1-A shows the proportions of renewables, coal, natural gas, and nuclear sources of power generation in the MROW subregion of the Midwestern grid in 2023. Renewables now dominate the region's power supply with 47%, and coal has dropped to comprise 29% of the total.

Source: U.S. Environmental Protection Agency

Minnesota has no local fossil fuel reserves to supply its energy needs. Most of the fossil-fuel derived energy consumed within Minnesota comes from other states and Canada. Over 73% of all energy consumed in Minnesota comes from fossil fuels used for heating, industrial processes, transportation, and electricity generation, as discussed later in the *Renewable Energy Goal for Total Energy Use* section.[iv]

Minnesota has an abundant supply of wind, solar, and bio-based energy. Minnesota ranks among the top five states in the nation for ethanol production capacity, according to U.S. Energy Information Administration (EIA) data. In addition, as of 2022 Minnesota ranks among the top 10 states in electricity generation from wind energy.[v] Renewable resources continue to make up an increasing share of the state's energy, as shown above and discussed further in Chapter 5.

Progress Towards Reaching Minnesota's Energy Standards & Goals since 2020

Carbon-free Electricity Standard

In 2023, the Minnesota Legislature added a requirement to the Renewable Electricity Standard (RES) and Solar Electricity Standard (SES) for utilities to generate or procure:

- *80% of retail electricity sold in the state from carbon-free energy technology by 2030 (for public utilities, 60% for other electric utilities);*
- *90% by 2035 for all electric utilities;*
- *100% by 2040 for all electric utilities. (Minn. Stat. § 216B.1691, subd. 2g)*

Status: Work on implementation of this standard has begun through the regulatory process.

There is an open PUC docket (23-151) to determine what the utilities' reporting requirements will be to determine compliance with the statute, and frequency and type of reporting going forward.

Renewable Electricity Standard

Derive 25% of retail electricity sold in the state from renewable resources by 2025; 55% by 2035. (Minn. Stat. § 216B.1691, subd. 2a)

Status: Utilities generated or procured renewable energy equivalent to more than 20% of 2022 retail electricity sales in Minnesota. Utilities accounted for this by retiring renewable energy credits (RECs) reflecting that amount. Utilities are planning for renewable generation to meet or exceed future RES milestones.

Of the approximately 180 utilities in Minnesota, 16 generation, transmission, and investor-owned utilities were subject to the RES before its revision in 2023. These utilities represent the majority of electricity sales in Minnesota. According to the most recent PUC order filed on August 1, 2023, in Docket No. E-999/PR-23-12, all utilities subject to the RES as of 2022 met the annual requirements for that year. Of those utilities, most are on track to meet and exceed the RES milestone of 25% by 2025. Based on communication with Commerce, subject utilities indicated that they expect to meet future RES compliance until various years, as indicated in Figure 5-A of this report. Utilities report annual compliance with the RES in Docket No. E999/PR-"YR"-12 (e.g., 23-12 for 2022 compliance).

Renewable energy, specifically wind energy, is currently the largest source of electricity generation within Minnesota.

As part of the 2023 revisions to the RES statute, the list of utilities who are subject to it has changed. Work is ongoing with the PUC to determine the updated list of utilities subject to the RES.

In 2022, Minnesota electric utilities reported 24.6% renewable energy (in megawatt-hours (MWh) per year) for the electricity sold in Minnesota. Historically, Minnesota and the Midwest relied on coal as the primary fuel source for electricity generation. However, Minnesota's suite of energy policies, combined with the low

costs of natural gas, solar, and wind, have led to a rapidly changing mix of resources used to generate electricity within state borders. Renewable energy, specifically wind energy, is currently the largest source of electricity generation within Minnesota.

Solar Electricity Standard

Generate 1.5% of public utility retail electricity sales from solar energy by 2020, and 10% of all retail electricity sales from solar energy by 2030 (Minn. Stat. § 216B.1691, subd. 2f).

Status: Utilities generally had solar generation to meet or exceed the 1.5% standard.

Power generated from solar energy in the state has increased in recent years. In 2013, the Minnesota Legislature amended the Renewable Energy Objectives Statute to include a Solar Electricity Standard (SES) of 1.5% by the end of 2020 for three investor-owned utilities: Minnesota Power, Otter Tail Power Co., and Xcel Energy. The statute further requires that at least 10% of the 1.5% SES goal be met by solar energy from facilities with a nameplate capacity of 20 kilowatt (kW) or less. All three investor-owned utilities reported compliance with the 2021 non-small SES requirements. Of the three, only Otter Tail Power Co. fell short in meeting the small-scale solar component for 2021.[vi]

Status: Minnesota utilities are making progress towards the 10% by 2030 standard.

The SES also requires that by 2030, 10% of all electricity sales in Minnesota must be generated by solar energy. According to data from the EIA, solar electricity accounted for roughly three percent of electricity generated within Minnesota in 2023, which is up slightly from 2020. Most solar generation capacity is from community solar installations, which accounted for roughly 58% of capacity in 2022.

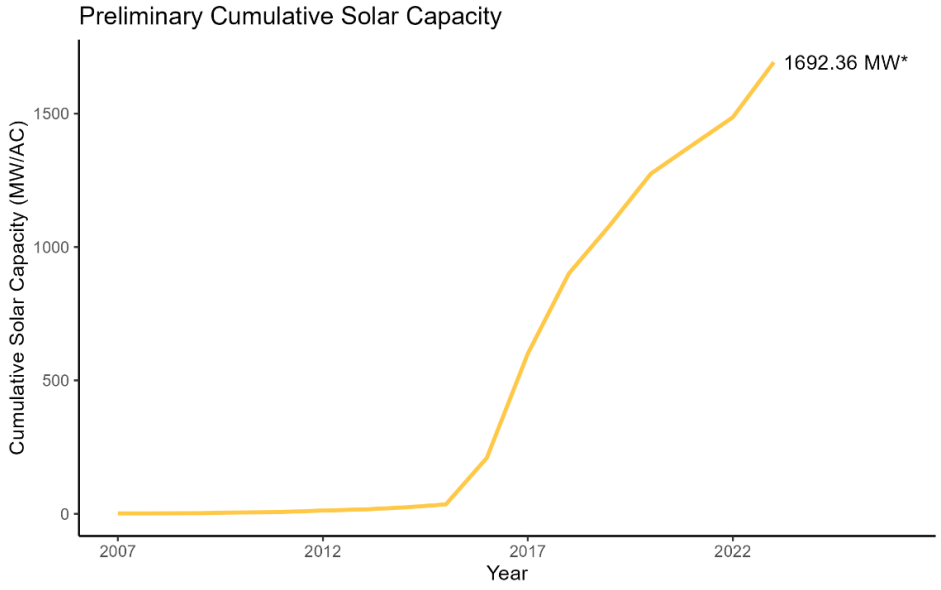

Figure 1-B: Minnesota's solar generating capacity has grown rapidly since 2015.

Figure 1-B shows Minnesota's cumulative solar power capacity from 2007–2023. 2023 figures are based on preliminary utility data and are subject to change.

Source: U.S. Energy Information Administration, Minnesota Public Utilities Commission

Energy Savings Goals

The Energy Conservation Optimization (ECO) Act of 2023 updated energy savings goals for Minnesota under Minn. Stat. §§ 216B.2401, 216B.2402, 216B.2403, and 216B.241:

- *Electric Investor-Owned Utilities: Annual energy savings goal equal to 1.75% of 3-year average weather-normalized retail sales at the generator, less sales to exempt customers and eligible electric vehicle charging sales. (Minn. Stat. § 216B.241, subd. 1c)*
- *Gas Investor-Owned Utilities: Annual energy savings goal equal to 1.0% of 3-year average weather-normalized retail sales at the generator, less sales to exempt customers and eligible electric vehicle charging sales. (Minn. Stat. § 216B.241, subd. 1c)*
- *Electric and Gas Consumer-Owned Utilities (i.e., Municipal and Cooperative Utilities): Annual energy savings goal equal to 1.5% of 3-year average weather-normalized retail sales at the generator, less sales to exempt customers and eligible electric vehicle charging sales. (Minn. Stat. § 216B.2403, subd. 2)*
- *Building Energy Use: Annual energy savings goal equal to at least 2.5% of electricity and natural gas retail sales through conservation programs, efficient fuel switching, rate design, energy efficiency, energy codes and appliance standards, and programs designed to transform the market or change consumer behavior and other efforts. (Minn. Stat. § 216B.2401)*

Prior to the passage of the ECO Act of 2023, the ECO Program, formerly known as the Conservation Improvement Program (CIP), had the following Energy Savings Goals:

- *Energy savings of 1.5% of average annual retail sales each year for electric and natural gas utilities, unless adjusted by the commissioner to no less than 1.0%. (Minn. Stat. § 216C.05)*

Status: Utilities are meeting and exceeding their energy efficiency goals.

Minnesota's electric utilities have met or exceeded 1.5% annual energy savings each year since 2011. Additionally, the state's natural gas utilities have generally met or exceeded 1% energy savings each year. More information about the ECO programs can be found in Chapter 6.

In total, in years 2020 and 2021, ECO programs benefited Minnesota's environment and economy by:

- Saving around 14.4 trillion British thermal units (Btus) of energy—enough energy to heat, cool, and power more than 147,000 Minnesota homes for a year.[vii]
- Reducing carbon dioxide (CO_2) emissions by 1.46 million tons, equivalent to removing over 296,000 gasoline-powered passenger vehicles from the road for one year.[viii, ix, x]
- Saving Minnesota's businesses and residents over $287 million in energy costs.[1]
- Supporting over 43,000 energy efficiency jobs, representing the largest sector of Minnesota's clean energy employment.[xi]

[1] Estimated energy cost savings were calculated by multiplying the average price per dekatherm (Dth) of natural gas and the average price per kilowatt-hour (kWh) of electricity in Minnesota by the corresponding Dth and kWh ECO energy savings achievements for 2020 and 2021. This calculation does not net out conservation cost recovery adjustments or conservation cost recovery charges to customers.

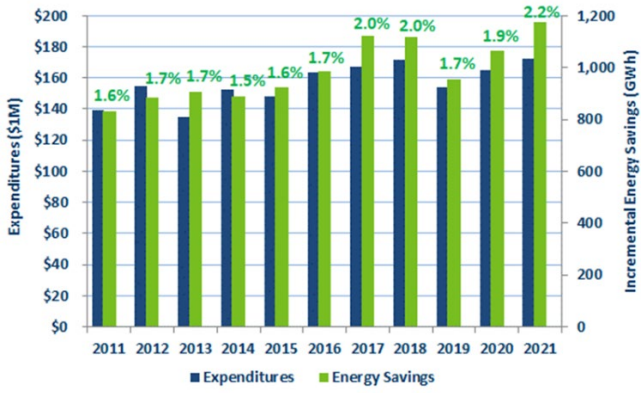

Figure 1-C: ECO Electric Results 2011–2021

Energy savings achievements are shown as a percentage of utility sales above green bars.

Source: Minnesota Department of Commerce

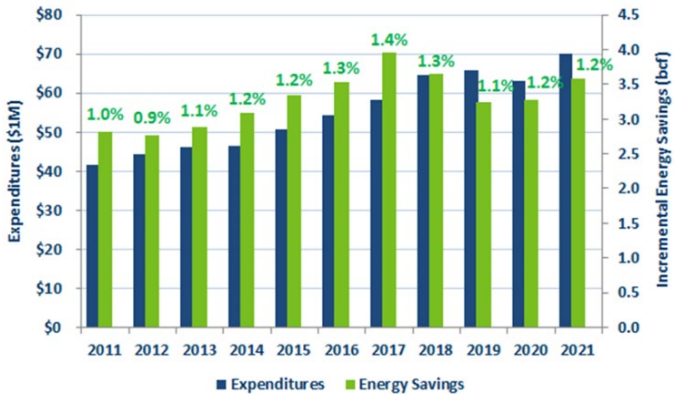

Figure 1-D: ECO Natural Gas Results 2011–2021

Energy savings achievements are shown as a percentage of utility sales above green bars.

Source: Minnesota Department of Commerce

Additional discussion of the state's policies, programs, research, and initiatives to support energy efficiency and conservation can be found in Chapters 2, 3, 5, 6, and 7.

Status: Utilities are meeting their energy savings goals, but overall emissions and energy use from buildings are increasing.

As a cold-climate state, energy efficiency is critical. Minnesota has some of the coldest winter weather in the nation, coupled with hot, humid summers.[xii] Buildings require of large amounts of energy to heat and cool. In 2021, Minnesota's buildings consumed 42.1% of the total energy use in the state, 19.2% of which was from commercial buildings, including large multifamily buildings.[xiii]

Buildings consume over 40% of the energy used in Minnesota.

Building codes provide a significant opportunity to reduce energy consumption and energy bills. The relationship between building codes and energy use intensity in buildings has been well documented.[xiv,xv] On March 31, 2020, the Minnesota Department of Labor and Industry updated the commercial building energy code from the 2012 International Energy Conservation Code (IECC) to the 2018 IECC. The U.S. Department of Energy (DOE) estimated that the new building standards will result in more than eight percent energy cost savings and six percent energy savings.[xvi] The IECC updates their codes every three years to provide further energy efficiency savings. The 2021 IECC building code, approved by the IECC in in 2020, is expected to further improve efficiency by 10% in residential and commercial buildings for decades to come.[xvii] The Minnesota Department of Labor and Industry began a Technical Advisory Group to examine the 2021 IECC building code in August 2023 and will reconvene in fall 2024 to review the residential energy provisions of the 2024 International Residential Code to determine whether to recommend the 2021 or the 2024 provisions for adoption by Minnesota.

Minnesota's policies and programs work together to support cost-effective energy conservation and efficiency in new and existing buildings. Minnesota is the only Midwestern state that consistently ranks in the top 10 states nationwide in the American Council for an Energy-Efficient Economy (ACEEE) State Energy Efficiency

Scorecard.[xviii] As a result of these efforts, Minnesota's per capita energy consumption is lower than nearly two-fifths of other states.[xix]

Additional discussion of the state's policies, programs, research, and initiatives to reduce energy use in buildings can be found in Chapters 6 and 7.

Preference for Renewable Energy in Resource Planning

Electric generation and transmission utilities that serve load in Minnesota must justify use of non-renewable energy resources in their long-term plans to serve customer needs and use renewable energy resources where and when feasible. (Minn. Stat. § 216B.2422, subd. 4)

Status: Utilities are evaluating potential system options to pursue least-cost, environmentally sound, and efficient resources consistent with current state and federal laws and goals.

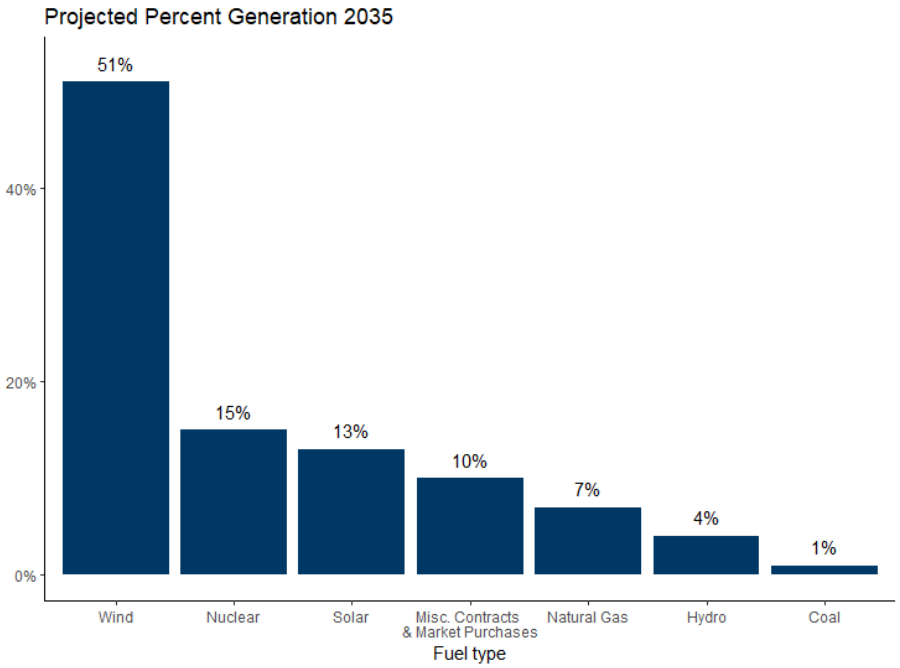

Figure 1-E: Utilities are planning to transition to an energy mix that is over 80% carbon free by 2035.

Figure 1-E shows the projected resource mix in 2035 for power delivered to Minnesota—including energy generated both inside and outside of the state—based on Xcel Energy, Minnesota Power, Otter Tail Power, and Great River Energy resource plans and announced retirements.

Source: Utility Integrated Resource Plans

Nine electric generation and transmission utilities that serve Minnesotans are required to file long-term plans on the resources needed to meet customer needs. An aggregated forecast of electric energy generation—including energy generated both inside and outside of Minnesota—based on Xcel Energy, Minnesota Power, Otter Tail Power, and Great River Energy resource plans and announced retirements, predicts a renewable electricity mix that includes more than 82% carbon-free resources by 2035, with 68% renewable resources (51% wind, 13% solar, and 4% hydro).

Future emissions reduction in the power sector will depend on the resources chosen to serve load as aging power plants continue to retire. Additional discussion of the state's policies, programs, research, and initiatives to decarbonize electricity generation can be found in Chapters 3, 4, and 5.

Renewable Energy Goal for Total Energy Use

Derive 25% by 2025 of total energy used in the state from renewable resources for heating, industrial processes, transportation, and electricity generation. (Minnesota Stat. § 216C.05, subd. 2)

Status: Minnesota obtained 13% of its *total* energy from renewable resources in 2022 and is at risk of missing its 25% by 2025 goal.

In 2022, 13% of the total energy consumed in Minnesota for heating, industrial processes, transportation, and electricity generation came from renewable sources, compared with a United States average of 9% renewable consumption. Minnesota will likely miss the state goal to provide one-fourth of its total energy consumption from renewable sources by 2025. Achieving this goal could be possible with a long-term decrease in total energy consumption (reducing the denominator) or a roughly 12% increase in renewable energy consumption (increasing the numerator).

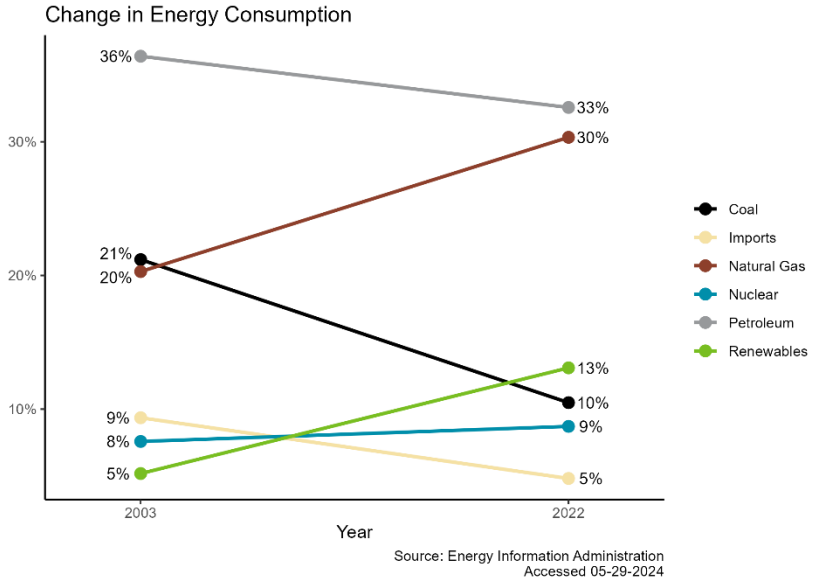

Figure 1-F: In 2022, 13% of all energy consumed in Minnesota came from renewable sources.

Source: U.S. Energy Information Administration

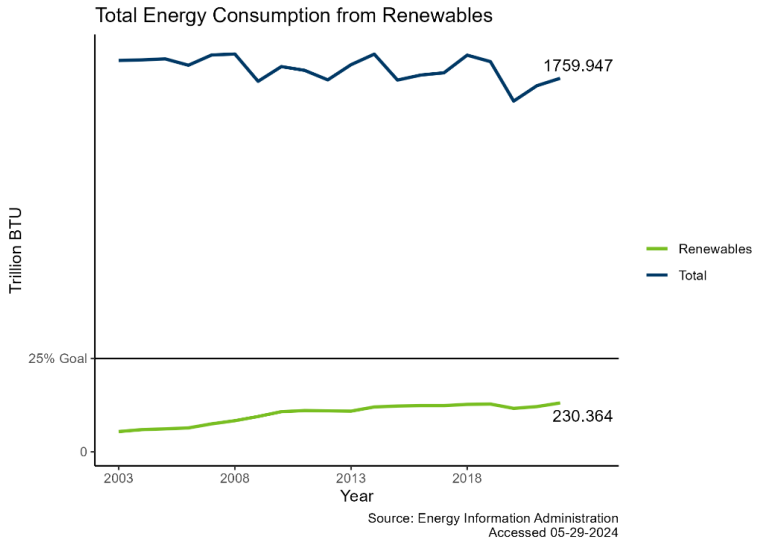

Figure 1-G: Minnesota will likely miss its goal of 25% of total energy use from renewables by 2025.

Source: U.S. Energy Information Administration

Greenhouse Gas Emissions Reduction Levels

To reduce greenhouse gas emissions statewide to a level at least 15% below 2005 base levels by 2015, 30% by 2025, 50% by 2030, and net zero by 2050. (Minn. Stat. § 216H.02, subd. 1)

In 2007, Governor Tim Pawlenty signed the bipartisan Next Generation Energy Act into law, setting statutory goals to reduce greenhouse gas (GHG) emissions. In September 2022, Governor Tim Walz released Minnesota's *Climate Action Framework* that set new GHG emission reduction goals in consideration of the most current climate science, and, in 2023, the legislature updated the standards into statute: to reduce GHG emissions by 15% below 2005 levels by 2015, 30% by 2025, 50% by 2030, and net zero by 2050. The GHG reduction targets follow the international goals set by the Intergovernmental Panel on Climate Change.[xx]

Status: In 2020 Minnesota was on track to meet GHG emission reduction goals for the first time.

The Minnesota Pollution Control Agency (MPCA), in collaboration with Commerce, reports on Minnesota's progress towards GHG goals in its *GHG Emissions Inventory Report* every two years (Minn. Stat. § 216H.07, subd. 3). According to the most recent report, released January 2023 for the calendar year 2020, Minnesota was on track to meet its GHG reduction goals for the first time in 2020.[xxi]

The year 2020 was unusual as individuals, organizations, and governments acted in response to the COVID-19 pandemic. The pandemic disrupted all parts of the economy, uniquely impacting Minnesota's GHG emissions. Due to the unusual nature of 2020, the 2023 report was cautious in interpreting Minnesota's GHG trends. All economic sectors had declining emissions between 2019–2020. While the pandemic impacted those results, emissions across many sectors were already declining between 2018–2019 prior to the pandemic. The declines between 2018–2019 may indicate longer-term trends, but it is too soon to tell. Future years' data will show whether these are lasting trends. The next report, on data from 2022, is due in January 2025.

Minnesota continues to see excellent progress in reducing emissions from electricity consumption because of growth in renewable electricity and reduction in coal-fired electricity, primarily from generation within state borders. In 2023 Minnesota's power sector reduced its CO_2 emissions by 10% (from 2022 levels), to the lowest point thus far in the 19 years the value has been tracked.[xxii] Future emissions reduction in the power sector will depend on the resources chosen within and outside state borders to serve load in Minnesota as aging power plants continue to retire.

According to data collected through the Regional Indicators Initiative, in cities commercial and industrial customers are usually the largest aggregate source of GHG emissions.[xxiii] This includes emissions from buildings as well as the industrial processes happening therein, and reducing these emissions will take significant collaboration between public and private partners.

Additional discussion of the state's policies, programs, research, and initiatives to decarbonize electricity generation can be found in Chapters 3, 4, and 5, and efforts to decarbonize buildings and transportation can be found in Chapter 7.

2020–2023 Federal Energy Policy Changes

On the federal level the past four years have included historical growth in incentives meant to speed the transition to a cleaner energy system. Congress passed legislation to strengthen U.S. energy infrastructure, including support to improve the resilience and reliability of the U.S. electrical grid. Additionally, new federal legislation has focused on providing equitable access to the clean energy transition and growing the workforce required for these growth industries, while also supporting entities and households in their personal efforts to decarbonize. This section includes synopses of the Acts passed during this time frame. The following uniting principles are present in federal funding programs beginning in 2023 and will continue to be key components of federal funding or consideration factors in scoring of federal funding proposals under the Acts.

- **Justice40 Initiative** was created by federal Executive Order (EO) 14008 on February 1, 2021. EO14008 created a "goal that 40% of overall benefits of certain federal climate, clean energy, affordable and sustainable housing, and other investments flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution."[xxiv] The Climate and Economic Justice Screening Tool (CEJST), a mapping tool released by the White House, is used to identify disadvantaged communities including all federally recognized Tribal Nations.
- **Community Involvement**: In conjunction with Justice40, current federal funding opportunities encourage or require in-depth community involvement in proposed projects, with a goal of ensuring that energy, environmental, and climate justice activities benefit disadvantaged communities via reduced pollution, increased community climate resilience, and increased energy resilience and reliability. Place-based investments are focused on community-driven initiatives to be responsive to community and stakeholder input. Costs associated with outreach, engagement, and educational efforts are eligible to include in project proposals; funding opportunities either require or encourage fully developed Community Benefit Plans and Agreements.
- **Build America, Buy America Act** requires domestic sources for iron, steel, manufactured products, and construction materials to be used in federally funded infrastructure projects whenever possible.
- **Workforce Development and Good-Paying Jobs:** The growth and retention of good-paying U.S. jobs is prioritized under current federal funding programs. To grow the skilled workforce needed across the various fronts of the clean energy transition, federal funders expect projects to include equitable workforce development programs and initiatives. The use of union labor and Davis-Bacon or Prevailing Wage adherence is encouraged or required. To this end, federal funding can be used for outreach, engagement, and educational efforts to create awareness of clean energy careers and training or re-training opportunities.

Synopsis of Acts:

Infrastructure Investment and Jobs Act

Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL), signed into law on November 15, 2021, authorizes $1.2 trillion in funding for transportation and infrastructure projects

across a variety of arenas: energy and power infrastructure, broadband internet, water infrastructure, roads and highways, airports, and more. The law includes approximately $75 billion in funding for the energy sector via a mix of formula and competitive grants. Through 2023, Minnesota entities (state and local units of government, Tribal governments of Tribes sharing geographic territory within the borders of the State of Minnesota, for-profit and non-profit entities, and other eligible entities) have received over $9.1 billion in federal funding from the IIJA, of which a minimum of $794 million is on energy- and resiliency-related projects (excluding transportation infrastructure related grants to MnDOT).[xxv] As of early 2024, Commerce is aware of another $1.5 billion in energy-related federal grant requests on proposals already submitted or on proposals in development by Minnesota entities.

In 2023, the State of Minnesota and Minnesota-based entities received several IIJA energy-related grant awards. Two were particularly noteworthy for their size:

- Heartland Hydrogen Hub (HH2H): Under DOE's Regional Clean Hydrogen Hub Program, the 10-year HH2H project received an award of up to $925 million, and it is anticipated that approximately half the funding will go to Minnesota projects. The grant proposal was led by the Energy and Environment Resource Center in Grand Forks, ND, for a collaborative initiative that will produce low-carbon hydrogen, decarbonize regional supply chains, and create clean energy jobs across Minnesota, Montana, North Dakota, South Dakota, and Wisconsin. The stated goal of the HH2H project is to decarbonize multiple sectors in the region, including agriculture and industrial manufacturing, while producing clean hydrogen for end use in fertilizer and power generation. Minnesota-based Xcel Energy is a lead partner in the HH2H project, and multiple small Minnesota agricultural cooperatives are expected to benefit from HH2H funding support to grow the supply chain of Minnesota-made green urea.[xxvi]
- Joint Targeted Interconnection Queue (JTIQ): Commerce was awarded a grant of $464 million of federal funding support for the multi-state JTIQ project. JTIQ is a 10-year project, expected to require over $2 billion in project spending to address coordinated transmission upgrades along the transmission seam spanning seven Midwest states (Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Iowa, and Missouri). JTIQ will

Figure 1-H: Joint Targeted Interconnection Queue

Figure 1-H shows the multi-state Joint Targeted Interconnection Queue projects in red.

Source: MISO-SPP Joint Targeted Interconnection Queue Update (.pdf), MISO & SPP. March 27, 2023.

include the construction of high-voltage transmission lines to improve reliability, resolve constraints in the transmission system, and increase the capacity of the system to accept up to 30 gigawatts of new generation, much of it wind energy. Partners in this project include MISO, SPP, the Great Plains Institute, ITC Midwest, Ottertail Power, and Xcel Energy.

In addition, Minnesota is receiving substantial energy-related formula funding from the IIJA, most notably a five-year increase in weatherization assistance funding that will allow the program to approximately double the number of Minnesota houses weatherized by the program during that period.

IJA Section	Name	Governmental Recipient	Grant Funds
40501	Weatherization Assistance Program	State (Commerce)	$ 76,218,512
40101(d)	Preventing Outages and Enhancing the Resilience of the Electric Grid Formula Grants to states	State (Commerce)	$29,777,000
	Preventing Outages and Enhancing the Resilience of the Electric Grid Formula Grants to Tribes	11 Tribal Nations	$6,415,731
40109	State Energy Program	State (Commerce)	$7,734,210
40552	Energy Efficiency Conservation Block Grants (EECBG)	To 28 Cities	$3,711,850
		State (Commerce)	$2,248,830
		To 10 Counties	$1,158,470
		To 11 Tribal Nations	$131,100
40552	Low-Income Home Energy Assistance Program (LIHEAP)	State (Commerce)	$3,974,694
40552	Energy Efficiency Revolving Loan Fund (EERLF)	State (Commerce)	$1,854,610
		To Commerce	$121,807,856
		To MN Tribal and local governments	$11,417,151
		Total Energy-related IIJA grants to MN governments	**$133,225,007**

Figure 1-I: Energy-related IIJA Grants to Minnesota Governments

Figure 1-I shows energy-related IIJA formula grants awarded to governmental entities (cities, counties, Tribal Nations, and the state government) within Minnesota. 2023 dollar values are subject to change as funds are awarded.

Source: Federal Funds Information for States, Infrastructure Investment and Jobs Act (IIJA) (.org), data as of January 3, 2024.

Inflation Reduction Act

The Inflation Reduction Act (IRA) was signed into law on August 16, 2022, and, by a wide margin, is the most significant federal incentives investment ever made to accelerate the clean energy transition and incentivize economy-wide climate action. There are over 100 distinct funding programs in the IRA, in the form of tax credits, loan programs, and grant programs. Through 2023, the IRA has supplied over $2.2 billion in federal funding to Minnesota agencies and entities, of which at least $159 million is on energy- and resiliency-related projects.[xxvii]

Tax Credits

Total project funding available via uncapped tax credits through the IRA is estimated at $800 billion[xxviii] to well over $1 trillion. The IRA expands the application of existing production and investment tax credits beyond wind and solar to other current and emerging clean energy technologies, such as nuclear, clean hydrogen, advanced biofuels, and fossil fuels with carbon capture and storage. New tax credits were added for new and used electric vehicle (EV) purchases and clean refueling equipment and chargers.

The IRA also expands the pool of entities eligible to receive tax credits, through the addition of Elective Pay (also known as Direct Pay) Provisions for states, local governments, non-profits, Tribal Nations, and other non-taxable entities. In addition, there are bonus tax credits to add to baseline tax credit amounts around selected focus areas of projects: those occurring in or benefiting low-income, Tribal, or energy communities, include prevailing wages, apprenticeship programs, domestic content, energy storage components, or selected clean energy technologies. Adding a multiplier effect, the baseline and all the bonus credits are stackable on a single project; for example, a project utilizing all the investment tax credit bonuses could have 70% of eligible project costs funded via the tax credits. IRA tax credits may be used on a project also benefiting from a federal grant or a federal loan, though grants and loans are not stackable.

Loan Programs

Loan programs for clean energy projects were allocated over $400 billion in the IRA, with the bulk of the new loan authority given to the DOE. The largest loan program is the $250 billion Energy Infrastructure Reinvestment Program, which supports utilities in their transition to clean energy. Other key programs include the $80 billion Innovation Clean Energy Loan Guarantees program, the $40 billion Advanced Vehicle Manufacturing program, and the Tribal Energy Loan Guarantee program and CO_2 Transportation Infrastructure program, both funded at $20 billion.

Commerce is fostering the newly authorized Minnesota Climate Innovation Financing Authority (MnCIFA), which was funded by the 2023 legislature with a $45 million appropriation. MnCIFA is recognized by the DOE as a state energy finance institution and, as such, has the opportunity to co-invest with DOE's loan program. MnCIFA is seeking opportunities to co-invest in in a variety of project areas, including decarbonization of existing buildings, reduction of transportation pollution, deploying emission reduction technologies for industry and agriculture, and deploying distributed power generation and storage.

Grants

The IRA includes $110 billion in funding for grants to deploy zero-emission technologies and support climate change projects. Some relevant examples:

- **U.S. Environmental Protection Agency (EPA) Greenhouse Gas Reduction Fund**: $27 billion in funding for financial programs and national, regional, or local "green banks" supporting clean-energy projects for income-eligible households or supporting entities. Commerce has received $62 million under the Greenhouse Gas Reduction Fund Solar for All program; this proposal focuses on financial assistance via credit enhancement, forgivable lending, Tribal Nation development funding workforce development, technical assistance energy/community navigators, and weatherization grants. MnCIFA is also a sub-awardee on a successful $5 billion Coalition for Green Capital Greenhouse Gas Reduction Fund proposal.
- **EPA Climate Pollution Reduction Grants:** This program was allocated $5 billion in funding for grants to state, local units of government, and Tribal governments to develop and undertake GHG emission (and other pollutant) reduction projects.
- **EPA Environmental and Climate Justice Block Grants:** $2.8 billion in funding to increase community involvement in pollutant reduction projects, including clean energy and climate justice projects.

Creating Helpful Incentives to Produce Semiconductors and Science Act

The Creating Helpful Incentives to Produce Semiconductors and Science Act of 2022 was signed into law on August 9, 2022, and aims to strengthen U.S. manufacturing and build U.S. supply chains. Investments include funding for grants, cooperative agreements, loans, and tax credits to support science and technology research and development and workforce development in growing and emerging industries, including clean energy, nanotechnology, quantum computing, semiconductors, and artificial intelligence.

2020–2023 Minnesota Energy Policy Changes

Between 2020 and 2023, the Minnesota State Legislature appropriated funding for energy programs to support the pursuit and distribution of federal funds and to establish many new state-specific programs and initiatives. Many energy-related policy changes were also implemented by the Minnesota Legislature in that timeframe. New programs and policies are summarized below, broken down by the year of the legislative session under which they were passed.

The 2020 Legislative Session

- COVID-19 Response (Chapter 71)
- LED Promotion (Chapter 105)
- Renewable Development Account (RDA) Bill (Chapter 118)

COVID-19 Response: Session law chapter 71, article 2, section 12 allowed Commerce to delay, stay, or waive licensing and other deadlines under the agency's purview until 60 days following the end of the peacetime emergency declared in Executive Order 20-01. (216B.241; 216C.18; 237.11)

LED Promotion: Chapter 105 amended the Conservation Improvement Program (CIP) provision that encourages efficient lighting to include light-emitting diode (LED) promotion instead of fluorescent lamps. (216B.241)

Renewable Development Account: Chapter 118 appropriated money from the RDA to four specific projects (116C.7792) and included bond language Xcel Energy needed due to COVID-19:

- **Prairie Island Indian Community's Net Zero Project:** A total of $46.2M over three years was appropriated for Prairie Island Indian Community's Net Zero Project.
- **Solar*Rewards:** The Solar Rewards program was extended, adding $5M in fiscal year (FY) 21 and $10M in FY22 and allowing of rollover funds in subsequent years, retroactive to FY19.
- **Energy Transition Grants:** $2M was appropriated for Community Energy Transition Grants to fund grants up to $500,000 to cities that have experienced or will be experiencing plant retirements or decommissioning.
- **Hydropower:** $2.75M was allocated for Granite Falls' hydropower dam to purchase a new turbine to expand the electric generating capacity of the city's existing hydroelectric generating facility.

The 2021 Legislative Session

- Power Purchase Agreement for Certain Electric Cogeneration Activities Authorization (Chapter 23)
- Energy Conservation and Optimization Act of 2021 (Chapter 29)
- Cold Weather Rule (1st Special Session chapter 4)
- Solar for Schools (1st Special Session chapter 4)
- State Building Energy Conservation Revolving Loan Fund (1st Special Session chapter 4)
- Energy Transition Office (1st Special Session chapter 4)
- Minnesota Efficient Technology Accelerator (1st Special Session chapter 4)
- Natural Gas Innovation Act (1st Special Session chapter 4)

Power Purchase Agreement for Certain Electric Cogeneration Activities Authorization: Chapter 23 provided a framework for a new power purchase agreement between Xcel Energy and St. Paul District Energy system's cogeneration facility, which has sold electricity to Xcel under the state's biomass mandate in prior years. The purchase agreement must not be extended beyond December 31, 2024, unless an electrification project is approved. (216B)

Energy Conservation and Optimization Act: Chapter 29 modernized the Conservation Improvement Program (CIP) through the Minnesota Energy Conservation and Optimization Act (ECO Act).[2] The ECO Act primarily served to modernize Minnesota's previous utility driven energy efficiency framework to provide a more holistic approach to energy efficiency programming. Notable highlights of the ECO Act include:

- Providing participating electric and natural gas utilities the opportunity to optimize energy use and delivery through the inclusion of load management and efficient fuel switching programs.
- Raising the energy savings goals for the state's electric investor-owned utilities.

[2] Codified in Minn. Stat. §§ 216B.2401, 216B.2402, 216B.2403, and 216B.241.

- More than doubling the low-income spending requirement for all investor-owned utilities.
- Providing greater planning flexibility for participating municipal and cooperative utilities.
- Including activities to improve energy efficiency for public schools.

Refer to Chapters 1, 3, and 6 for details about the ECO program.

Cold Weather Rule: 1st Special Session chapter 4, art. 8, sec. 9 to 15 extended the Cold Weather Rule Period, during which utilities may not disconnect customers who maintain an agreement with the utility to pay arrearages. The revised period begins two weeks earlier (October 1) and ends two weeks later (April 30), for residents already meeting poverty guidelines for the Energy Assistance Program (EAP) and the Weatherization Assistance Program (WAP). (216B.096; 216B.097)

The Cold Weather Rules also permits remote disconnections using advanced metering infrastructure and requires utilities to send disconnection notices to Commerce.

Solar on Landfill Pilot: 1st Special Session chapter 4, art. 8, sec. 3 and 4 established an account in the remediation fund for depositing revenues from lease payments from solar energy generating systems installed on closed landfill sites managed by the MPCA. (115B.431)

Solar for Schools: 1st Special Session chapter 4, art. 8, sec. 23 established a Commerce program to award grants to schools that install solar energy generating systems on or adjacent to school buildings.

Art. 8, sec. 24 authorized Xcel Energy to file a plan with the PUC by October 1, 2021, to provide financial assistance to schools that install solar energy generating systems on or adjacent to school buildings within Xcel Energy service area. (216C)

State Building Energy Conservation Revolving Loan Fund: 1st Special Session chapter 4, art. 8, sec. 1 established an Admin account that provides revolving loans for energy conservation in state-owned buildings. $5 million in FY 2022 was appropriated into the account to provide loans to state agencies for energy conservation projects. (16B.86; 16B.87)

Energy Transition Office: 1st Special Session chapter 4, art. 8, sec. 6 to sec. 8 established an Energy Transition Office in the Department of Employment and Economic Development to assist communities and workers experiencing economic dislocation due to the retirement of an electric generating plant. It also established an advisory committee to develop a statewide energy transition plan. (116J)

Minnesota Efficient Technology Accelerator: 1st Special Session chapter 4, art. 8, sec. 17 authorized the Center for Energy and the Environment to file a proposal with Commerce to create the Minnesota Efficient Technology Accelerator: a collaboration with technology manufacturers to accelerate the development of energy efficient technologies that will result in cost-efficient energy savings for Minnesota consumers.

Natural Gas Innovation Act: 1st Special Session chapter 4, art. 8, sec. 20 authorized a natural gas utility to file a plan with the PUC to obtain innovative resources that displace conventional natural gas, including renewable natural gas, power-to-hydrogen, power-to-ammonia, carbon dioxide capture, strategic electrification, and

others. Programs created under the NGIA must be cost-effective, reduce GHG emissions, and have a term of five years.

The initial innovation plan must include programs to provide audits to small- and medium-sized businesses, target industrial facilities that cannot easily electrify, conduct deep energy retrofits and install cold-climate electric air-source heat pumps in residences, and expand district heating systems. In the absence of plan, a utility may deliver innovative resources to voluntary customers under a PUC-approved green tariff program and may recover costs for those resources that are up to five percent higher than the cost of conventional natural gas. (216B)

The 2022 Legislative Session

- Prairie Island Net Zero project modified, grant established, and money appropriated. (Chapter 41)

Prairie Island Net Zero project modified, grant established, and money appropriated: Chapter 41 established a certified cost requirement of the Prairie Island Indian Community Net Zero Energy Project and appropriated an additional $30.2M through June 30, 2031. (Laws 2020, ch. 118; Laws 2021, First Special Session ch. 4)

The 2023 Legislative Session

- 100% Carbon-Free by 2040 (Chapter 7)
- Minnesota State Competitiveness Fund (Chapter 24)
- Jobs, Economic Development, Labor, and Industry Omnibus (Chapter 53):
    - Minnesota Climate Innovation Authority Account
    - State Competitiveness Fund
- Environment & Energy Policy and Finance Omnibus (Chapter 60) programs and studies:
    - Solar modules reuse and recycling study
    - Solar for Schools Program Modifications
    - Solar on Public Buildings Program
    - Community Solar Garden Modifications
    - Community Solar Garden Study
    - Made in Minnesota
    - Solar*Rewards Expansion
    - Strengthen Minnesota Homes program
    - Weatherization, Preweatherization, and Workforce Training Program
    - Residential Electrical Panel Upgrade Grant Program
    - Residential Heat Pump Rebate Program
    - School Air Ventilation Program Act
    - Tribal Advocacy Council on Energy
    - Electric Vehicle Rebates
    - Electric School Bus Deployment Program
    - Auto dealer EV training and certification reimbursement grants

- High voltage DC transmission line upgrades
- Electric Grid Resiliency Grants
- Distribute Energy Resources System Upgrade Program
- Energy Benchmarking
- Energy Storage Incentive Program
- Energy Storage System Capacity Study
- Clean Energy Economy Minnesota for the Minnesota Energy Alley initiative
- Clean Energy Resource Teams partnerships
- City of Anoka Rum River Dam Feasibility Study
- City of Granite Falls hydroelectric repair
- University of St. Thomas Center for Microgrid Research

- Environment & Energy Policy and Finance Omnibus (Chapter 60) policies:
  - Buy Clean, Buy Fair Minnesota
  - Sustainable Building Guidelines Modifications
  - Preference Order for Purchase of State Vehicles
  - Utility Reporting Due Date Modification
  - Repeal/Reinstatement of Intervenor Compensation Statute
  - Transportation Electrification Plan
  - Customer's Access to Electricity Usage Data
  - Prairie Island Nuclear Power Plan Settlement Payments
  - Distributed Solar Energy Standard
  - Utility Customer Dispute Resolution
  - Definition of Low-Income Household
  - Approval of Projects to Modernize Transmission and Distribution System
  - Updated integrated distribution plan for distributed solar
  - Large Wind Energy Conversion System Certification of Need Exemption
  - Modification of Threshold Requiring PUC Approval
  - Commerce's Assessment Increase
  - Compensation for Certain PUC Proceeding Participants
  - Property-Assessed Clean Energy (PACE) Loan Program
  - RDA Projects Subject to Prevailing Wage/Diversity Report
  - Energy Storage System Definition
  - Conforming Changes to definition of large energy power facilities and site permit
  - Gas and Hazardous Liquid Definitions Changes
  - Greenhouse Gas Emission Reduction Goal Modifications
  - Modification to the Telecommunication Access Program Annual Report
  - Restriction on single family solar installations prohibited
  - Extension of Sunset on Gas Utility Recovery of Infrastructure Costs to 2028
  - Decommissioning of Allen S. King Coal Plant

- Cannabis Omnibus (Chapter 63): energy standards rules for cannabis businesses
- Transportation Omnibus (Chapter 68): Electric transmission lines in highway right-of-way

100% Carbon-Free by 2040: Chapter 7 amended Minnesota's Renewable Electricity Standard by adding a carbon-free standard that utilities must meet beginning in 2030, with an exception for utilities in low density counties that generate electricity via solid waste incinerators. Chapter 7 also streamlined the siting and routing process for solar energy generating systems and certain high-voltage transmission lines and authorized PUC to require payment of the state prevailing wage to workers constructing large wind and solar energy systems.

PUC is required to determine how it will measure utility efforts to meet the renewable, solar, and carbon-free standards, as well as allow for partial compliance with the carbon-free standard, including purchases from a regional transmission organization.

Minnesota State Competitiveness Fund: The Minnesota State Legislature established the Minnesota State Competitiveness Fund (SCF) to increase the success of Minnesota applicants in the pursuit of federal funds for energy projects funded under the IIJA and the IRA. Chapter 24 appropriated $115 million for technical assistance, state matching funds to eligible entities to qualify for federal funds, and grant-writing help for rural, Tribal, and disadvantaged communities, better positioning Minnesota to successfully compete for energy-related federal funding opportunities. This chapter also supports additional Commerce staff to quantitatively analyze climate and equity impacts in support of applicants. (216C)

State Competitiveness Fund Program	Funds Appropriated FY2024–2025
Match program (cost-share coverage)[3]	$100,000,000
Support for local grant-seeking assistance[3]	$6,000,000
Commerce administration and technical assistance[3]	$6,750,000
Commerce information system development[3]	$1,500,000
Commerce reports and audits[3]	$750,000
Grants to leverage IRA tax credits and loans (income-eligible focus)[4]	$75,000,000
Total State Competitiveness Fund	**$190,000,000**

Figure 1-J: State Competitiveness Grants funding, FY2024–2025

Figure 1-J State Competitiveness grants awarded for fiscal years 2024 to 2025. Total dollar value is subject to change as funds are awarded.

[3] Minn. law 2023, chapter 24 (HF 1656)
[4] Minn. law 2023, chapter 53, art. 21, sec. 6(c) (SF3035)

State funding totaling $190 million was appropriated to provide grants for assistance with project and proposal development, offset the cost-share requirements of federal funding programs, and reduce the project costs for Minnesota entities receiving federal grant funding. A breakdown of the funding is provided in the table above. By the end 2023, Commerce had allocated over $29 million for round one of the SCF grant programs. Additional details on SCF-funded programs can be found in the annual State Competitiveness Fund Annual Report to the Minnesota State Legislature.

Jobs, Economic Development, Labor, and Industry Omnibus: Chapter 53, art. 21, sec. 2, created the Minnesota Climate Innovation Authority Account to stimulate the development of clean energy and GHG emissions reduction projects by using innovative financing tools to leverage private and public capital to overcome the market barriers that inhibit the financing of these projects.

Art. 21, sec. 6(b) required that, by June 30, 2025, Minnesota Department of Management and Budget transfer $25 million to the Minnesota Climate Innovation Authority Account. Art. 21, sec. 6(c) required Minnesota Department of Management and Budget to transfer $75 million to the State Competitiveness Fund account. (216C.44)

Environment & Energy Policy and Finance Omnibus established new programs and studies, modified existing programs, and appropriated programmatic funding for fiscal years 2024 and 2025 within chapter 60, art. 10 through 12, including the following:

Solar modules reuse and recycling study: Art. 3, sec. 36 required MPCA, in consultation with Commerce and the Department of Employment and Economic Development, to report on how to develop a statewide system to reuse and recycle solar photovoltaic modules and installation components. After completion of the report, a work group will be created, including the Commerce Commissioner or designee(s), to advise on policy recommendations for a statewide system to manage solar photovoltaic modules and installation components.

Solar for Schools program modified and money appropriated: Art. 12 modified the statute to provide Commerce authority to administrator Solar for Schools Program statewide, including inside Xcel Energy service area. Art. 10 appropriated an additional $1.138M for grants to colleges and universities outside Xcel Energy service area and $15M for K-12 institutions outside Xcel Energy service area, and art. 11 appropriated $14.31M for grants to K-12 institutions inside the Xcel Energy service area. (Minn. Stat. § 216C.375)

Solar on Public Building Program established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and grant award process for the solar on public buildings grant program to award grants to local units of government and Tribal Nations for the purchase and installation of solar energy generating systems on public buildings. Art. 11 appropriated $5M for grants inside Xcel Energy service area. (Minn. Stat. § 216C.377)

Community Solar Garden modifications made several changes in the statute governing community solar gardens in Art. 12, sec. 14, including sunsetting the program operated by Xcel Energy and establishing a new program administered by Commerce; requiring at least 55% of each garden to be reserved for low- and moderate-income households and other target subscribers; creating a new bill credit structure that guarantees savings for income-eligible households; increasing the maximum garden capacity from one to five megawatts;

and removing the requirement that subscribers live in the same county as the generating facility or in an adjacent county. Art. 10 appropriated $1,922,000 for activities under Minn. Stat. § 216B.1641.

Community Solar Garden Study: Art. 12 established that Commerce must contract a third party for a study on the operation of the Community Solar Garden, pursuant Minn. Stat. § 216B.1641, and submit a report by December 15, 2024, to the legislature. Art. 10 appropriated $300,000 for the study.

"Made in Minnesota" solar energy production incentive program: Art. 11 appropriated $200,000 to administer the program. (Minn. Stat. § 216C.417)

Solar*Rewards Expansion extends and allocates funds to the Solar*Rewards program administered by Xcel Energy. Refer to docket E002/M-13-1015 for more program details. The updated statute requires that one-half of available funds in 2023, 2024, and 2025 be set aside for low-income households and nonprofits that serve them. Art. 11 appropriated $11.25M for program operation in 2024 and $6.25M for program operation in 2025.

Strengthen Minnesota Homes program established and money appropriated: Art. 10 required Commerce to develop administrative procedures governing the program, and appropriated $1M in planning funds for the program. (Minn. Stat. § 65A.299, subd. 4)

Weatherization, preweatherization, and workforce training additions and money appropriated: Art. 10 included the following expansions of the existing weatherization program, including appropriations of:

- $38.737M for weatherization and preweatherization work to serve additional households and allow for services that would otherwise be denied by current federal limitations in the federal weatherization assistance program. The purposes for which these state funds may be used was expanded, and a grant program was established in Commerce to train workers to for the weatherization industry.
- $300,000 to remediate vermiculite insulation from households that are eligible for weatherization assistance under Minnesota's WAP state plan.

Residential Electrical Panel Upgrade Grant Program established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and grant award process for the Residential Electrical Panel Upgrade Grant program to award grants to owners of residential buildings to upgrade the buildings' electrical panels. Art. 10 appropriated $3M for grants outside Xcel Energy service area, and art. 11 appropriated $3.5M for grants inside Xcel Energy service area. (Minn. Stat. § 216C.45)

Residential Heat Pump Rebate Program established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and rebate award process for the heat pump rebate program to supplement rebates for the purchase and installation of heat pumps in residences whose homeowners have received or applied for a rebate under the federal Inflation Reduction Act. Art. 10 appropriated $6M for grants outside the Xcel Energy service area, and art. 11 appropriated $7M for grants inside the Xcel Energy service area. (Minn. Stat. § 216C.46)

School Air Ventilation Program Act established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and grant award process for the air ventilation

pilot program grants, and art. 10 appropriated $1M to award grants to school boards to reimburse for the following activities:

- completion of a heating, ventilation, and air conditioning assessment report;
- subsequent testing, adjusting balancing work performed as a result of assessment; and
- ventilation equipment upgrades, replacements, or other measures recommended by the assessment to improve health, safety, and heating, ventilation, and air conditioning (HVAC) system efficiency. (Minn. Stat. § 123B.663)

Tribal Advocacy Council on Energy established and money appropriated: $300,000 for the creation of, technical assistance for, and administrative support of a Tribal Advisory Council on Energy (TACE) with the 11 federally recognized Tribal Nations in Minnesota, lead in coordination with Commerce. Commerce will provide staff to assist this Council.

Electric Vehicle Rebate program established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and rebate award process for the EV Rebates program. Art. 10 appropriated $5M for EV rebates outside Xcel Energy service area, and art. 11 appropriated $10.716M for EV rebates inside Xcel Energy service area. (Minn. Stat. § 216C.401)

Electric School Bus Deployment Program established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and grant award process for the electric school bus grants program, art. 10 appropriated $6M for the program outside Xcel Energy service area, and art. 11 appropriated $7M for the program inside Xcel Energy service area. The program also permits a public utility to file a program to promote deployment of electric school buses in a school district with the PUC. (Minn. Stat. § 216C.374)

Manufacturers' Certification of Auto Dealers to Sell EVs reimbursement grants established and money appropriated: Art. 12 required Commerce to develop administrative procedures governing the application and grant award process for the auto dealers EV training and certifications reimbursement grants. Art. 10 appropriated $1M for grants outside Xcel Energy service area, and art. 11 appropriated $1M for grants inside Xcel Energy service area. (Minn. Stat. § 216C.402)

High-voltage DC transmission line upgrades between North Dakota and Minnesota: Art. 10 appropriated $15M to Minnesota Power to increase the capacity and improve the reliability of an existing high-voltage direct current transmission line between ND and MN.

Electric Grid Resiliency Grants established a grant program in Commerce to develop distributed energy projects. Art. 10 appropriated $5.3M for the program. (2023 Session law, art. 12, sec. 72)

Distribute Energy Resources System Upgrade Program established and money appropriated: Art. 12 established a Commerce program to provide funds to Xcel Energy to complete electric grid upgrades that are necessary to accommodate the interconnection of ratepayers' distributed energy resources. Art.11 appropriated $10.25M for the program. (Minn. Stat. § 216C.378)

Energy benchmarking: Minn. Stat. § 216C.331 created a program that requires owners of commercial and multifamily buildings of 50,000 square feet or more, that are located in the 7-country metropolitan area and municipalities with 50,000 people or more, to annually document each building's energy use via an EPA computerized benchmarking tool and send the information to Commerce. Art. 10 appropriated $2.108M for implementation of the benchmarking, of which $750,000 is reserved for non-investor owned utilities and $756,000 for the Building Owners and Managers Association Greater Minneapolis.

Energy Storage Incentive Grants Programs established and money appropriated: Art. 12 required Commerce and Xcel Energy to develop administrative procedures governing the application and rebate award process for the on-site solar-energy storage incentive grants programs, to reduce the cost to purchase and install an on-site energy storage. Art. 10 appropriated $3M to award grants outside Xcel Energy service area, and art. 11 appropriated $4M to award grants inside Xcel Energy service area. (2023 Session law, art. 10, sec. 2, subd. 2(v) and Minn. Stat. § 216C.379)

Energy Storage System Capacity Study: Art. 11 appropriated $250,000 for study of the energy storage system capacity required to achieve the state renewable electricity standard and carbon-free goals under Minn. Stat. § 216B.1691, and to host a public meeting to obtain recommendations on policies and programs to accelerate energy storage system deployment within Minnesota. (2023 Session law, art. 12, sec. 74)

Clean Energy Economy Minnesota for the Minnesota Energy Alley initiative: Art. 10 appropriated $3M to secure the state's energy and economic development future.

Clean Energy Resource Teams partnerships: Art. 10 appropriated $1M, see *2024 State Energy Policy and Conservation Report Chapter 2* for more details about CERTs duties. (Minn. Stat. § 216C.385, subd. 3)

City of Anoka Rum River Dam Feasibility Study money appropriated: $500,000 to the city of Anoka for feasibility studies related to the repair and reconstruction of the Rum River Dam.

City of Granite Falls hydroelectric repair: Art. 11 appropriated $2M for the repair and overage costs for its hydroelectric generating facility.

University of St. Thomas Center for Microgrid Research: Art. 11 appropriated $3.4M for the research.

Article 12, the Energy Policy article of the omnibus, also included the followings policies:

Buy Clean, Buy Fair Minnesota: Requires that the Department of Administration and Department of Transportation establish an Environmental Standards Procurement Task Force and standards to ensure that when the state funds new and renovated state buildings, as well as new and reconstructed trunk highways, it uses products and materials that have lower global warming impacts and are preferably made, assembled, or mined in Minnesota. (Art. 12, sec. 1)

Sustainable Building Guidelines Modifications: Amended Minn. Stat. § 16B.325, subd. 2, to establish energy guidelines for state buildings to incorporate provisions for resiliency with respect to climate change. (Art. 12, sec. 2)

Preference Order for Purchase of State Vehicles: Promotes the use of electric vehicles in the state fleet. (Art. 12, sec. 3)

Utility Reporting Due Date Modification: Changes dates by which utilities must file reports with the PUC regarding the number of customer disconnections. (Art. 12, sec. 10)

Repeal/Reinstatement of Intervenor Compensation Statute: Repeals the current intervenor compensation provisions while the compensation for participants in proceedings statute (Minn. Stat. § 216B.631) is in effect. (Art. 12, sec. 11)

Transportation Electrification Plan: Requires each public utility to file a transportation electrification plan with the PUC at least every four years that is designed to maximize the overall benefits of EVs and electrified transportation while minimizing overall costs, promote the purchase of electric vehicles, and promote the deployment of electric vehicle infrastructure. (Art. 12, sec. 12)

Customer's Access to Electricity Usage Data: Requires a utility to provide a customer's electricity usage data to the customer if needed for the interconnection of a distributed generating facility. (Art. 12, sec. 13)

Prairie Island Nuclear Power Plan Settlement Payments: Requires the PUC to approve as a rate increase a $7.5 million payment from Xcel Energy to the Prairie Island Indian Community each year the Prairie Island nuclear plant is in operation and $50,000 for each dry cask containing spent nuclear fuel that is stored at the facility. The money is to be used for any purpose that benefits the Prairie Island Indian Community. (Art. 12, sec. 15)

Distributed Solar Energy Standard: Requires that by the end of 2030 at least three percent of retail electric sales of both Xcel Energy and Minnesota Power be generated from solar energy generating systems with a capacity of 10 MW or less that are constructed or purchased after August 1, 2023; the comparable target for Otter Tail Power is one percent. Projects whose capacity is 100 kW or greater may be counted towards this target only if workers constructing the systems are paid at least the state prevailing wage and their employer participates in a registered apprenticeship program. (Art. 12, sec. 16)

Utility Customer Dispute Resolution: Establishes the complaint, investigative, and administrative and judicial review requirements for certain complaints against public utilities. (Art. 12, sec. 18)

Definition of Low-Income Household: Establishes a new definition of low-income household that determines eligibility for low-income programs under a utility's ECO plan: 80% of area median income or eligibility for other federal, state, or utility programs approved by Commerce. (Art. 12, sec. 19)

Approval of Projects to Modernize Transmission and Distribution System: Authorizes the PUC to certify a transmission project other than a high-voltage transmission line as part of a utility's state transmission plan, if the PUC finds the project to be in the public interest. (Art. 12, sec. 20)

Updated integrated distribution plan for distributed solar: Requires Xcel Energy to include in its integrated distribution plan filed with the PUC a forecast of distribution system upgrades necessary to interconnect distributed generation facilities Xcel adds to its system to comply with the distributed solar energy standard and the new solar community garden provisions. (Art. 12, sec. 21)

Large Wind Energy Conversion System Certification of Need Exemption: Excludes a solar energy or large wind system for which a site permit has been applied for by an independent power producer from the requirement to obtain a certificate of need from the PUC. (Art. 12, sec. 22)

Modification of Threshold Requiring PUC Approval: Increases the threshold for selling, acquiring, leasing, or renting a plant or operating system, above which said sale or consolidation requires PUC authorization. (Art. 12, sec. 23)

Commerce's Assessment Increase: Increases from $500,000 to $1,000,000 the maximum amount that Commerce can assess utilities to conduct activities related to energy grid reliability at the state, regional, or national level. (Art. 12, sec. 24)

Compensation for Certain PUC Proceeding Participants: Creates Minn. Stat. § 216B.631 which can provide compensation to certain participants in PUC proceedings. (Art. 12, sec. 25)

Property-Assessed Clean Energy (PACE) Loan Program: Expands program requirements to address land and water improvements on farmland. Requires disclosure of all terms and conditions in the loan document and written consent from the mortgage lender of any mortgage encumbering the commercial real property. (Art. 12, sec. 44)

RDA Projects Subject to Prevailing Wage/Diversity Report: Requires renewable development account utilities to submit annual diversity reports and requires prevailing wage to be paid on construction projects receiving funds from the renewable development account under sec. 116C.779, subd. 1, and to comply with certain prevailing wage provisions of the Minnesota Fair Labor Standards Act and prevailing wage law. (Minn. Stat. § 216C.51 and art. 12, sec. 47)

Energy Storage System Definition makes changes to definitions to energy storage system in 216E: For the purpose of obtaining a site permit from the PUC, an energy storage system is defined as having a nameplate capacity of 10,000 kilowatts or greater. (Art. 12, sec. 48)

Conforming changes to definition of large energy power facilities incorporates the new definition of "large electric power facilities," now expanded to include energy storage systems, into existing statutes governing site permits. (Art 12, sec. 49)

Gas and Hazardous Liquid Definitions Changes: Defines "gas" (to include carbon dioxide) and "hazardous liquid" in Minn. Stat. § 216G.02 (Art 12, sec. 60)

Greenhouse Gas Emission Reduction Goal Modifications: Amends the state greenhouse gas emissions reduction goal by establishing a 50% reduction target by 2030 and a net zero target by 2050. (Art. 12, sec. 61)

Modification to Annual Report on Telecommunications Access Program: Changes due date to March 31 of each year. (Art. 12, sec. 62)

Restriction on single family solar installations: Prohibited limits restrictions a homeowners association may impose on a property owner seeking to install a solar energy generating system. (Art. 12, sec. 63)

Extension of Sunset on Gas Utility Recovery of Infrastructure Costs to 2028: Moves the sunset date from June 30, 2023, to June 30, 2028 (Art. 12, sec. 66)

Decommissioning of Allen S. King Coal Plant: Requires Xcel Energy to file a plan and schedule for demolition of the King plant with the PUC in its next integrated resource plan or by December 31, 2025. A copy must also be submitted to the local city council. (Art. 12, sec. 70)

Cannabis Omnibus Bill: Chapter 63, art. 1, sec. 8 orders that the Office of Cannabis Management, in consultation with Commerce, must establish energy standards rules for cannabis businesses. Art. 9, sec. 6 appropriated $164,000 to establish the energy standards. (Minn. Stat. § 342.08)

Transportation Omnibus: Chapter 68, art. 4, sec. 29, 30, 31 and 77 amends rules and authority related to electric transmission lines in highway right-of-ways. (Minn. Stat. §§ 161.45; 161.46; 222.37)

References – Chapter 1

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Chapter 2: Minnesota Energy Leadership

Chapter 1 detailed how Minnesota's 2022 *Climate Action Framework*, carbon-free by 2040 legislation, and historic investments in energy between 2021–2023 have our state poised to move rapidly forward in its clean energy transition.

As the state's energy agency, Commerce is determined to work with other agencies, stakeholders, and industry to make the most of this historic opportunity to continue building a stronger, more resilient Minnesota. Unprecedented levels of state and federal funding are allowing Minnesota to achieve its clean energy goals. Commerce supports this by providing residents with accurate energy information; supplying technical assistance to local, state, and Tribal governments; and educating businesses about energy efficiency and electrification opportunities available to them.

Chapter 2 highlights some of the myriad ways that Commerce, other agencies, and many important partners are pursuing Minnesota's energy and climate goals. Examples include:

- Efficient operation and management of the state agencies and enterprise by the Department of Administration's Office of Enterprise Sustainability,
- Continued growth of and investment in community organizations like the Clean Energy Resource Teams,
- Innovative program develop such as Solar for Schools, and
- A variety of energy-related programs for businesses and, through them, the clean energy economy.

This chapter also describes current collaboration with the governments of Tribes sharing geographic territory within the borders of the State of Minnesota.

Energy Reduction Activities of State Agencies

Minnesota's *Climate Action Framework* includes goals for building energy use and waste reduction. Since a subset of the buildings within Minnesota are those owned and leased by the state government, various efforts are underway to lower the energy use of said government-owned buildings. In April 2019, Gov. Walz issued Executive Order (EO) 19-27 titled "Directing State Government to Conserve Energy and Water, and Reduce Waste to Save Money." The executive order continued work started under Gov. Dayton's EO 17-12 and EO 18-01.

Energy Intensity for Minnesota Agencies

Executive Order 19-27 outlines six sustainability goals, including a goal to reduce energy intensity 30% by 2027 from a 2017 baseline. Each of the 24 cabinet agencies are required to make progress toward the goal and submit an annual plan addressing the six focus areas. The plans require agencies to address energy conservation, energy efficiency, reducing fuel use, or fuel switching. Find progress toward the energy intensity goal, and other sustainability goals related to reducing fleet fossil fuel use, water consumption, and greenhouse gas (GHG) emissions and increasing solid waste diversion and procurement at sustainability.mn.gov.

The baseline energy intensity use is 130 kilo British thermal units (Btu) per square foot (kBtu/sq ft). In 2022, energy intensity was 114 kBtu/sq ft, so a 12% decrease in energy use. Energy use intensity dropped in 2020 due to the COVID-19 pandemic, and then slowly increased to pre-pandemic levels. During the pandemic natural gas use generally increased because it takes more energy to heat buildings with fewer people, while electricity use decreased from fewer lights, computers, and other equipment drawing power. Buildings with residents that are used 24 hours a day, every day, are the greatest challenge and opportunity for reducing energy use.

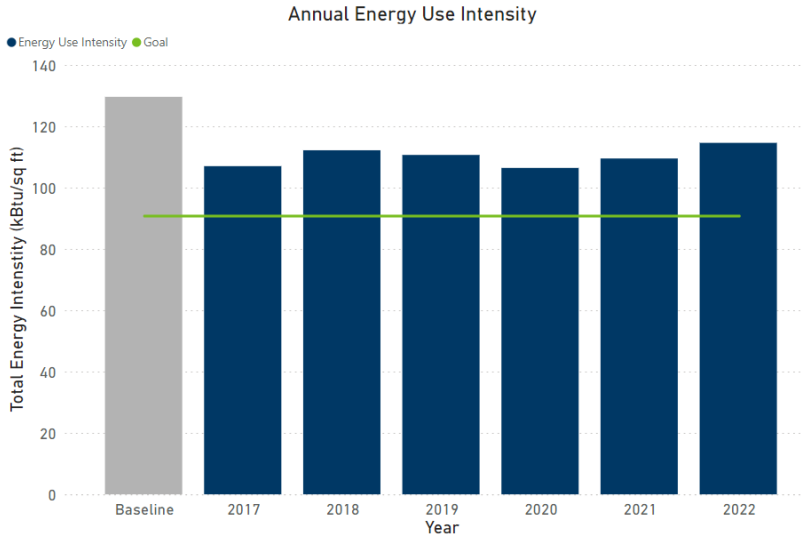

Figure 2-A: Energy Use Intensity (2017–2022)

Energy use intensity at the 24 cabinet agencies' buildings, including Metropolitan Council, is calculated by the total energy used in kilo British thermal units (kBtu) divided by the square footage (sq ft) of building space. Values include all owned and leased buildings for the 24 cabinet agencies. Energy use is not weather-normalized.

Source: Minnesota Department of Administration

To assist agencies in funding projects that will reduce energy use, the Department of Administration manages a $5 million revolving loan fund available to state agencies for energy conservation and improvement projects.

The revolving loan fund has financed four projects at agencies for efficient lighting and equipment, including light-emitting diode (LED) lamps at facilities for the Minnesota Department of Corrections and Minnesota Department of Transportation (MnDOT), as well as efficient cooling at a MnDOT building.

The enterprise's primary sources of energy are electricity and natural gas at 43% and 48%, respectively. In addition to the renewable energy in Minnesota's electric mix, nearly three percent of electricity used at the 24 cabinet agencies comes from renewable sources like onsite solar or geothermal, the combustion of biosolids in wastewater treatment, and subscriptions to green tariff programs offered through utility companies. This percentage is trending upward.

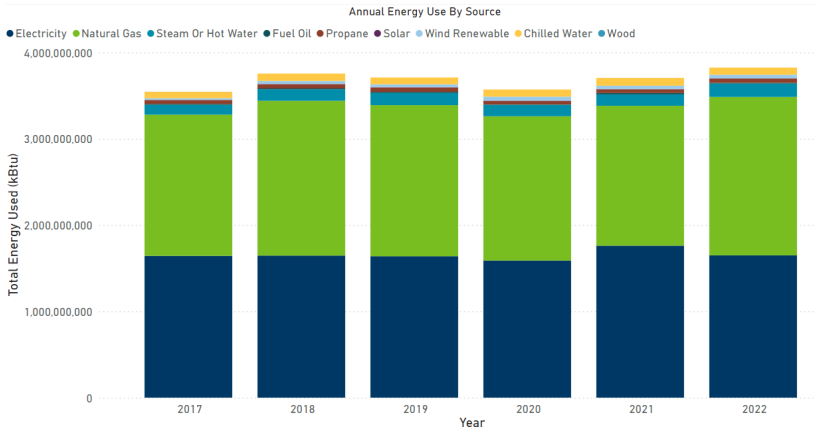

Figure 2-B: Total Energy Use by Source (2017–2022)

Total energy use at the 24 cabinet agencies, including Metropolitan Council, is calculated by the sum of all energy sources used to heat, cool, and illuminate agency buildings and process wastewater. Energy use is not weather-normalized.

Source: Minnesota Department of Administration

Energy, Water, and Greenhouse Gas Workgroup

Executive Order 19-27 also established three sustainability workgroups, including the Energy, Water, and GHG workgroup. Commerce continues in its leadership role on this workgroup, supporting implementation of energy efficiency and renewable energy strategies to achieve the state's goal to reduce energy consumption 30% per square foot by 2027, relative to a 2017 adjusted baseline.

Through this partnership, the Energy, Water, and GHG workgroup has improved accuracy of energy use tracking and reporting, released state contracts for solar design and installation and building energy efficiency audits, and completed the 2020 enterprise-wide Energy Action Plan.

Supporting Community-Led Efforts

Communities throughout Minnesota continue to lead energy efforts with innovative initiatives. Programs supported by the state of Minnesota have helped to facilitate many community initiatives, notably through the Community Energy Collaborative, Clean Energy Resource Teams partnership, the GreenStep program, the Local Energy Efficiency Program, and Climate-Smart Municipalities. Commerce acknowledges that underserved communities bear the greatest adverse impacts from climate change, shoulder the highest energy burdens, and stand to benefit the most from the emerging clean energy economy. As such, many of these initiatives collaborate with those communities.

Community Energy Collaborative

Commerce is working to establish long-term trusting relationships with communities that have traditionally been underserved or underrepresented in the state-based energy conversation. Commerce is seeking to proactively engage directly with communities and organizations representing and serving underserved, diverse populations via the Community Energy Collaborative (CEC).

During Phase 1, the collaborative identified ways to incorporate new technologies and develop energy policies and programs with an equity lens by developing a framework that recognizes the value of lived experience and

broader stakeholder engagement in meeting Minnesota's clean energy goals. It was an opportunity for Commerce and community organizations to collaborate to create a sustainable and inclusive energy future.

Phase Two then worked on developing tailored strategies and solutions, ensuring that community voices were integral to the planning process. Many of the suggestions have been added to in legislative policies and energy planning and programming structures.

In 2024, CEC is entering into the third year and Phase Three. The initiative is implementing these solutions, aiming to create equitable energy access and foster sustainable practices within these communities. The key to closing equity gaps and resolving climate vulnerability is direct participation by impacted communities in the development and implementation of solutions and policy decisions that directly affect them. CEC is using the Spectrum of Community Engagement to Ownership tool as a pathway to strengthen and transform local initiatives. This tool fosters equitable spaces where communities can participate, particularly communities commonly excluded from voice and power.

Rather than merely informing stakeholders and communities, CEC has moved to a consultative approach, gathering input from the community by conducting annual needs assessments to ensure community needs are integrated into legislative processes and informing energy programs and policies. This approach ensures that community members move from being passive recipients to active co-owners of energy projects, reinforcing the importance of inclusivity and grassroots involvement in shaping the state's energy policies and programs.

Clean Energy Resource Teams (CERTs)

The Clean Energy Resource Teams (CERTs)[i] is a partnership between Commerce, Great Plains Institute, Southwest Regional Development Commission, and University of Minnesota Extension Regional Sustainable Development Partnerships created by Minn. Stat. § 216C.385. The mission of the partnership is to connect individuals and communities in Minnesota to the resources they need to identify and implement community-based clean energy projects.

Since it was established in 2003, the CERTs partnership has helped Minnesotans obtain the resources they need to identify and implement community-scale renewable energy and energy efficiency projects.

CERTs initially was funded by a grant from the Minnesota Legislative Citizen Commission on Minnesota Resources. At present, approximately a third of CERTs core funding comes from the Energy Conservation Optimization Program. CERTs continues as a public-private partnership staffed and operated by each of the four organizations who together offer a full cohort of resources and opportunities.

Between 2020 and 2024, CERTs worked with Tribal Nations on energy education (e.g., home energy event with Fond du Lac Band), solar development (e.g., net zero project with Prairie Island Indian Community), home electrification (e.g., exploring heat pumps with Lower Sioux Indian Community), vehicle electrification (e.g., through the development of an EV-Smart Native Nations program), and clean energy workforce development (e.g., solar career pathways with White Earth Nation and local partners). CERTs seed grants supported a range of clean energy projects with numerous Tribal Nations across Minnesota.

Since 2010, Clean Energy Resource Teams efforts saved or offset 715 billion Btu of energy use.

CERTs
CLEAN ENERGY RESOURCE TEAMS

Another focus of CERTs' work was to reduce energy burden in Minnesota (see Chapter 6, *Reducing Energy Burden for Low-Income Minnesotans*, for more about energy burden). CERTs partnered with utilities, communities action agencies, and others to pilot and then scale up the use of energy efficiency "blitz" outreach events in manufactured home parks. CERTs also leveraged funds for projects piloting the use of solar to reduce energy burden for manufactured home residents. Another avenue for impact was through food shelves, where CERTs established partnerships to connect food shelf shoppers with energy conservation items and tips, Energy Assistance and Weatherization Programs, and utility programs. In many cases, CERTs also provided assistance to the food shelves themselves on energy efficiency and renewable energy for their facilities, including solar site assessments, connections to energy audits, and support with funding opportunities.

In 2023, CERTs launched its Ambassadors program, through which individuals and organizations around the state—with particular attention to disadvantaged communities—develop their capacity to help community members navigate clean energy opportunities, such as federal, state, and utility programs. In its first year, the program grew organically to over 800 individuals.[ii]

Since its start in 2003, CERTs has grown to support and engage communities across Minnesota in seven regions, each of which are guided by a regional steering committee and local CERTs staff. Between 2020 and 2023 CERTs connected with more than 23,400 Minnesotans across the state through meetings, presentations, and outreach activities. CERTs awarded 109 community-based clean energy projects with seed grants. Since 2010, CERTs efforts helped save or offset nearly 715 billion Btus of energy use and over $9.1 million in energy costs.

GreenStep Cities, Tribal Nations, and Schools

The Minnesota GreenStep Cities & Tribal Nations program focuses on helping communities achieve their sustainability goals through implementation of 29 optional best practices. Each best practice can be implemented by completing one or more specific actions at a 1, 2, or 3-star level, from a list of four to eight actions. These actions are locally tailored, focusing on cost savings and energy-use reduction, and encouraging civic innovation. The Minnesota GreenStep Cities program will celebrate its 15-year anniversary in 2025.[iii, iv]

As a non-regulatory program, GreenStep learns from Minnesota cities—and in recent years from Tribal Nations and schools as well—and continually refines a set of best practice actions and resources for taking action. The program also benefits from contact with over 14 GreenStep-like programs across the nation and helped create the national Sustainable States Network in 2015.

As of 2023, GreenStep participants represent Minnesota as a whole in terms of geographic distribution. More than half (53%) of the state's population resides in the 144 GreenStep cities and four GreenStep Tribal Nations.

The Gold Leaf Challenge, launched in 2024, focuses on pathways for communities to take local climate action. Using the GreenStep program resources, this new program aims to challenge, assist, and recognize efforts for completing new actions across 44 identified high-priority, high-impact actions. Communities of any type (i.e., local/Tribal/regional governments, neighborhoods, institutions, etc.) also work on setting and completing goals. Actions and goals include energy efficiency and renewable energy priorities.

GreenStep initiatives in participating communities have yielded over 300 certified green buildings, 4,398 renewable energy generation sites, and 523 electric vehicle charging stations. 89% of GreenStep Cities use Buildings, Benchmarks, and Beyond (B3) Benchmarking software to track their buildings' energy use; for comparison, only 42% of Minnesota cities in general use B3 Benchmarking.

Climate-Smart Municipalities

Led by the University of Minnesota's Institute on the Environment, the Climate Smart Municipalities initiative is a multi-stakeholder international renewable energy and climate smart solutions exchange between 12 Minnesota cities, counties, and regions and eight peer organizations in the German state of North-Rhine Westphalia. Started in 2016, the network has helped Minnesota cities and counties collaborate in new ways with each other and state agencies, including Commerce, to implement high-impact local climate and energy measures. With support from Minnesota legislators, the private sector, and state agencies the initiative has resulted in 10 cities (Comfrey, Duluth, Elk River, Morris, New Ulm, Rochester, St. Cloud, St. James, Warren, and White Bear Lake) and two regional community partners launching and advancing measures that take a holistic, systems approach and emphasize community co-creation.

One example includes the City of Rochester, which, in 2023, took a big step towards GHG reduction with a project to install two geothermal wells at City Hall. The geothermal technology will allow the building's heating and cooling systems to operate without the use of fossil fuels and addresses system needs that resulted from the sunsetting of the previous steam system, which had reached its useful life. The system is built by Minnesota-based Darcy Solutions. The anticipated GHG reduction dovetails with Rochester Public Utilities' goal to achieve 100% renewable electricity by 2030.

The impact of the Climate-Smart Municipalities network is closely tied to the opportunity it provides municipal, county, and business leaders to experience that they are part of a transformative energy and sustainability journey that is occurring worldwide. This reinforces participants' local and regional leadership. Climate Smart Municipalities is the only such Germany-US state partnership project in the country. It has led to memorandum

of understanding being signed by Commerce, the Minnesota Pollution Control Agency, and—planned for 2024—MnDOT with their peer agencies in North-Rhine Westphalia.

Solar for Schools

In 2021, the Minnesota State Legislature established the Solar for Schools (SFS) grant program (Minn. Stat. § 216C.375). The program is administered by Commerce. In 2023, the legislature passed language that folds the previously separate program for schools in Xcel Energy territory (Minn. Stat. § 216C.376) into the program administered by Commerce, effective as of January 1, 2024.

The SFS program was designed to stimulate the installation of solar energy systems on Minnesota schools, as well as integration of renewable energy use into school curriculum. As of May 2023, kindergarten through 12th grade (K-12) schools (Independent, Special, and Cooperative Districts), Tribal Contract Schools, as well as MN State Colleges and Universities are eligible to apply for grants through the program.

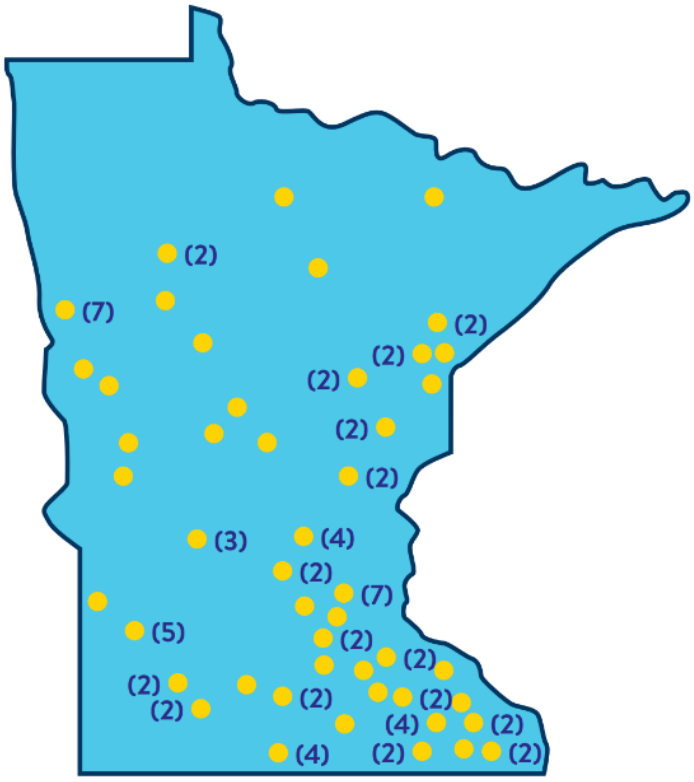

Figure 2-C: Minnesota's Cumulative K-12 Solar Schools

Yellow dots in Figure 2-C show the locations of schools participating in the Solar for Schools program. School districts and towns with more than one participating school are called out in paratheses.

Source: Minnesota Department of Commerce, data as of June 10, 2024

Minnesota Impact

Prior to 2022 when the SFS program began, the total installed solar capacity at Minnesota K-12 schools was over 13 megawatts (MW), with K-12 schools subscribed to another 9.1 MW of community solar.[v]

Through 2023, 105 schools across Minnesota have been awarded SFS grants. In the first 2024 funding round another 66 schools were invited to submit full applications. As a result, in its first three years the program is on track to nearly double the number of Minnesota K-12 schools with on-site solar energy, with a combined added solar capacity of roughly 20 MW.

Prior to the launch of the SFS programs, Minnesota State ranked 13th of 50 in cumulative installed solar capacity on schools and 11th in overall number of K-12 schools with solar.[vi] Considering the impact the SFS programs have had on the number of and total capacity of solar schools in the state, and the likely increase in demand due to new direct pay provisions, Minnesota has the potential to become a national leader in solar schools.

Solar on Public Buildings

In 2023 the Minnesota State Legislature established the Solar for Public Buildings Grant Program (Minn. Stat. § 216C.377). The program is administered by Commerce and designed to provide grants to stimulate the installation of solar energy systems on Minnesota's public buildings. As of 2024, only local units of government in Xcel Energy electric service territory are eligible for grants through this program. While this program is not yet available to local units of government across the rest of Minnesota, localities outside Xcel Energy territory have expressed interest.

Eligible applicants include counties, cities, towns, and other local government jurisdictions who own and operate public buildings, as well as federally recognized Tribal Nations in Minnesota. School districts are excluded from this program, as they are eligible for financial assistance under the SFS program discussed previously.

Commerce will distribute $4.3 million in grants (each not exceeding $84,000) for the installation of solar arrays on or adjacent to public buildings, with system capacity not to exceed the lesser of 40 kilowatts-alternating current (kW_{AC}) or 120% of the average annual electricity consumption. Commerce will administer at least two application rounds starting in 2024, with additional rounds dependent on funding. Future program iterations could consider solar arrays that are larger than 40 kW, as is now possible in the SFS program, to extend that benefit to local governments. Future iterations could also consider additional funding or prioritization of grant awards for arrays built in income-eligible communities or Justice 40 census tracts.

Community Solar Gardens

The 2013 legislature enacted Minn. Stat. § 216B.1641 requiring Xcel Energy to establish a community solar garden (CSG) program (the "Legacy CSG program"). This allowed Xcel Energy retail customers who might not otherwise have the ability to install solar panels on their property to subscribe to output from a ground-mounted or rooftop-mounted PV system, and to receive solar production credits on their Xcel Energy bill. In its 2023 Annual CSG Compliance Report, Xcel Energy noted the Legacy CSG program included over 900 MW_{AC} at 490 completed project sites, serving 34,000 subscribers. An additional 388 MW_{AC} at 423 sites was in progress.[vii] See Figure 2-D below for a breakdown of the subscriber types.

	Residential	Small Business	Commercial & Industrial	Other	Total
# of Subscriptions	30,061	1,527	2,234	576	34,398
% of Subscriptions	87%	4%	6%	2%	100%

Figure 2-D: Xcel Energy Solar Garden Subscription Metrics

Figure 2-D depicts Xcel Energy's completed solar gardens and participation under the different classification types.

Source: January 2024 Snapshot from Xcel Energy's Apr 1, 2024, Compliance Filing.

In May 2024 the PUC voted to move all CSGs whose subscribers were on the Applicable Retail Rate (ARR) bill credit rate to the 2017 vintage Value of Solar (VOS) bill credit rate on April 1, 2025. See Chapter 3, *Solar*

Programs and Tariffs: the value of solar for Community Solar Gardens, for an explanation of ARR and VOS. As the current ARR is higher than the VOS rate, residential and small general service subscribers will receive an "adder" to the VOS rate to partially compensate for lost subscription revenue from existing CSGs.[viii]

During the 2023 legislative session, the Minnesota Legislature made changes to the Community Solar Garden statute (Minn. Stat. § 216B.1641) that sunsets the Legacy CSG program operated by Xcel Energy and establishes a new program to be administered by Commerce. As of January 1, 2024, Xcel Energy's Legacy CSG Program is closed to new applications. In its place, Commerce launched the Low- and Moderate-Income (LMI) Accessible Community Solar Garden Program (LMI-Accessible CSG Program).

The 2023 law does not impact CSG subscribers under Xcel Energy's Legacy CSG Program, including those that received initial program approval prior to 2024 but have not yet gone online. The 2023 law applies to all community solar projects in Xcel Energy service territory that begin the application process in 2024 or later, as well as not-yet-completed projects in the Solar*Rewards Community Program that want to switch to the new program.

Commerce's new LMI-Accessible CSG Program makes several key changes from Xcel Energy's legacy program, though it is still limited to Xcel Energy customers in Minnesota. CSG projects in the new program must allocate at least 30% of their capacity to LMI household subscribers, which are defined as those making 150% of area median income or below. An additional 25% of each garden's capacity must be reserved for additional LMI households, affordable housing providers, and/or public interest subscribers (such as schools, faith communities, and non-profits). The bill credit rates for subscribers in Commerce-approved gardens will be calculated by customer class based on a percentage of the annually updated average retail electric rates. The cost of a CSG subscription (including all fees) must not exceed the value of the subscriber's CSG bill credit. For income-eligible households, subscription costs cannot exceed 90% of the bill credit, thereby providing guaranteed savings. Beginning in 2025, subscribers will have the option to enroll in consolidated billing, meaning that their subscription fees will be included on their Xcel Energy bill and not paid separately to the CSG operator.

Additionally, the LMI-Accessible CSG Program removes the previous requirement that subscribers must be based in the same or an adjacent county as the CSG. Now, Xcel Energy customers are eligible to sign up for any LMI-Accessible CSG project. These individual gardens may now be as large as five MW (up from the previous one MW limit). However, the annual capacity of Commerce-approved gardens is capped. In each year from 2024 to 2026, the program may approve up to 100 MW of projects. From 2027 to 2030, the cap drops to 80 MW per year. Starting in 2031, the program may approve up to 60 MW per year.

As of June 2024, Commerce has approved 47 projects totaling 44.7 MW for the LMI Accessible CSG Program. The first of these projects are expected to go online and begin generating bill credits in the summer of 2024.

Partnering with Tribal Nations

There are 11 federally recognized Tribal governments that share geography with Minnesota. Each Tribe is a separate sovereign nation with its own government, unique unto itself and distinct from all other federally recognized Tribes. Government-to-government relations between the Tribal Nations that share geography with

the State of Minnesota were recently codified into Laws of Minnesota 2021, 1st Special Session, chapter 14, article 11, section 5 to foster stronger government-to-government relations. Prior to Minn. Stat. § 10.65 being passed, government-to-government relations were established through Governors' executive orders.

Governor Walz issued Executive Order (EO) 19-01, updating the previous order (EO 16-01) in establishing the Minnesota Council on Diversity and Inclusion by expanding its focus to include equity issues, and calling for consultation to create equitable practices for the state to address the disparities and inequities throughout Minnesota. Under the order, Minnesota state policies and programs must ensure fair distribution of benefits, recognizing that historical, cultural, and institutional structures haven't consistently served all groups in our society.

Tribes are sovereign nations with the inherent right and authority to regulate activities on their lands independently from state governments. In consultation with Tribal Nations within Minnesota, each cabinet-level executive branch agency is required to develop and implement tribal consultation policies and designate a staff member as their Tribal liaison. Agency Tribal liaisons are responsible for implementing the consultation policy and serving as the principal point of contact for Tribal Nations within Minnesota. Minn. Stat. § 10.65 also requires training for designated staff to foster a collaborative relationship between the State of Minnesota and Tribal Nations.

Commerce established a Tribal Consultation Policy in 2022 and began engagements with tribal leaders, opening doors to new relationships and opportunities. Commerce leadership and staff receive Tribal-State Relations Training, an on-going training opportunity for all state staff. The training was established in 2013 with the main purpose of providing training and education for Minnesota State employees about Tribal governments, histories, cultures, and traditions. The training is designed to empower state employees to work effectively with Tribal members and promote authentic and respectful relationships among state agencies and Tribes.

Commerce recently hired a Tribal Liaison in May 2023. Since then, Commerce Commissioner Grace Arnold and Commerce Tribal Liaison conducted six Tribal Consultations: White Earth Nation, Red Lake Nation, Fond-du-Lac Band of Lake Superior Chippewa, and Prairie Island Indian Community were in-person, and Grand Portage Band of Lake Superior Chippewa was virtual in 2023. Tribal consultations allowed for introductions and relationship building between each respective Tribal Council, key Tribal staff, Commerce Commissioner, Commerce Tribal Liaison, and key Commerce staff. The commissioner presented an overview of Commerce, the agency's 2024 legislative policy proposals, and services where Commerce could partner with the Tribe, if interested. All the Tribes are working or have been working on developing their own energy-producing projects, each at different stages. The main issue discussed in Tribal consultation with Commerce is lack of capacity within the Tribes to develop projects, apply for state and federal funds, and implement the projects. The main request to Commerce was technical support and assistance to access the federal and state funding opportunities.

In early 2024, Commerce was able to provide energy development assistance funding to four Tribes and a Tribal-serving non-profit from the Minnesota State Competitiveness Fund (SCF); the four Tribes are Fond-du-Lac Band of Lake Superior Chippewa, Lower Sioux Community, Leech Lake Band of Ojibwe, and Bois Forte Band of Chippewa. The Tribal-serving non-profit is Midwest Tribal Energy Resources Association. In the SCF-Match assistance, Lower Sioux Community was funded in the quick round and Grand Portage Band of Lake Superior

Chippewa was funded in the standard round. One Tribal-serving non-profit, Native Sun, was also funded in the standard round.

In the legislative session ending May 2023, legislation was passed that allowed Commerce to support and provide administrative assistance to the development and on-going operation of a Tribal Advisory Council on Energy (TACE). In early 2024, Commerce Tribal Liaison supported an effort by all 11 Tribes to establish the TACE, with the goals of helping reduce members' energy burden, increase efficiency, and promoting self-sufficiency. A TACE workgroup that has at least one Tribal representative from each Tribal Nation has been working to establish the council's governance structure. The TACE workgroup has met three times and established the final draft of a governance document. It is expected that TACE will be formally established sometime summer 2024.

The Tribal Advisory Council on Energy will help reduce members' energy burden, increase efficiency, and promote self-sufficiency.

Commerce will continue to offer Tribal Consultations in an on-going schedule to routinely engage with all Tribal Nations sharing geography with Minnesota. The agency will continue to conduct government-to-government relations and work collaboratively on renewable energy project or any other efforts that the Tribal Nations may undertake for their community.

Assisting Business-Led efforts

Efforts by Minnesota businesses to reduce their energy usage and emissions and increase reliance on sustainable energy resources date back to the 1970s, with the creation of the U.S. Department of Energy (DOE) State Energy Program as well as the U.S. Environmental Protection Agency (EPA), when efforts nationwide to reduce reliance on imported fossil fuels began in earnest. Since that time, many businesses have realized economic benefits from energy conservation, efficiency, and renewable energy, as well as the marketing benefits of promoting their green-business efforts—both in terms of attracting customers and qualified workers.

Within Commerce's State Energy Office, the Energy Conservation and Optimization (ECO) program provides support to industry through Conservation Applied Research and Development (CARD) grants, the Energy Market Transformation team provides financing of energy efficiency and renewable energy measures in business through third-party administered financing, and financing efforts are expanding through the Minnesota Climate Innovation Finance Authority.

Minnesota Climate Innovation Finance Authority (MnCIFA)

In 2023, the Minnesota State Legislature passed bills[5] that created and funded the Minnesota Climate Innovation Finance Authority (MnCIFA), a publicly accountable financing authority commonly known in other states as a "green bank." The mission of MnCIFA is to accelerate the adoption of proven clean energy technology and GHG reduction projects to expand access to untapped markets and to bring benefits to historically underserved communities.

MnCIFA will use public dollars to leverage private investment by reducing the perceived risk, in a sense acting as private-sector gap funding. The Authority will also help pool projects to create investable opportunities and demonstrate the performance of clean energy projects in Minnesota's market. MnCIFA will partner with Minnesota's strong ecosystem of clean energy service providers, using additional investment to increase the adoption of existing products and reduce barriers for underserved and low-income populations.

MnCIFA will also foster robust consumer protections and support further development of Minnesota's clean energy workforce by requiring that large projects are subject to prevailing wage requirements. MnCIFA will also prioritize activities supporting creation of high-quality employment and apprenticeship opportunities for local workers.[ix]

Public-private partnerships

Two specific partnerships are the Southwest Regional Development Commission (SRDC) Commercial Property Assessed Clean Energy (C-PACE) program and St. Paul Port Authority's Trillion Btu Program. Commerce, SRDC, and the Rural Minnesota Energy Board partnered in 2013 to provide financing for clean energy projects with the aim of job retention and creation, energy cost savings for businesses, and improved tax bases of communities in the 18-county Southwestern Minnesota area. Funded in part with an Energy Efficiency Conservation Block Grant and DOE State Energy Program funds, the loan tool allows for project costs to be repaid through a special assessment on property tax, offset by the decrease in energy costs for minimal impact to businesses. Since the start of the program, there has been $1.012 million in loans under $100,000, with 28 originations since 2013 for small, rural businesses.

Businesses and non-profits in Minnesota have received funding for over 400 projects from the Saint Paul Port Authority, leveraging more than $300 million in project costs.

[5] Laws of Minnesota 2023, chapter 53, article 21, section 2 created the Minnesota Climate Innovation Authority Account (MCIAA) to stimulate the development of clean energy and GHG emissions reduction projects by using innovative financing tools to leverage private and public capital to overcome the market barriers that inhibit the financing of these projects.

Laws of Minn. 2023, art. 21, sec. 6(b) states that in the biennium ending on June 30, 2025, Minnesota Department of Management and Budget will transfer $25 million from the general fund to the MCIAA.

Laws of Minn. 2023, art. 10, sec. 6 appropriated $20 million from the general fund to the MCIAA.

Based on the success of the SRDC program, Commerce will be utilizing $1.5 million in funding from the Infrastructure Investment and Jobs Act (IIJA) Revolving Loan Fund (40502) to expand the regional C-PACE programs to other Regional Development Organizations (RDOs). This will be in the form of a Request for Proposals to the RDOs to provide funding for pilot projects or for full programs. Commerce will also provide $300,000 to SRDC for additional lending on their current program.

Ongoing energy and cost savings benefits from American Recovery and Reinvestment Act investments continue, as well from the Saint Paul Port Authority's (SPPA) Trillion Btu program. The Trillion Btu program is a revolving loan fund for commercial and industrial businesses and non-profit organizations with low-cost capital to be used for investment in cost-effective energy efficiency and renewable energy projects. With more than $17.5 million in base funding from Commerce, SPPA has continued to build the program, providing funding for over 400 projects and leveraged more than $300 million in project costs (which includes funding from private lenders). Most of the projects funded by Trillion Btu are more than $100,000, but the program also funds smaller projects for lighting and other energy efficiency improvements. The SPPA has Joint Powers Agreements with 70 Minnesota counties and the program has provided more than $20 million in annual energy bill savings for businesses statewide.

The Trillion Btu and SRDC programs partner on referrals, with the SRDC funding smaller projects (under $100,000) in their region and referring larger projects to the SPPA, as well as SPPA referring smaller projects in the southwest region to SRDC. The SPPA is willing to have similar referral relationships with any of the other RDOs that establish C-PACE programs in the future to better serve businesses statewide, regardless of size.

Clean Energy Jobs

During the funding of the American Recovery and Reinvestment Act, Commerce received grant funding and dedicated staff resources to assist in the development of clean energy jobs throughout Minnesota. Since those funds expired, Commerce has continued to participate In the Minnesota Energy Consortium and worked to both track and support workforce development initiatives.

Sustainability jobs in Minnesota grew by 3.4% in 2022, rebounding to pre-COVID levels.

The Minnesota Energy Consortium was formed in 2005 by energy industry leaders and the Minnesota State Colleges and Universities as they analyzed projected workforce shortages regarding the field of energy generation.[x] The partnership continues to work with energy utilities, Minnesota State colleges and universities, and state agencies to develop career pathways, build formal relationships within the workforce system, ensure a solid pipeline of students, improve accuracy of workforce data, and build relationships with contractors.

Commerce also continues workforce development tracking and training to meet specific workforce needs. For example, the DOE-funded Weatherization Assistance Program (WAP) supports training of contractors, residential auditors, and training and certification of quality-control inspectors. All DOE-funded work completed for WAP meets DOE national Standard Work Specifications and is approved by a quality-control inspectors. (See Chapter 6, *Low-Income Weatherization Assistance Program*, for additional information about WAP.)

Minnesota State colleges and universities, as well as unions and private institutions, continue to provide training for clean energy jobs throughout Minnesota. These and other sustainability jobs in Minnesota grew by 3.4% in 2022.[xi] Minnesota's clean energy workforce is nearly back to the 4th quarter 2019 employment levels, after losing more than 15% of the workforce between March and June 2020 due to the coronavirus pandemic constraining project deployments.[xii] The energy efficiency workforce was hit particularly hard by the pandemic since much of the work requires entering people's homes. The industry is rebounding now, growing 50% faster than Minnesota's overall workforce in 2022, with jobs in advanced transportation growing 11% -- one of the fastest growing sectors in the state.

Energy efficiency jobs comprise the largest sector of clean energy jobs in Minnesota, employing more than 43,100 Minnesotans in 2022. Renewable energy employed 8,713 people, followed by the advanced transportation sector. Grid modernization jobs grew 13% as utilities pursued grid modernization investments, and battery storage jobs grew five percent as energy storage technologies began to mature.

Jobs in clean energy and sustainability industries are located throughout the state, with over 33% of jobs located in Greater Minnesota. Minnesota's clean energy economy supports small businesses and veterans as well—in 2022, 72% of Minnesota's clean energy businesses employed fewer than 20 individuals, and over 11% of clean energy workers were veterans.[xv]

Sector	Q4 2019 Employment	Q4 2022 Employment
Energy Efficiency	47,114	43,133
Renewables	7,920	8,713
Clean Transport.	3,191	4,226
Grid & Storage	2,899	2,923
Clean Fuels	681	712
Total	**61,805**	**59,708**

Figure 2-E: Clean Energy Jobs in MN between 2019 and 2022

Minnesota lost more than 11,000 clean energy jobs between March and June 2020 as the coronavirus pandemic constrained project deployments and prompted payroll cuts.[xiii] Growth is returning the industry to its pre-2020 levels.[xiv]

References – Chapter 2

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[ii] How did CERTs serve Minnesota communities in 2023?, Clean Energy Resource Teams, January 2024.
[iii] GreenStep Cities – Decade of Growth video, YouTube, Aug. 27, 2020.
[iv] 10 Years of Impacts & Accomplishments with Minnesota GreenStep Cities, GreenStep Cities, April 2020.
[v] Brighter Future: A Study on Solar in U.S. K-12 Schools and Commerce internal data
[vi] Brighter Future: A Study on Solar in U.S. K-12 Schools and Commerce internal data
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[xii] Minnesota 2020 Clean Energy Jobs Report, Clean Jobs Midwest, based on the 2020 U.S. Energy Employment Report (2020 USEER)
[xiii] Minnesota 2020 Clean Energy Jobs Report, Clean Jobs Midwest, based on the 2020 U.S. Energy Employment Report (2020 USEER)
[xiv] *Minnesota Clean Energy Jobs Report*, Clean Jobs Midwest (accessed Apr. 29, 2024).
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Chapter 3: Minnesota Utility Rates

Minnesota Retail Utility Rate Policy and Design

Background

Minn. Stat. § 216C.18, subd. 1a, requires the Minnesota Public Utilities Commission (PUC), in consultation with Commerce to prepare a Rate Plan as part of this four-year *Energy Policy & Conservation Report*. The Rate Plan is to address the PUC's rate design policy pertaining to cogeneration and small power production (Minn. Stat. § 216B.164); energy conservation improvement (Minn. Stat. § 216B.241); and state energy policy related to energy savings, the use of fossil fuels and renewable energy, and Minnesota electric rates compared to the national average (Minn. Stat. § 216C.05).

For context, Minnesota statute directs the PUC to balance many factors when setting rates and implementing energy policy, including cost to customers, fairness to different groups of customers, financial needs of utilities, reliability, and the environment. Minn. Stat. Chapter 216B includes the following direction to the PUC in carrying out its energy utility rate-making responsibilities:

- Rates shall be just and reasonable, not unreasonably preferential or discriminatory, and consistent with the financial need of public utilities to provide service. (Minn. Stat. § 216B.03)
- Due consideration must be given to the public's need for adequate, efficient, and reasonable service and the need of the public utility for sufficient revenue to meet the cost of furnishing service and to earn a fair and reasonable return on its investments. (Minn. Stat. § 216B.16, subd. 6)
- Rates shall, to the maximum extent possible, be set to encourage energy conservation and the use of renewable energy. (Minn. Stat. § 216B.03)
- Cogeneration and small production shall be encouraged consistent with the protection of ratepayers and the public. (Minn. Stat. § 216B.164).

The PUC has other responsibilities integral to implementing state energy policies that are not in the legislative scope of this chapter, including granting certificates of needs, site permits, and route permits for energy generation facilities and transmission lines; reviewing electric utility resource plans, transmission plans, and integrated distribution plans; reviewing utility service quality reporting; reviewing cost recovery in rate cases and riders; setting planning values for environmental pollutants; and reviewing utility compliance with Renewable Electricity Standard (RES), Solar Electricity Standard (SES), and the newly established 2040 Carbon-free Electricity Standard and Distributed Solar Electricity Standard.

Cogeneration & Small Power Production and other Distributed Generation

Cogeneration and Small Power Production

As of December 31, 2023, there were 26,459 distributed energy resources[6] systems (40.8% increase over 2022) totaling 1.49 gigawatts alternating current (GW_{AC}) of nameplate capacity (8% increase over 2022) reported in Minnesota.[i] Xcel Energy's Community Solar Garden program accounts for more than half of all installed distributed energy resource (DER) capacity.

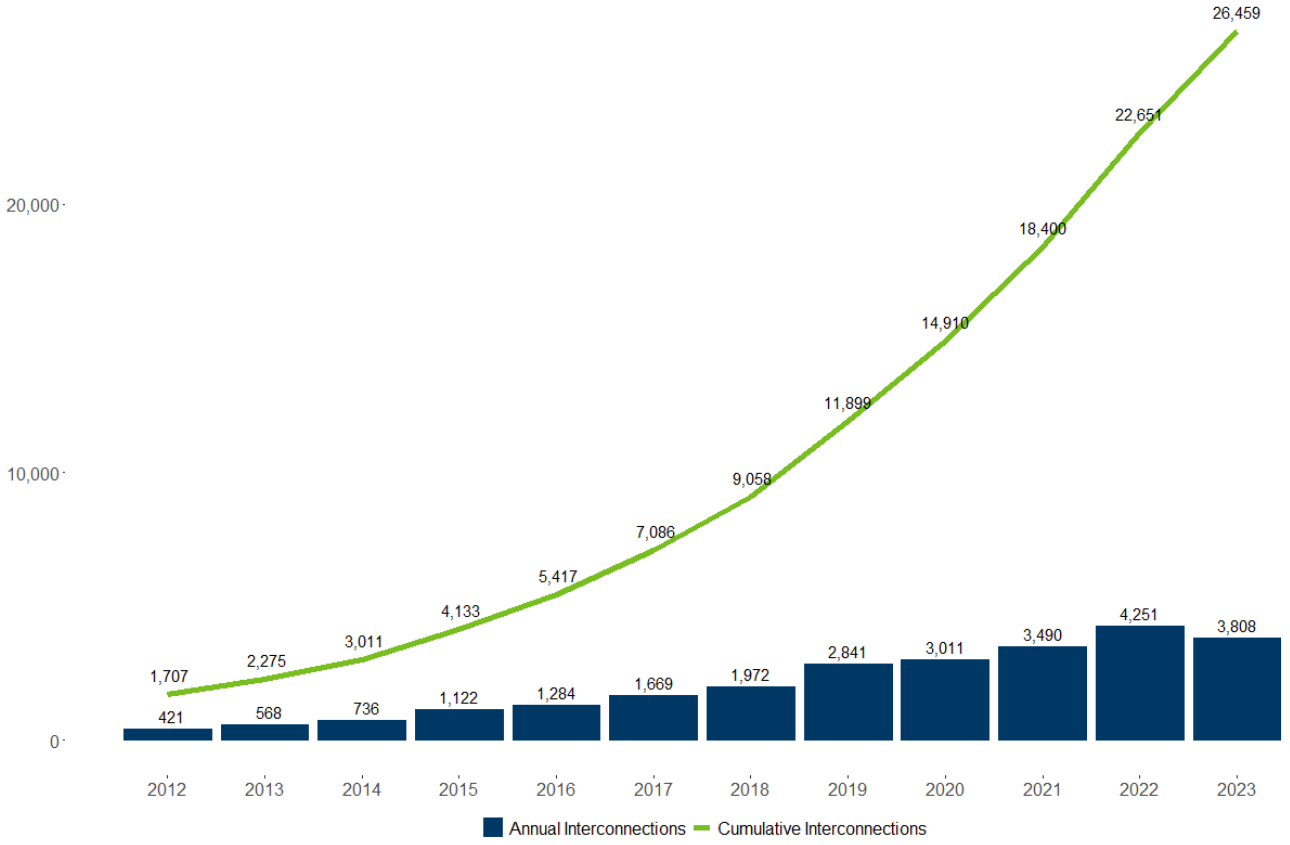

Figure 3-A: Annual and Cumulative Distributed Energy Resource Interconnections, 2012–2023

Bars show annual DER interconnections and green line displays cumulative DER interconnections. 2023 figures are based on preliminary utility data and are subject to change.

Source: Utility reports in Docket No. E999/PR-24-10 (2012–2023). Due to reporting errors, PUC staff used 2023 data from Xcel Energy's MN DIP interconnection report (Docket No. E999/CI-16-521).

[6] There are a lot of terms used to describe customer-owned distributed generation or distributed energy resources. Some terms carry different meanings, and others reflect changes over time. The federal Public Utilities Regulatory Policies Act (PURPA) refers to "small power producers," "cogeneration," and "qualifying facilities." Some examples of these are rooftop solar, solar+storage, combined heat and power, and distributed wind. Minnesota statute on interconnection references "distributed generation," whereas the net metering statute uses similar terms to PURPA. "Distributed energy resources" (DER) is the emerging terminology used to capture supply and demand side resources that can be used throughout an electric distribution system to meet energy and reliability needs of customers and can be installed on either the customer or utility side of the electric meter, including distributed generation and storage.

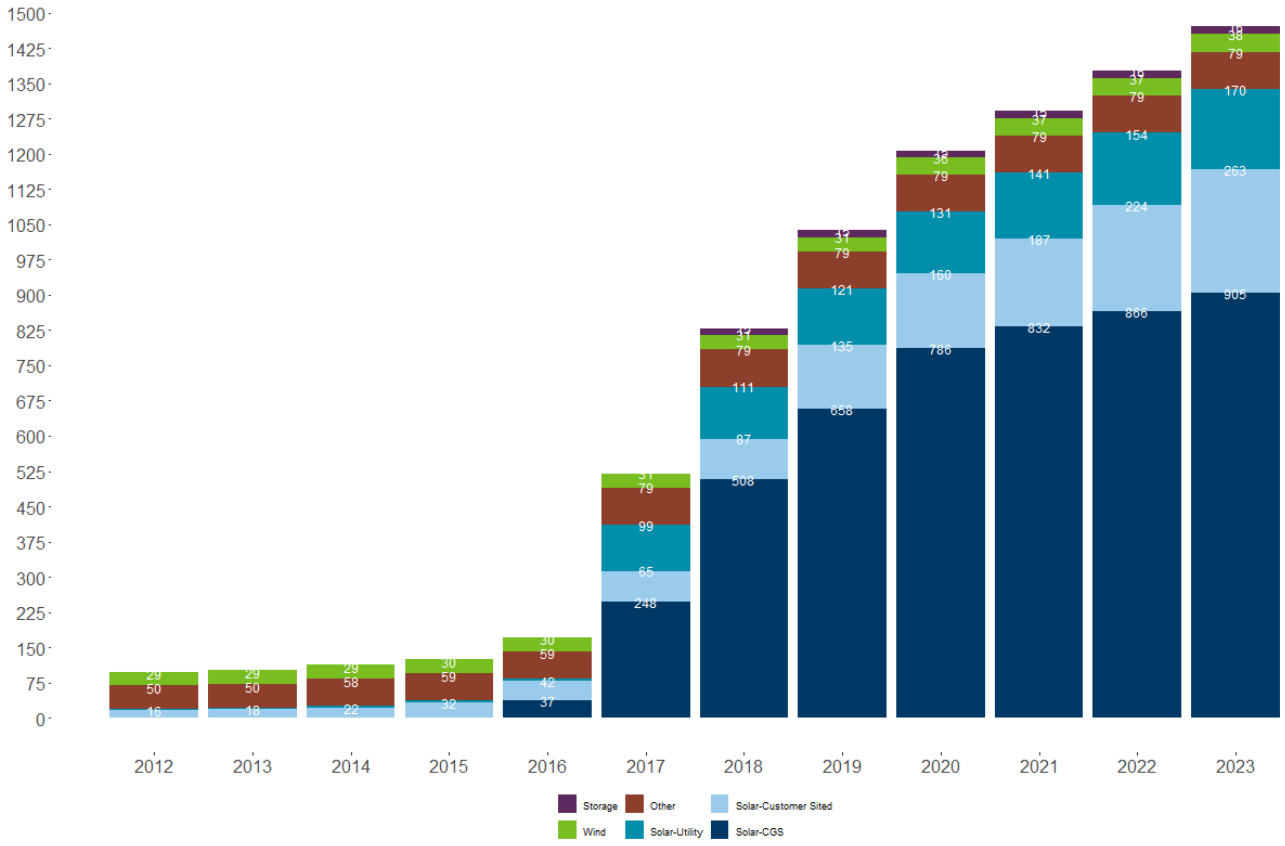

Figure 3-B: Cumulative Installed Distributed Energy Resource Capacity (MW), 2012–2023

Bars display cumulative installed DER capacity by technology type. "Other" includes biogas, biomass, hydro, methane, municipal solid waste, storage, and natural gas. 2023 figures are based on preliminary utility data and are subject to change.

Source: Utility reports in Docket No. E999/PR-24-10 (2012–2023). Due to reporting errors, PUC staff used 2023 data from Xcel Energy's MN DIP interconnection report (Docket No. E999/CI-16-521).

Background and History: Pre-2020

In 1978, Congress enacted the federal Public Utilities Regulatory Policies Act (PURPA), which among other things requires retail electric utilities to purchase power from cogeneration facilities and certain independent power producers and gives state regulatory authorities the responsibility to implement many of its provisions. In 1981, Minnesota enacted Minn. Stat. § 216B.164 to frame implementation of PURPA in this state; provisions regarding net-metering were added in 1983. Substantive modifications and additions to this Minnesota statute were enacted in 2013, 2015, and 2017. In 2020, the Federal Energy Regulatory Commission (FERC) adopted PURPA reforms in Order 872, including lowering the threshold to below five megawatts (MW) for a utility's obligation to purchase. The chart below summarizes federal and state statutes and rules that apply to small power producers and cogeneration:

- The PUC first adopted cogeneration and small power production rules (Minn. Rules (R.), Chapter 7835), implementing these statutes in 1983. The rules were amended in 2015 to implement the 2013 statutory changes with other technical updates.

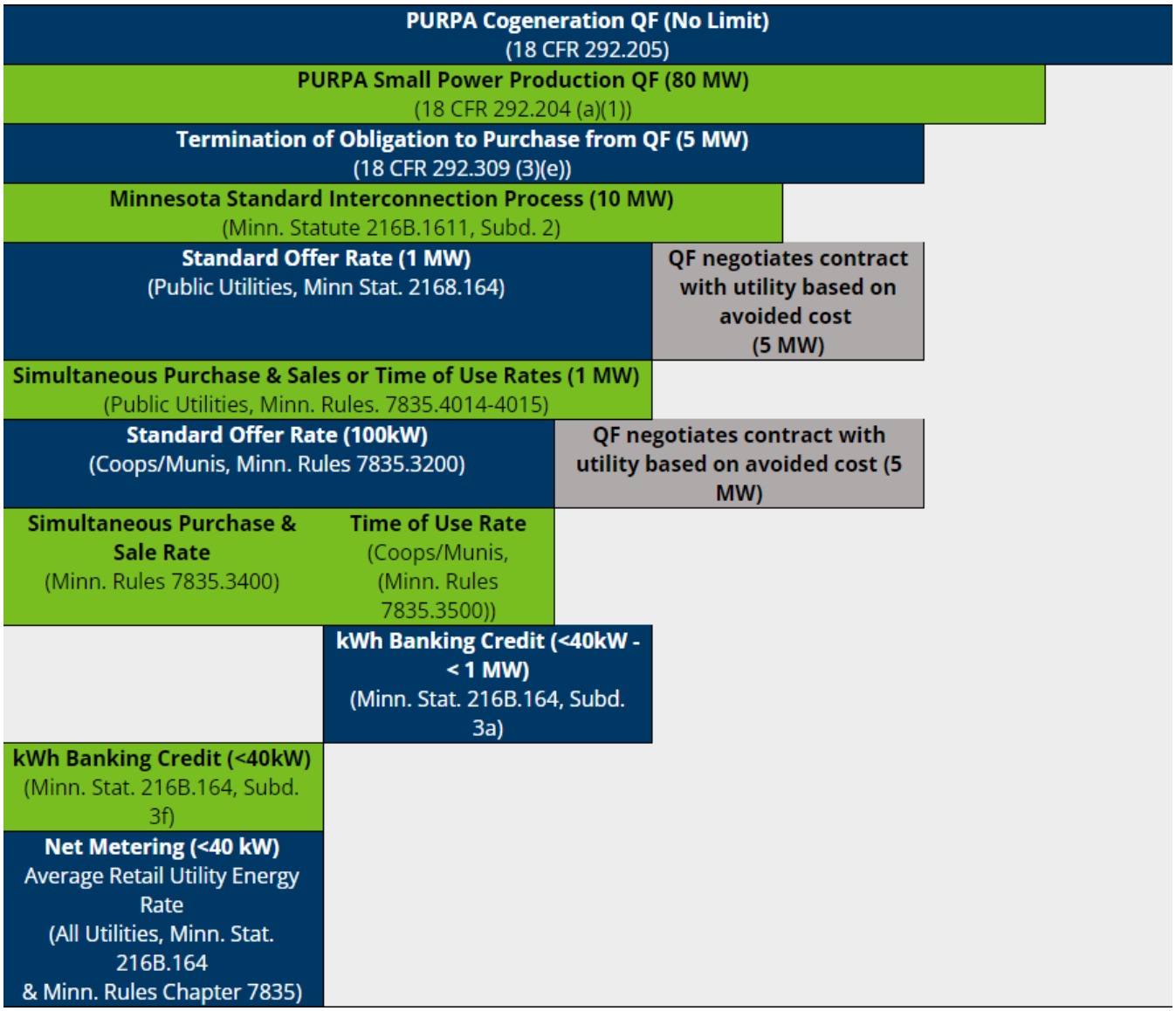

Figure 3-C: Comparison of Minnesota Statutes and Rules related to Public Utility Regulatory Policies Act (PURPA) for Distributed Energy Resources

Bars on this graph are not proportional in size. Please refer to size limits in each bar. In 2017, Minn. Stat. § 216B.164 was amended to allow cooperative utilities to assume jurisdiction. Local cooperatives' rules may differ from the state rules used in this chart. For more information, visit https://mn.gov/puc/activities/economic-analysis/distributed-energy/.

Source: PUC staff compilation confirmed by the Commission's Distributed Generation Advisory Group (2020)

PUC responsibilities with respect to implementation of PURPA and related state statutes include:

- Giving the maximum possible encouragement to cogeneration and small power production consistent with the protection of ratepayers and the public. (Minn. Stat. § 216B.164, subd. 1)

- Setting rates for purchases by utilities of energy from cogeneration facilities and small power producers (collectively known as Qualifying Facilities), and for excess energy from net-metered customers. (Minn. Stat. § 216B.164, various subdivisions)
- Resolving disputes between electric utilities and qualifying facilities (Minn. Stat. § 216B.164, subd. 5)
- Adopting statewide distributed energy resource interconnection standards for projects up to 10 MW that operate in parallel with the utility electric grid. (Minn. Stat. § 216B.1611)
- In 2017, subd. 11 was added to Minn. Stat. § 216B.164, which allows cooperative electric associations to assume the authority previously delegated to the PUC if it elects to do so by resolution and if it has rules in effect implementing the section, including provisions for dispute resolution. Most Minnesota-based electric cooperatives have chosen to assume this authority (see Docket No. 17-487).

Activity & Policies from 2020 and beyond

In 2023, Minnesota established a distributed solar energy standard for Xcel Energy, Minnesota Power, and Otter Tail that the utilities estimate will result in 500 MW of distributed solar by 2030, using competitive bidding for projects 10 MW or less constructed or procured after August 1, 2023 (Minn. Stat. § 216B.1691, subd. 2h). Implementation details can be found in Docket No. 23-403.

FERC requires regional grid operators (i.e., Midcontinent Independent System Operator (MISO) and Southwest Power Pool (SPP)) to allow DER and DER aggregators to participate in the market directly (FERC Order 2222). MISO and SPP are in the process of finalizing tariffs to implement this requirement and FERC has stated an expectation that wholesale participation is available before 2029. These tariffs must address technical considerations such as locational requirements for DER aggregations, data sharing, metering and telemetry requirements, and coordination among regional grid operators, DER aggregators, distribution utilities, and the relevant retail regulatory authority (e.g., PUC). One issue will be ensuring DER do not participate in a utility's retail programs and the wholesale market.

Several Minnesota utilities are moving toward time-of-use rates for all residential customers. Current utility tariffs limit net metering compensation options based on whether a customer is on a time-varying rate. The impact on existing customers net metering contracts may need to be considered. Also, as advanced metering infrastructure is rolled out, time- or locational-based rates or interconnection agreements become more technically possible.

Solar Programs and Tariffs: the value of solar for Community Solar Gardens

Background and History: Pre-2020

In 2013 Minnesota became the first state in the country to establish a statewide methodology for calculating the value of solar energy through amendments to Minn. Stat. § 216B.164. The amended statute allowed utilities to ask for approval to use a Value of Solar (VOS) tariff rather than standard net-metering for solar facilities.[ii, iii] The law required Commerce to develop a methodology for calculating a VOS rate to compensate customers who provide distributed solar photovoltaic (PV) electricity generation to their utility, for the value that generation produces for the utility, its customers, and society. On April 1, 2014, PUC approved Commerce's proposed methodology to calculate the value of solar.[iv,v]

Also in 2013, the legislature enacted Minn. Stat. § 216B.1641, requiring Xcel Energy to establish a community solar garden (CSG) program. The statute also establishes uniform standards, fees, and processes for the interconnection of community solar garden facilities. Xcel Energy's CSG program began accepting applications in December 2014.

Minn. Stat. § 216B.1641(d) defined compensation for CSG subscribers, noting that the utility shall purchase (offer bill credits) at the VOS rate, or, until that rate was approved, at an applicable retail rate (ARR) which the PUC updated annually. The ARR was the sole payment structure used until the PUC approved a 2017 VOS rate, with a 25-year schedule, for compensating customers in conjunction with Xcel Energy's CSG program. After that a new VOS vintage rate was updated each year and reviewed and approved by the PUC.[vi]

Activity & Policies from 2020 and beyond

In its 2023 Annual CSG Compliance Report, Xcel Energy noted the Legacy CSG program included over 900 MW_{AC} at 490 completed project sites, serving 34,000 subscribers. An additional 388 MW_{AC} at 423 sites was in progress. Approximately 69% of the Legacy CSG capacity was on the ARR rate.[vii] As of December 31, 2023, Xcel Energy's Legacy CSG Program closed to new projects but is anticipated to continue to serve subscribers through 2049 due to 25-year contracts and projects still in process.

In 2024 the PUC discontinued Xcel Energy's annual ARR and future VOS vintage rate filings given the rates no longer apply to new CSG projects. The PUC's May 30, 2024, Order approved a proposal from Xcel Energy to transition all ARR gardens to a modified VOS rate. As a result, based on Xcel Energy's 2023's Annual Report, 25,723 subscribers in the Legacy CSG program that currently receive the ARR will move to the modified 2017 VOS beginning April 1, 2025.

In 2023, Minn. Stat. § 216B.1641 was amended to create both a new Low-to-Moderate Income (LMI) Accessible and Legacy Community Solar Garden program for Xcel Energy customers. Commerce was charged with administering the LMI-Accessible CSG Program; see Chapter 2, *Community Solar Gardens*, for details.[viii] The amended statute also required the PUC to take certain actions, including annually approving bill credits based on a formula using average retail rates in statute rather than VOS, exempting income-eligible customers from CSG costs recovered in the fuel clause adjustment, and offering consolidated billing (i.e., a single Xcel Energy utility bill that incorporates the subscriber's monthly electric service, CSG bill credits, and the CSG subscription costs paid to a developer). Xcel Energy was charged with maintaining the Legacy Program for existing CSG customers and, unless modified, replaced, or superseded, the PUC's orders establishing the Legacy CSG program were to apply to the LMI-Accessible CSG Program (Minn. Stat. § 216B.1641, subd.3(b)).

Minnesota Distributed Energy Resource Interconnection Standards

Background and History: Pre-2020

- In 2001, the Minnesota Legislature enacted Minn. Stat. § 216B.1611, requiring the PUC to establish generic standards for interconnection and operation of on-site distributed generation for facilities of no more than 10 MW of interconnected capacity. After receiving stakeholder input, the PUC issued its order establishing standards in Docket No. E-999/CI-01-1023 on September 28, 2004, referred to as the

'2004 interconnection standards.' The order contained the interconnection process, technical requirements, application, engineering data submittal, attachment, interconnection agreement, and rates.

- In 2019, the PUC approved the Minnesota Distributed Energy Resource Interconnection Process and Agreement (MN DIP and MN DIA). In 2020, the PUC adopted updated, statewide Minnesota Technical Interconnection and Interoperability Requirements (TIIR).

Activity & Policies from 2020 and beyond

As of January 1, 2024, the TIIR is in full effect including the use of advanced inverters. For more information, visit https://mn.gov/puc/activities/economic-analysis/distributed-energy/interconnections/

Since 2020, the PUC has addressed several issues related to DER interconnection, especially related to emerging technology and areas of the distribution grid that have become capacity-constrained due to existing and planned DER.

- The PUC maintains a Distributed Generation Workgroup which meets at least annually and is tasked with reviewing implementation and technical issues that arise with the statewide interconnection standards (MN DIP, MN DIA, TIIR) or emerging DER technology. The PUC has requested the workgroup address, among other things:
  1) unintentional islanding;
  2) independent technical review proposal;
  3) energy storage, power control systems, and advanced inverter technical issues and impacts on operating agreements;
  4) interconnection review screens for non-exporting DER applications and DER applications with storage.

- Due to higher penetration and volume of distributed energy and stakeholder engagement, the PUC has acted on the following, specific to Xcel Energy's interconnection process:
- Established a cost sharing program and fee for small DER customers (under 40 kilowatts (kW)) used to cover supplemental review and distribution upgrade costs (e.g., transformers, reconductoring) which previously were fully borne by the individual DER customer that triggered the costs. In 2023, the legislature approved a $250,000 seed fund from Xcel Energy's Renewable Development Account to support the program;
- Improved publicly available hosting capacity analysis maps and grid information for DER customers to understand capacity constrained areas; and
- Required additional stakeholder engagement, documentation, and revision of business and engineering practices that impact interconnection.

In 2023, the legislature required the PUC to consider establishing interconnection procedures that allowed customer-sited DER projects with capacity of 40 kW and under priority over larger projects that may be in superior queue positions. The PUC's April 15, 2024, order approved an Xcel Energy proposal for two

administrative interconnection queues: a “Priority Queue” for customer-sited 40 kW and under projects and a “General Queue” for projects greater than 40 kW.

In 2023, Commerce was appropriated a total of $10.25 million to grant to Xcel Energy over two years for DER system upgrades. Minn. Stat. § 216C.378 describes the program’s purpose is to fund infrastructure investments necessary to enable DER interconnection, especially for 40 kW and under projects in capacity constrained areas, and advance innovative solutions to minimize upgrade costs (Docket No. 23-458).

Customer privacy (Docket No. 12-1344), open data access standards (Docket No. 19-505), and grid data and security (Docket No. 20-800) open dockets will determine what customer and grid data should be publicly available, what format to inform interconnection and other customer decisions, and what should be protected for privacy and security reasons.

Energy Conservation and Optimization Cost Recovery, Incentives, and Decoupling

Background and History: Pre-2020

- Commerce has responsibility for implementing and overseeing utility energy conservation and optimization (ECO) programs under Minn. Stat. § 216B.241; more detail of which can be found in Chapter 6. The PUC has responsibility for:
- Implementing utility cost recovery mechanisms to assure that public utilities recover their costs associated with Energy Conservation and Optimization (ECO) programs approved by Commerce. (Minn. Stat. § 216B.241, subd. 2b)
- Developing and implementing ECO performance incentive mechanisms for public utilities related to meeting energy savings goals. (Minn. Stat. § 216B.16, subd. 6c, and § 216B.241, subd. 2c)
- Developing criteria and standards for decoupling utility revenues from changes in energy sales to reduce a public utility’s disincentive to promote energy efficiency and implement pilot programs. (Minn. Stat. § 216B.2412)

The PUC allow natural gas and electric public utilities to include their ECO program-related costs in base rates established in rate cases and track the difference between the amounts built into base rates compared to actual costs. The difference in incurred costs is eligible for true-up in a rider on consumer bills; the PUC reviews and approves updated rider adjustments annually, including utilities’ financial incentives for inclusion in the rider.

As part of the Next Generation Energy Act passed in 2007, the legislature directed the PUC to review its existing energy conservation incentive plans under Minn. Stat. § 216B.16, subd. 6c, and to adjust utility performance incentives to recognize progress in meeting newly established energy-savings goals. On January 27, 2010, the PUC issued its Order Establishing Utility Performance Incentives for Energy Conservation, establishing a shared-savings financial incentive that awards a utility a percentage of the net benefits created by a utility’s energy conservation investments. The PUC has approved adjustments to the shared-savings incentive over the years based on Commerce’s in-depth review and analysis in the record.

Also in 2007, the legislature passed Minn. Stat. § 216B.2412, which required the PUC to establish criteria and standards for the decoupling of energy sales from revenues and establish at least one pilot program for a rate-

regulated natural gas or electric utility. Decoupling is intended to make a regulated utility indifferent to the risk of lost revenues resulting from fewer energy sales due to customer or utility investments in cost-effective energy efficiency and other resources that reduce total customer energy consumption, by separating a utility's revenues from changes in energy sales. The PUC issued its Order Establishing Criteria and Standards to be Utilized in Pilot Proposals for Revenue Decoupling on June 19, 2009.

CenterPoint Energy implemented the first pilot decoupling program which is still occurring, with modifications. Minnesota Energy Resources, Great Plains Natural Gas Co., and Xcel Energy-Electric also currently have decoupling programs. Minn. Stat. § 216B.2412, subd. 3, requires the PUC to report annually to the legislature on decoupling pilot programs. More detailed information on utility decoupling pilots can be found in these reports, at the Minnesota Legislative Research Library's Mandated Reports - Search: https://www.lrl.mn.gov/mndocs/mandates_detail?orderid=1615

Activity & Policies from 2020 and beyond

The Commission addresses utilities decoupling pilot programs as part of each utility's general rate case. Each year, utilities file annual decoupling true-ups. See the PUC's annual dockets list for Docket Numbers: Annual Dockets / Public Utilities Commission (mn.gov).

In October 2020, the PUC approved modifications to the overall design of the shared-savings performance incentives for natural gas and electric utilities conservation under Minn. Stat. § 216B.241. The modified incentive design started in the 2021–2023 triennial ECO period. The PUC also asked Commerce to continue its stakeholder process to (1) further explore improvements to the mechanism for review and potential adoption in the 2024–2026 triennium, and (2) develop an additional incentive for low-income ECO programs that could be implemented starting in 2022. See Chapter 6, *Energy Conservation and Optimization Program*, for further details about ECO program progress and activities since 2020 and for program projections looking forward.

Minnesota State Energy Policy in Minn. Stat. § 216C.05

Minn. Stat. § 216C.05 states:

> It is the energy policy of the state of Minnesota that:
>
> (1) annual energy savings equal to at least 1.5% of annual retail energy sales of electricity and natural gas be achieved through cost-effective energy efficiency;
>
> (2) the per capita use of fossil fuel as an energy input be reduced by 15% by the year 2015, through increased reliance on energy efficiency and renewable energy alternatives;
>
> (3) 25% of the total energy used in the state be derived from renewable energy resources by the year 2025; and
>
> (4) retail electricity rates for each customer class be at least five percent below the national average.

In the section below, these four goals (energy savings, reduced reliance on fossil fuels, renewable energy as a portion of total energy use, and electricity rates by customer class) are discussed or referenced to where they've been discussed previously in other chapters.

Energy savings as a portion of annual retail energy sales (Minn. Stat. § 216C.05(1))

As detailed in Chapters 1 and 5, this goal was updated to 2.5% energy savings in 2021 with the passage of ECO in Minn. Stat. § 216B.2401. See Chapters 1 and 5 for details about how the new standard is being met.

PUC reviews and approves electric and gas utilities' annual tracker accounts, financial incentives, and the adjustment factor (rate) charged to customers related to ECO implementation, as well as reviewing energy conservation and demand response program proposals outside the ECO Act and setting energy savings and demand response goals in resource plans.

Reduced Reliance on Fossil Fuels (Minn. Stat. § 216C.05(2))

The proportion of electricity generated in Minnesota from fossil fuels (coal and natural gas) decreased from 67% in 2005 to 45% in 2020.[ix] During this same 15-year period, Minnesota's population increased by 9.6%.[x] Thus, Minnesota's per capita use of fossil fuels for electricity reduced by 28.8% between 2005 and 2020.

In 2023, Minnesota adopted a carbon-free electricity standard as described in previous chapters. The Minnesota Legislature also directed the PUC to open a proceeding to consider gas utility regulatory and policy changes necessary to help achieve the state's greenhouse gas (GHG) reduction goals.[xi] For natural gas not used in electricity generation, the Minnesota Pollution Control Agency measures emissions at the end user rather than the utility when looking at the state's economy-wide goal:

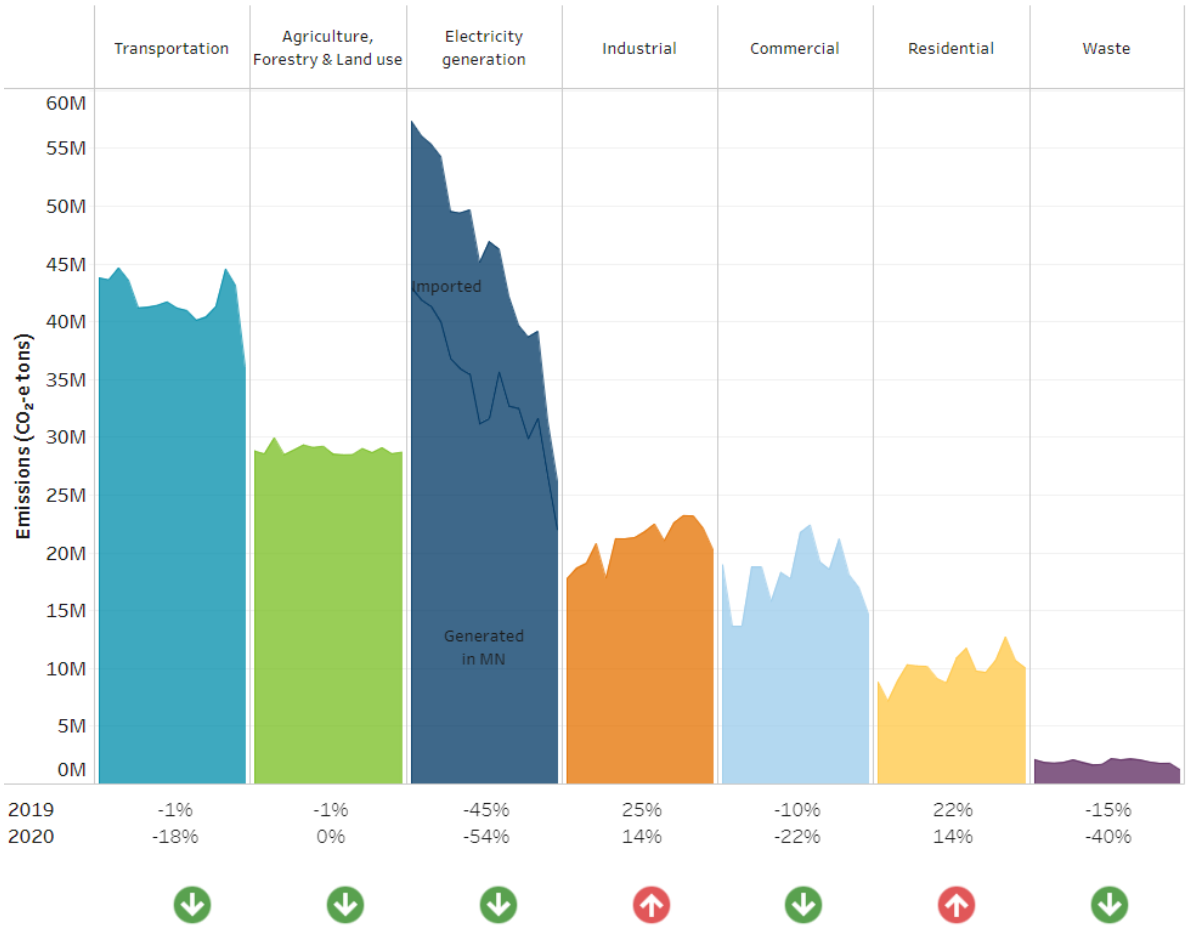

Figure 3-D: Emissions by Minnesota Economic Sector (Carbon dioxide Equivalent (CO_2e) tons)

Chart shows change in total emissions within seven economic sectors in Minnesota. Electricity generation is shown in 3rd column (dark blue). Natural gas utility emissions are dispersed in agriculture (2nd column, green), industrial (4th, orange), commercial (5th, light blue), and residential (6th, light orange). Below the chart shows the percentage change in emissions in 2019 and 2020 and an arrow of the overall trend of emissions increasing (red) or decreasing (green).

Source: Minnesota Pollution Control Agency

The PUC is in the process of establishing gas utility integrated resource plans (gas IRPs) for Xcel Energy, CenterPoint Energy, and the Minnesota Energy Resource Corporation and intends to finalize the gas IRPs by August 2024. Gas IRPs require utilities to evaluate different ways to ensure they have enough gas to serve customers at reasonable costs, provide information about utility distribution system investments, and evaluate whether there are opportunities to use new technologies to avoid some infrastructure projects. For more information, visit https://mn.gov/puc/activities/economic-analysis/planning/gas-irp/

Renewable energy as a portion of the total energy used statewide (Minn. Stat. § 216C.05(3))

As detailed in Chapter 1, Minnesota obtained 13% of its *total* energy (electricity and thermal energy) from renewable resources in 2021 and is at risk of missing its 25% by 2025 goal.

Refer to Chapter 1 for details about Minnesota's progress towards its renewable electricity (Minn. Stat. § 216B.1691, subd. 2a), solar electricity (Minn. Stat. § 216B.1691, subd. 2f), and 2040 carbon-free electricity (Minn. Stat. § 216B.1691, subd. 2g) standards. Utilities will address progress toward the updated renewable electricity standard in the biennial reports filed in Docket No. E999/PR-24-12.

In 2023, Minn. Stat. § 216B.2427, otherwise known as the Natural Gas Innovation Act (NGIA) was enacted. NGIA allows natural gas utilities to file, for PUC approval, innovation plans for the development or provision of innovative resources that will contribute to achieving the state's GHG and renewable energy goals. The PUC's June 1, 2022, and September 12, 2022, Orders establish frameworks for lifecycle GHG emissions intensity accounting and cost-benefit accounting for comparing innovative resources and measuring cost effectiveness of innovation plans (Docket No. G999/CI-21-566). As of March 2024, two natural gas utilities have filed NGIA Plans: CenterPoint Energy (Docket No. G008/M-23-215) and Xcel Energy (Docket No. G002/M-23-518).

The Commission has approved Renewable Natural Gas (RNG) interconnection rates and tariffs for CenterPoint Energy (Docket No. G008/M-20-434), Minnesota Energy Resource Corporation (MERC) (Docket No. G011/M-23-489), and Great Plains Natural Gas (Docket No. G004/M-24-73) to allow the RNG producers to use the gas utilities' local distribution system.

PUC establishes and reviews compliance requirements for utilities to meet various standards, approves interconnection and other tariffs and rates, and requires integrated resource planning for electric utilities and, beginning in 2024, gas utilities.

Electricity Rates (Minn. Stat. § 216C.05(4))

Between 2010 and 2019 (faded blue and red in the following chart), Minnesota's average electricity rates for all customer classes were below national averages. As shown in the chart above, the state did not achieve 95% below national average in three years for residential customers and one year for commercial customers during this timeframe.

Between 2020–2022 (bold blue and red in chart below), Minnesota's average electricity rates were below the national average except for industrial rates in 2021; however, Minnesota only achieved 95% of the national average for residential customers in 2021–2022 and commercial customers in 2020.

Electricity rates for this analysis rely on data from the U.S. Energy Information Administration (EIA). The actual per kilowatt-hour (kWh) rate on a customer's utility bill is different than the average rate EIA displays because the EIA data converts all charges on the utility bill that make up a utility's revenue and divide it by units of electricity sold (kWh).

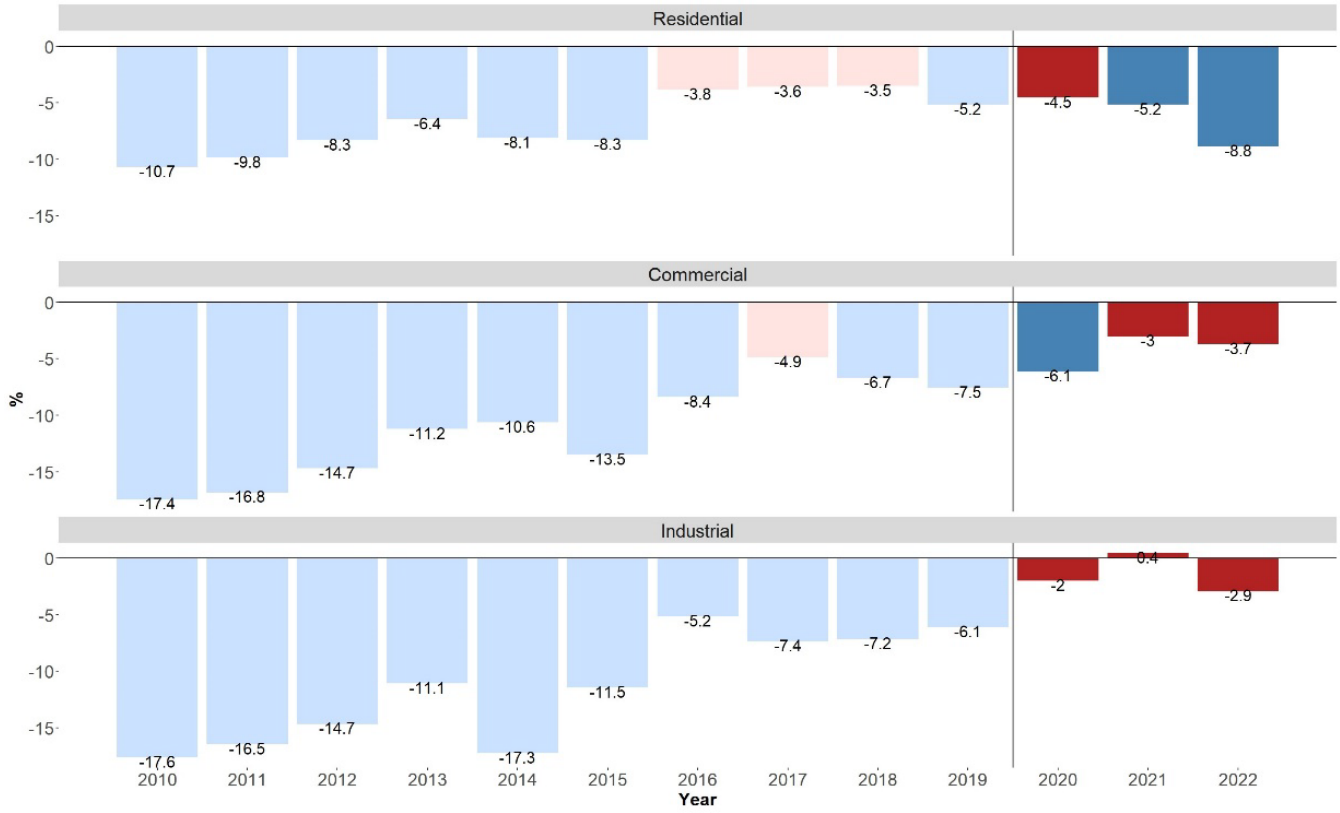

Figure 3-E: Minnesota Average Electric Rates by Customer Class compared to National Averages

Figure 3-E shows percentage difference between Minnesota electric rates compared to national average electric rates for customer classes. Rates for individual Minnesota utilities—public, cooperative, and municipal—vary from this composite analysis. Blue bars indicate Minnesota rates are below 95% of national average, whereas red bars indicate the Minnesota rates are not 95% or more below national averages.

Source: U.S. Energy Information Administration

In 2023, the breakdown of cost recovery in the average Minnesota residential consumer's electric bill was 41% generation, 23% transmission and distribution, 12% customer service and administration, and 11% taxes.

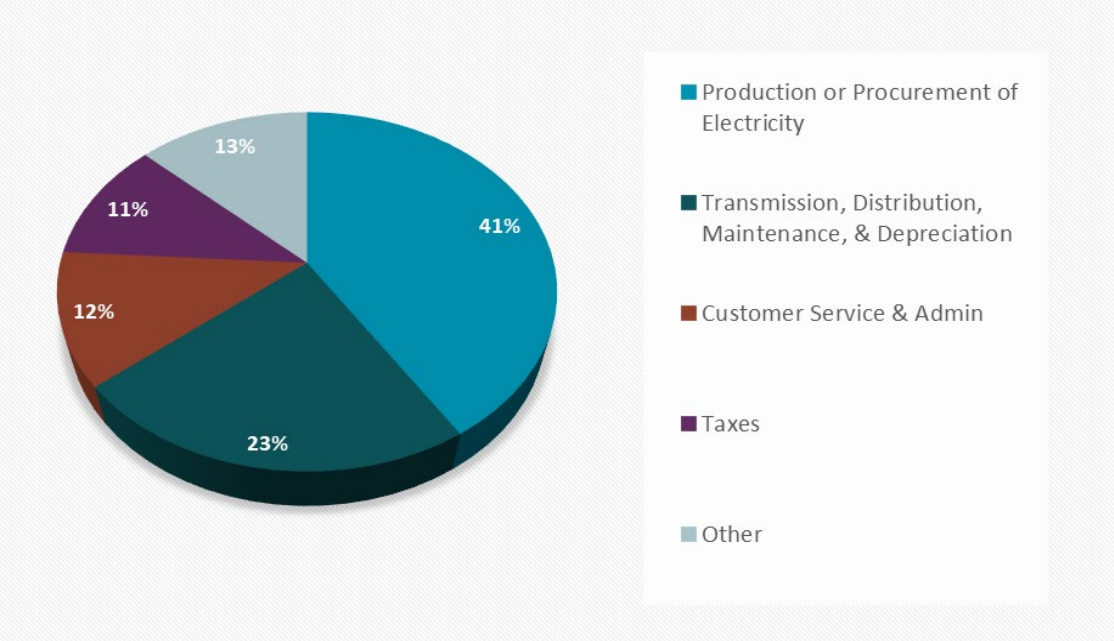

Figure 3-F: Estimated Typical Cost Recovery Minnesota Residential Electric Bill

Shows what percentage of the average Minnesota residential customers electric bill recovers various categories of utility costs. See utility reporting in Docket No. E999/CI-01-1127 for a specific rate-regulated electric utility's cost breakdown by generation, transmission, and distribution.

Source: PUC staff compiled aggregate data from utility rate cases in recent years.

An individual consumer's electric bill is comprised of:

- Fixed Charge: a set amount billed to each meter each month;
- Energy Charge: an amount that changes based on how much energy they use (per kWh) and potentially on the time of day of their usage;
- Demand Charge: an amount based on certain customers' demand (highest energy need over a certain timeframe); and
- Surcharges: taxes, fuel adjustments, riders, etc. Surcharges may be based on actual consumption or their demand level.

Some consumers may have multiple meters or voluntary programs (e.g., solar net metering, community solar garden bill credits, demand customers, or electric vehicle charging) that are also displayed on the electric utility bill.

An individual consumer receives a separate natural gas bill except for customers that receive both natural gas and electric service from Xcel Energy. Those customers receive a combined bill with separate charges for gas and electric.

The PUC establishes the fixed charge and energy charges during utility rate cases. Surcharges are typically addressed in separate proceedings and may vary throughout the year. One type of surcharge is riders established by statute below is a list of active riders:

Minn. Stat. §	Topic	Electric/Gas
216B.16, subd. 7	Fuel Clause Adjustment	Electric
216B.16, subd. 7b-c	Transmission cost adjustment	Electric
216B.1636	Electric infrastructure costs	Electric
216B.1645, subd. 2	Renewable energy PPAs/investment/Renewable Development Fund	Electric
216B.1645, subd. 2a	Utility owned renewable facilities	Electric
216B.1696	Energy-intensive trade-exposed (EITE)	Electric
216B.16, subd. 15	Gas Affordability Program costs	Gas
216B.1635	Natural gas utility infrastructure	Gas
216B.16, subd. 6b	Conservation improvement program costs	Gas & Electric
216B.16, subd. 6c	DSM financial incentives	Gas & Electric
216B.2412	Decoupling/Sales True-Up	Gas & Electric

Figure 3-G: Energy Utility Riders for Cost Recovery Approved in Minnesota Statute

Lists available riders for electric and gas utilities by statute and topic.

For more information, visit Understanding Your Bill / Public Utilities Commission (mn.gov)

References – Chapter 3

[i] Annual DER Data reported by all Minnesota electric utilities, Docket No. 23-10, and compiled and stored online at https://mn.gov/puc/activities/utility-reporting/annual-der-reports/. Updated 2023 data will be available later in 2024 based on Docket No. 24-10.

[ii] Minn. Stat. § 216B.1691, subd. 10.

[iii] Cory, Karlynn, "Minnesota Values Solar Generation with New 'Value of Solar' Tariff," *Transforming Energy*, National Renewable Energy Laboratory, Oct. 3, 2014.

[iv] "Order Approving Distributed Solar Value Methodology," Docket E-999/M-14-65, Minn. PUC, April 1, 2014.

[v] Minnesota Value of Solar: Methodology, Minnesota Department of Commerce, Division of Energy Resources, April 1, 2014.

[vi] *In the Matter of the Petition of Northern States Power Company, dba Xcel Energy, for Approval of Its Proposed Community Solar Garden Program,* E-002/M-13-867*,* ORDER APPROVING VALUE-OF-SOLAR RATE FOR XCEL'S SOLAR-GARDEN PROGRAM, CLARIFYING PROGRAM PARAMETERS, AND REQUIRING FURTHER FILINGS, September 16, 2015.

[vii] *Compliance – 2023 Annual Report, Legacy Community Solar Gardens Program, Docket No. E002/M-13-867* (.pdf), Xcel Energy, April 1, 2024.

[viii] Minnesota Department of Commerce CSG Program website, accessed on March 15, 2024: https://mn.gov/commerce/energy/consumer/energy-programs/community-solar-gardens.jsp

[ix] Energy Policy and Conservation Quadrennial Report, 2020 (.pdf), Minnesota Department of Commerce. March 1, 2021.

[x] PopFinder For MN, Counties, & Regions / MN State Demographic Center

[xi] Docket No. G999/CI-21-565

Chapter 4: Minnesota Resource Permitting, Planning, and Reliability

Being part of the North American power grid, which has been called "the world's largest machine," means that Minnesota's electrical grid and natural gas infrastructure extends beyond state borders both regionally and internationally.[i] It connects to almost every business and residence in the state.

Before the late 1970s, individual utilities owned and operated their own generation, transmission, and distribution facilities. Starting in 1978, the U.S. Congress passed several laws aimed at encouraging non-utility generators to compete in wholesale electricity markets. Then, in 1996, the Federal Energy Regulatory Commission (FERC) issued a series of orders that encouraged, but did not require, transmission-owning utilities to form and join "regional transmission organizations" or RTOs. These RTOs would not own but would operate and provide open access to the utilities' transmission systems. Nearly all Minnesota electric utilities are now part of the Midcontinent Independent System Operator (MISO).

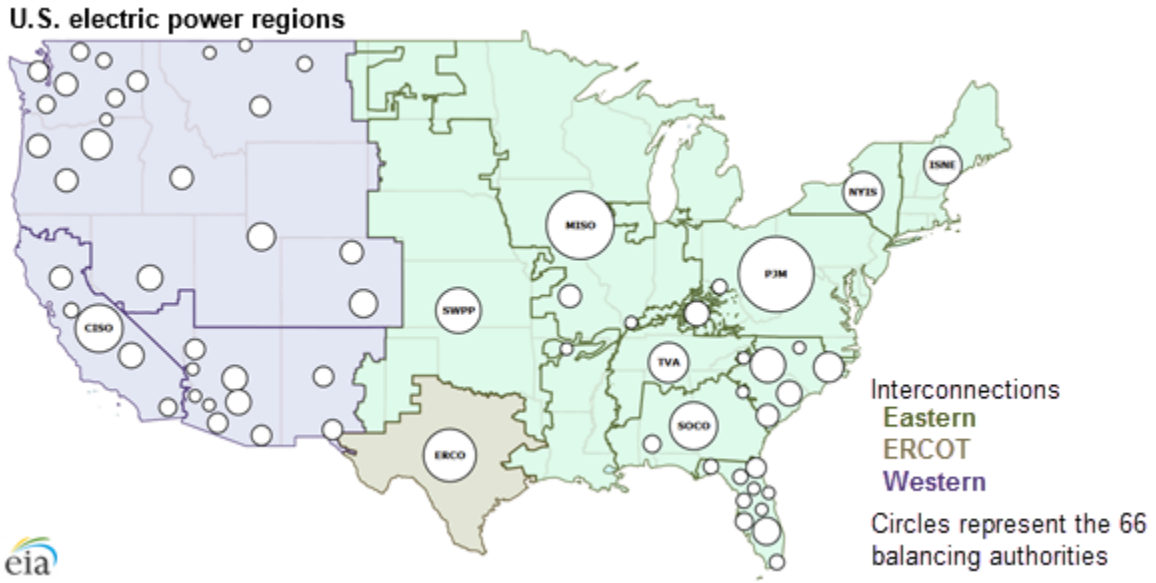

Figure 4-A: U.S. Electric Power Regions

Figure 4-A depicts the three national interconnections and control regions of the U.S. electric power grid. Electricity generated at power plants moves through a complex network of electricity substations, power lines, and distribution transformers before it reaches customers. In the U.S., the power system consists of more than 7,300 power plants, nearly 160,000 miles of high-voltage power lines, and millions of low-voltage power lines and distribution transformers, which connect 145 million customers. Local electricity grids are interconnected to form larger networks for reliability and commercial purposes. At the highest level, the U.S. power system in the Lower 48 states is made up of three main interconnections, which operate largely independently from each other with limited transfers of power between them.

Source: U.S. Energy Information Administration

Accordingly, the high-voltage transmission system in Minnesota and much of the U.S. is now planned and operated by RTOs under federal oversight, since high-voltage electricity transmission crosses state boundaries and operates as a multi-state, interconnected network. The RTO that most Minnesota utilities are in is called is MISO. MISO is responsible for planning the high-voltage transmission system in fifteen states and Manitoba, including most of Minnesota.[ii] The remainder of Minnesota's high-voltage electricity transmission systems are included in the Southwest Power Pool (SPP) RTO.

Site and Route Permitting

To ensure adequate and reliable electric and natural gas service at reasonable rates, Commerce and the Minnesota Public Utilities Commission (PUC) rely on economists, scientists, accountants, financial analysts, lawyers, and planners in their expert capacities. Commerce and the PUC also engage in technical, policy, and planning proceedings at federal, regional, and state levels, and Commerce participates in reliability and planning proceedings led by FERC, North American Electric Reliability Corporation, MISO, and PUC.

Through involvement in these organizations, Commerce and the PUC work to make sure that utilities can construct or obtain energy from generation facilities in an environmentally sound, efficient, and least-cost manner to support the wide range of electricity uses that power the state's economy and that the financial and economic requirements of public utilities are met.

The PUC has had responsibility to grant Certificates of Need and site or route permits for certain large energy facilities in Minnesota, such as power plants, transmission lines, wind farms, and pipelines, since 2005 when the state legislature transferred authority from the Environmental Quality Board. The PUC's permitting processes are defined in the following statutes and associated rules:

- Power plants, including solar farms, energy storage systems, and transmission lines (Minn. Stat. § 216E and Minn. R. 7850);
- Large wind energy conversion systems with a combined nameplate capacity of 5,000 kilowatts (kW) or more (Minn. Stat. § 216F and Minn. R. 7854); and
- Pipelines (Minn. Stat. § 216G and Minn. R. 7852).

The PUC's permitting decisions rely on the official record developed for each project, which includes information submitted by the applicant, involved parties, and participants in the docket, as well as from public input gathered during public meetings and hearings. The Commerce Energy Environmental Review and Analysis (EERA) unit conducts environmental review for energy facilities that are being reviewed by the PUC. An administrative law judge from the Minnesota Office of Administrative Hearings oversees public and evidentiary hearings on behalf of the PUC.

Although the PUC's permitting processes vary with the type and size of the proposed energy facility, all review processes include two main parts:

1. Gathering information about the project: This includes the merits of the proposed project, potential environmental impacts, community effects, and how such effects could be avoided or mitigated.

Information on potential effects is gathered through public meetings and public comment periods. Information is also provided in permit applications by prospective permittees, in comments or testimony by other parties or participants, and in EERA's environmental review documents, such as environmental impact statements.

2. Development and discussion of appropriate permit conditions for the project: Given information gathered about the project, its potential impacts and possible mitigation measures, proceedings seek to identify applicable permit conditions. These proceedings include public hearings and submission of public testimony. The administrative law judge for the hearing typically produces a report for the PUC that includes proposed findings of fact, conclusions of law, and recommendations regarding the project.

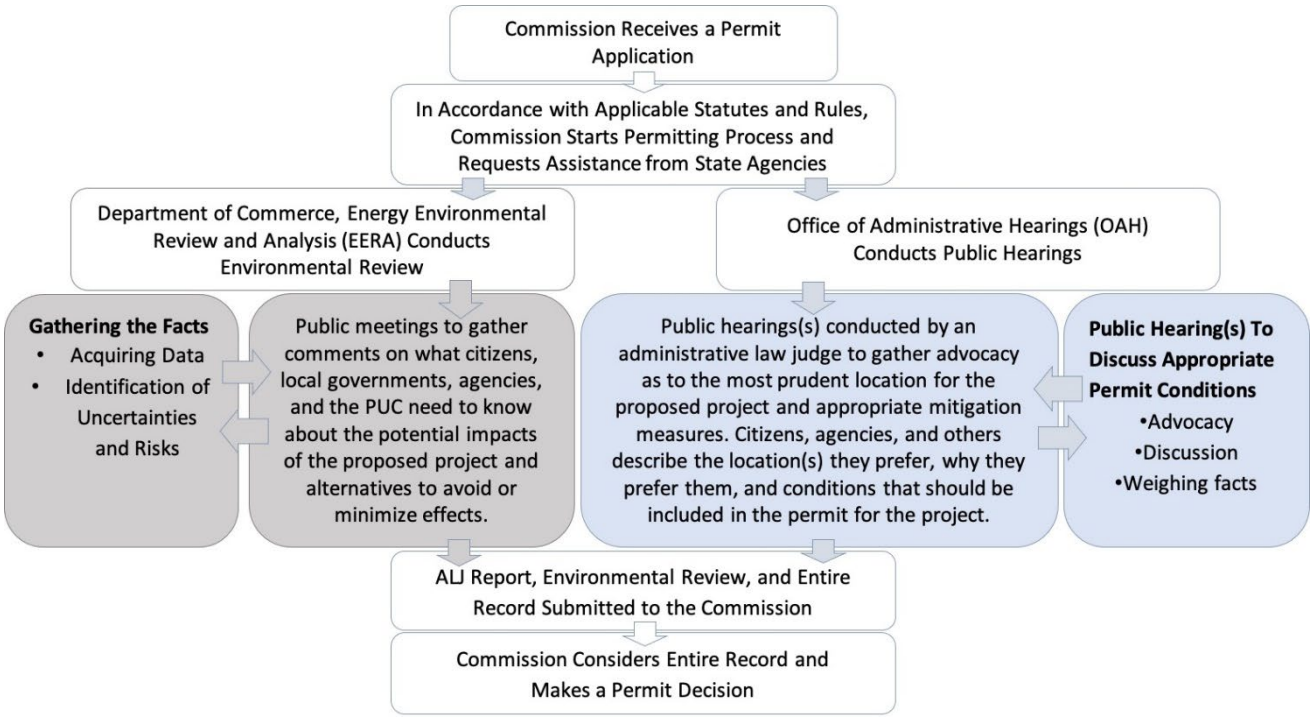

Figure 4-B: Minnesota PUC Permitting Process

Figure 4-B illustrates permitting processes that the PUC applies in considering applications for energy facility construction, including gathering and analyzing data, assessing environmental impacts, determining appropriate permit conditions, and weighing decisions whether to approve permits. Public hearings and reviews are included in each step of the process.

PUC permitting decisions are guided by criteria specified in statutes and rules. The PUC is generally charged with permitting energy facilities following systematic processes to ensure facilities are compatible with state policies for environmental preservation and the efficient use of resources. For more information, visit https://mn.gov/puc/activities/energy-facilities/

Activity and Policies

From 2020 through 2023, Commerce prepared 13 environmental assessments (EA) and three environmental impact statements (EIS) for energy facilities in Minnesota. The number of EAs was approximately double that

from 2016 through 2019; this is due to an increase in site permit applications for solar farms. From 2020 through 2023, the PUC permitted 20 energy facilities in Minnesota. Energy facilities currently in the permitting process and those previously permitted are described on Commerce's website.[iii]

During this same period, several wind farms in Minnesota began reaching the end of their service lives, and some of the permittees chose to repower their wind farms rather than fully decommissioning them. The repowering process typically includes updating electric generation equipment in wind turbine nacelles and replacing existing wind turbine rotors with longer blades.[iv]

Year	Carbon-Based Power Plant	Solar Power Plant	Transmission Line	Wind Farm	Pipeline
2020	0	0	2	0	0
2021	0	2	1	3	1
2022	0	4	0	2	1
2023	0	1	2	0	1
TOTALS	0	7	5	5	3
GRAND TOTAL	**20**				

Figure 4-C: Minnesota PUC Permitting Actions (2020–2023)

Figure 4-C summarizes the power plant, transmission line, wind farm, and pipeline permits issued by the PUC from 2020 through 2023. The PUC issued a total of 20 permits, of which five were for wind farms, five for transmission lines, three for pipelines, and seven for solar plants.

Source: Minnesota Public Utilities Commission

Capacity Expansion (CapX)2050 Transmission Vision Study

A joint initiative of 10 transmission system owners in the Upper Midwest that assembled to support the CAPX2020 series of transmission projects now is evaluating changing transmission needs through 2050 as more carbon-free energy sources are added and carbon-based generation is removed. The CAPX2050 group is cooperating with MISO in evaluating challenges and solutions for long-term transmission planning. The group issued a report in March 2020 that among other things concluded that more robust transmission capacity can help address needs for system balancing by providing access to a greater diversity of energy supplies.[v]

More robust transmission capacity can help address needs for system balancing by providing access to a greater diversity of energy supplies.

Looking Forward

The regional high-voltage transmission system continues to deliver reliable electricity to Minnesota residents. However, limits on transmission capacity could slow the modernization of aging assets and long-term growth of wind and solar energy development in the region. Therefore, large-scale transmission upgrades are needed over the next decade.

The three main issues facing infrastructure permitting over the next decade are likely to be:

1) the high-voltage transmission system build-out required to facilitate modernization of aging assets, load growth, and changing generation portfolio;
2) continued growth in wind and solar development; and
3) a potential large increase in energy storage using batteries or other technologies.

High-voltage transmission planning and build-out

The electric transmission system has seen increasing load and been called on more to deliver wind- and solar-generated electricity from where it is produced to where it is needed, all while the transmission assets are aging. High-voltage transmission systems require modernization of aging assets while also anticipating increased load due to electrification and renewable energy. Both of these trends are expected to continue if Minnesota and the U.S. are to meet carbon reduction goals.

The high-voltage transmission system in Minnesota and much of the United States is planned and operated by regional transmission organizations under federal oversight because high-voltage electricity transmission crosses state boundaries and operates as large, interconnected networks. Depending on location, Minnesota utilities operate in either the MISO or SPP.

In July 2022, after two years of planning discussions, MISO approved an initial group of 18 regional "backbone" 345-kV Long-range Transmission Projects in the Upper Midwest—called the Tranche 1 portfolio. Three of these projects are in Minnesota, and in 2023 all three had at least started the state approval processes needed for construction. In addition, Xcel Energy, in 2023, applied to the PUC for a certificate of need and a route permit for an approximately 170-mile long proposed 345-kV double-circuit line between Sherburne County and Lyon County (Minnesota Energy Connection) to use the existing interconnection capacity at their retiring Sherco coal plants for new wind and solar projects. Collectively, these projects represent the most high-voltage transmission lines proposed in one year in Minnesota since 2012, when the last CapX project was approved.

The 18 high-voltage 345-kV long-range transmission projects that MISO approved in 2022 are expected to go in service between 2028 and 2030. MISO is also considering a new "Tranche 2" group of projects to be presented to the MISO Board of Directors for approval, potentially in 2024. A successful Tranche 2 will need to adequately address existing and expected generation, load growth, and improve system stability and reliability.

In a separate planning process, in 2022, MISO and SPP worked together to complete their Joint Targeted Interconnection Queue (JTIQ) Study, the status of which was last updated here: November 2023 Joint Targeted Interconnection Queue Update. The resulting five projects, one of which is in Minnesota, are intended to help reduce uncertainty and lower the cost of transmission upgrades required when new generation projects interconnecting into one region affect the transmission system of the other. A successful Tranche 2 will need to adequately address existing and expected generation, load growth, and improve system stability and reliability.

Wind, solar, and storage growth

During the past four years, the PUC's energy facility permitting continued to experience growth in site permits for solar power plants. The 2013 solar electricity standard (SES), mentioned previously in Chapter 1, along with declines in prices for solar panels is driving increasing solar power development in the state. As shown previously in Figure 4-C, solar power plants represented the largest portion of PUC permitting actions between 2020 and 2023. Further, utility resource plans indicate substantial additions of solar power generation in the next 10 years. See Chapter 5, *Projections*, for further information about anticipated growth in Minnesota's solar power generation.

Without new transmission infrastructure, interconnection costs for individual wind and solar projects could become prohibitive.

Energy storage is also anticipated to grow in Minnesota in the next decade, introducing questions about its permitting and integration into the grid to allow for the variety of grid services it can provide. In 2023, Minnesota's 'energy facilities permitting' statute was amended to add 10 megawatts (MW) and larger storage to the projects reviewed and approved by the PUC. See Chapter 5, *Energy Storage*, for more details about anticipated energy storage growth and related challenges.

Commerce expects the trends observed over the last four year to continue. The PUC likely will receive applications for a growing number of wind farms, solar power plants, and battery storage across the state. Many of the new energy facilities will connect to the electric transmission grid, spurring the need for new transmission infrastructure. Without new transmission infrastructure, interconnection costs for individual wind, solar, and storage projects could become cost prohibitive. Commerce and PUC also anticipate some new storage and DER technologies to interconnect at the distribution level, helping supply generation capacity.

The PUC reviews route permit applications for certain intrastate pipelines; including gas, petroleum fuels or oils, etc. In 2022, the PUC received its first application for a carbon dioxide (CO_2) pipeline (Docket No. IP-7093/PPL-22-422) to transport captured CO_2 from an ethanol plant near Fergus Falls to North Dakota where the CO_2 would be sequestered underground. In 2023, the first renewable natural gas pipeline permit application was submitted (Docket No. G6915/GP-23-392). In 2023, Minnesota's pipeline routing statute was amended to further define "gas" and "hazardous liquid" (Minn. Stat. § 216G.02, subd. 1).

Resource Planning

Commerce, the PUC, utilities, and stakeholders engage in several state-based processes that examine each utility's integrated resource plans (IRPs) to generate, transmit, and deliver electricity through integrated generation, transmission, and distribution system planning. Minnesota statutes, including Minn. Stat. § 216B.2422, require Commerce to evaluate five- to 15-year outlooks on how much electricity customers will need, how much electricity the utility is able to generate and purchase, and options for fulfilling future needs.

Utility	PUC Docket #	Status
Basin Electric Power Cooperative	22-311	O-IRP
Dairyland Power Cooperative	23-259	O-IRP
Great River Energy	22-75	Order Pending
Interstate Power & Light Company	17-374	Order Issued April 2, 2019
Minnesota Municipal Power Agency	18-524	Order Issued May 28, 2019
Minnesota Power	21-33	Order Issued January 9, 2023
Minnkota Power Cooperative Inc., Northern Municipal Power Agency	22-312	Order Issued August 30, 2023
Missouri River Energy Services	21-414	Order Issued February 15, 2022
Otter Tail Power Company	21-339	Pending
Southern MN Municipal Power Agency	21-782	Order Issued November 2, 2022
Xcel Energy	24-67	Pending

Figure 4-D: Minnesota Utility Resource Planning Processes (2017–2024)

Figure 4-D summarizes the 11 electric utility resource planning proceedings convened at the PUC from 2017 through 2024.

Source: PUC Electric Integrated Resource Planning website, accessed May 2, 2024

Minnesota is a national leader in utility integrated planning processes, first with the establishment of its IRP process in the 1980s, and more recently with the creation of distribution system planning requirements.[vi] For decades Minnesota has pursued a progressive, inclusive, and successful process of resource planning to establish a reliable and resilient electric system. State processes, along with Commerce's scrutiny and evaluation of utilities' long-term plans, have led to a robust electrical system, enabled stakeholders to better understand system trade-offs, and helped to ensure the most sustainable and affordable solutions are implemented.

Utility resource planning processes are intended to answer such questions as whether and how utilities should invest in renewable resources, how to accommodate growing DER, whether large generation facilities are the most cost-effective option, whether long-distance regional transmission lines are needed, and the ideal pace for utilities to invest in new technologies.

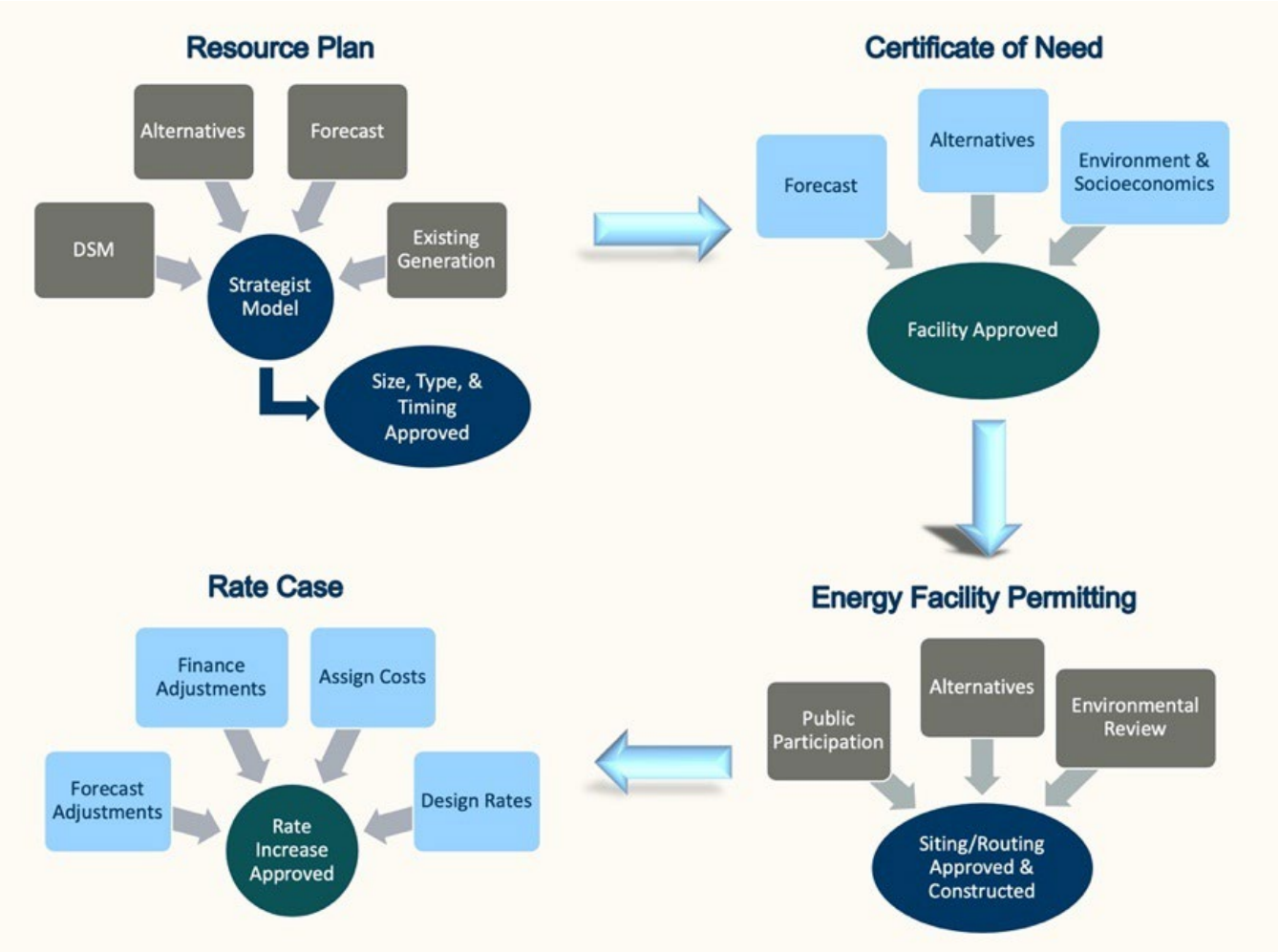

Figure 4-E: Minnesota Four Energy Regulatory Processes

Figure 4-E illustrates the four energy regulatory processes that the PUC uses to apply state policies in considering energy resource planning, certificates of need, construction permits and line routes, and utility rate adjustments.

Activity and Policies

Utility planning in Minnesota has changed over time to adapt to the evolving energy landscape. Minnesota laws addressing resource planning and transmission planning turned out to be ahead of their time when they were first enacted. These laws provided a framework that offered Commerce the flexibility to evaluate changes as that have emerged. Commerce has continued to meet its regulatory obligations as policies and goals have changed. However, new policies and system changes have influenced how Commerce operates as well as the factors it has included in its analysis.

Some of the most notable changes from 2018 to 2024 include the U.S. Environmental Protection Agency (EPA)'s release of final carbon pollution standards for power plants, renewals and changes in federal Production Tax Credit (PTC) and Investment Tax Credit (ITC) programs, and Minnesota's roll-out of a community solar garden (CSG) program and value of solar (VOS) bill credit rate enacted in the 2013 legislative session.

In 2018, the EPA promulgated the Affordable Clean Energy rule to replace the federal Clean Power Plan. The Affordable Clean Energy rule narrowed the greenhouse gas (GHG) emission control options required for electric generating sources and affected regional evaluation of plans for generation and transmission as well as state-level utility resource planning. During the same time, renewable energy and conservation technologies continued improving, costs declined rapidly and shifting customer preferences encouraged utilities to continue investing in sustainable energy systems.[vii] On January 19, 2021, a federal appeals court struck down the Affordable Clean Energy rule, finding that it failed to comply with the Clean Air Act and would have led to more power sector emissions. The court directed the EPA to create a new regulatory approach.[viii] On April 25, 2024, the EPA released final carbon pollution standards for power plants that set CO_2 limits for new gas-fired combustion turbines and CO_2 emission guidelines for existing coal, oil, and gas-fired steam generating units.

Initially the federal PTC helped utilities acquire wind resources as least-cost system resources. The extensions and phase-out of the PTC and ITC put pressure on utilities to maximize these inexpensive system resources and capture the value of tax-equity funded resources while program benefits were still available. In recent years, wind-generated energy has been more cost-competitive than power generated from burning natural gas or, in many cases, other existing system resources. See Chapter 5, *Wind Energy*, for further discussion about levelized costs for wind power and other resources. Costs for solar photovoltaic (PV) also have declined in recent years. This spurred a boom in large-scale wind and solar development in Minnesota and increased the need for new and upgraded transmission lines to allow for the transport and export of the state's wind resources in particular. These factors have a large effect on the resource and transmission plans that utilities have proposed.

Growth of distributed energy resources—from solar to battery electric vehicles and other technologies—prompted the need to change the way utilities and regulators plan for distribution system investments and operations.

Minnesota's CSG and VOS legislation, along with limited subsidies for small-scale solar and declining solar equipment prices, also stimulated the growth of solar DERs connected to the distribution system. The growth of solar DER triggered the need for distribution system upgrades in some locations, which are paid for by DER customers interconnecting to the grid. DER growth from solar and other technologies, including battery electric vehicles, also prompted the need to change the way utilities and regulators plan for distribution system investments and operations. These developments, combined with a new policy requiring that utilities study available distribution system capacity to accommodate new DERs, spurred the need for systematic distribution planning. Rate-regulated utilities in Minnesota are required to file an Integrated Distribution Plan (IDP) every odd-numbered year. These IDPs lay out for regulators and the public the planned investments in distribution system architecture and modernization.

Emerging Trends and Issues

Minnesota's electric systems are undergoing a period of transition in three key areas. First, the electric grid is moving from a system based on mechanical and analog parts to one that utilizes digital technologies, providing grid operators with greater visibility and control over the system. Second, the electrical grid is changing from a system designed for centralized large-scale generators, with one-way power flows, to a dynamic and distributed system with numerous smaller generators and increased two-way power flows. Third, the electric grid is changing due to environmental and economic pressures, including the push to end reliance on carbon-based resources, as well as the rapid decline in costs for renewable generation and energy storage systems. These three shifts are transforming utilities' resource planning processes and state oversight of them.

Digitalization

The electrical grid is transitioning from relying upon manual tools to integrating digital technologies all the way from the interstate transmission system level down to the distribution system for residential, commercial, and industrial customers. Advanced technologies are providing real-time information, increased data access, and more system control and communication. These changes lead to additional resource options and, with them, greater complexity than ever before. System digitalization is transforming the ability of Minnesota utilities to provide new services. State regulation and oversight of utilities has expanded to address new questions about such factors as data access, cybersecurity, modeling, grid integration, optimization, operations, and utility services.

Decentralization

Decentralized resources include distributed wind, solar, and battery energy storage systems, plus controllable loads like smart thermostats and interruptible water heaters. Also, while utility-scale wind and solar fields aren't generally considered DERs, they are less centralized than the fossil-fired and nuclear plants that dominated power generation in the U.S. utility system for more than a century. These alternatives to conventional central power plants create new issues that utilities and state agencies must consider during resource planning processes, requiring utility planners and regulators to update their knowledge and expertise. The complex options, trade-offs, and considerations including security, privacy, and new policy directions present new challenges for Commerce and PUC staff.

Distribution system investments likely will be a large part of utility spending in the next decade as new infrastructure, software, communication systems, and hardware are needed to provide visibility and control over an increasingly dynamic distribution system. However, with increased storm severity and greater customer demand for reliable power, utilities are also pursuing distribution system hardening, meaning system upgrades to increase resilience and reliability. In light of this trend, Commerce supports the continued evolution of distribution system planning to complement existing resource and transmission planning processes.

Market Pressures

Environmental requirements, changes in the relative cost of technologies, and customer preferences are accelerating the rate of change in Minnesota's energy economy. Xcel Energy's 2019 IRP,[ix] Minnesota Power's 2021 IRP,[x] and Otter Tail Power's 2021 IRP[xi] all accounted for the concurrent retirement of some baseload coal-generating facilities and seasonal use of others, the integration of thousands of megawatts of wind and solar, as well as large increases in demand response. These plans went well beyond what historically has been considered in utility IRPs.

Minnesota's communities, institutions, and businesses increasingly are developing sustainability goals, many of which include procurements of carbon-free energy (see also Chapter 2).[xii,xiii,xiv,xv] These customer preferences are spurring trends toward renewable product offerings by utilities in the state, as well as power purchase agreements with independent producers. These actions, along with Minnesota's 2040 Carbon-free Electricity Standard, are prompting utilities to plan for additional wind, solar, and other distributed generation as well as high-voltage transmission lines.

Each planning process seeks to ensure that utilities are evaluating potential system options and pursuing least-cost, environmentally sound, and efficient resources consistent with state and federal laws and goals. The increasingly complex and dynamic planning environment challenges Commerce and PUC staff to continue building its capacity to support IRP processes.

Commerce continues applying planning priorities of reliability, affordability, least-cost planning, and minimization of environmental impact. Stakeholder processes are a key part of evaluating each utility's proposed IRP. Minnesota has pursued uniquely collaborative utility, regulator, stakeholder, and public processes. These stakeholder processes have served to inform regulatory and policy making proceedings, clarified differing perspectives, and helped to identify challenges to planning objectives.

The increasingly complex and dynamic planning environment challenges Commerce and PUC staff to continue building its capacity to support IRP processes.

Commerce expects to continue facilitating and participating in stakeholder processes and monitoring local and regional planning changes as well as best practices for new and emerging issues. Additionally, Commerce will continue supporting the PUC and other Minnesota agencies and utilities in addressing regional and federal issues on ratemaking, planning, economic and technical analysis, and other areas.

Energy Reliability, Security, and Response

Background

Owners and operators of energy infrastructure in Minnesota are responsible for ongoing maintenance and upgrades to their equipment (Minn. Stat. § 216B.79). Additionally, Executive Order (EO) 23-13, *Updating Emergency Responsibilities Assigned to State Agencies,* requires Commerce to coordinate with other agencies and utilities to support public works restoration.

State and local officials work with operators and stakeholders to assure public safety and mitigate the consequences of threats to the state's energy economy. Such threats include severe weather events (e.g., tornados, straight-line winds, and floods), cyber threats, and changes in energy infrastructure and production that can affect delivery of energy supplies to customers in Minnesota.

In 2023, Commerce created the Office of Energy Reliability and Security (OERS) in response to an increased focus on reliability and the need to continue to evolve the state's energy security practices. The OERS works under a framework of planning, preparedness, and response. Roles within the office address transmission planning, cyber and physical security, delivered fuels, community energy resilience, and Commerce's emergency managers. The office's objectives are to:

- Mitigate future emergencies through diligent planning, monitoring, and communicating situational awareness of emergent issues, and
- Have processes and procedures in place to effectively respond in the event of an emergency.

Commerce maintains and updates energy plans, provides periodic supply forecasts and situational awareness bulletins, and supports threat-assessment and resiliency planning efforts among various agencies. Staff also compile and distribute a Situational Awareness report as needed to keep leadership informed about potential fuel shortages and emergency conditions.

Energy Security Planning and Response

Commerce has the ongoing responsibility to maintain the statewide Emergency Energy Conservation and Allocation Plan (Plan), mandated by Minn. Stat. § 216C.15. Beyond this Plan, energy emergency preparation and response are governed by the Minnesota Emergency Operations Plan, several Governor's Executive Orders, the federal Emergency Energy Conservation code (42 USC Ch. 93), and the federal Energy Conservation code (42 USC Ch. 77).

The 2021 Infrastructure Investment and Jobs Act (IIJA) addressed energy assurance planning through a requirement of State Energy Offices to develop and maintain a State Energy Security Plan (SESP). The SESP supersedes previous state energy assurance plans. Minnesota submitted its new SESP to the U.S. Department of Energy (DOE) in September 2022 and a revised SESP in September 2023. The DOE found that the 2023 SESP fully addressed the elements required by Congress, which are:

1. Address all energy sources and regulated and unregulated energy providers;

2. Provide a state energy profile, including an assessment of energy production, transmission, distribution, and end-use;
3. Address potential hazards to each energy sector or system, including physical threats and vulnerabilities and cybersecurity threats and vulnerabilities;
4. Provide a risk assessment of energy infrastructure and cross-sector interdependencies;
5. Provide a risk mitigation approach to enhance reliability and end-use resilience; and
6. Address multi-state and regional coordination, planning, and response, and coordination with Indian Tribes with respect to planning and response, and to the extent practicable, encourage mutual assistance in cyber and physical response plans.

As Commerce further evolves its mission and expertise, the SESP and affiliated documents will be modified considering DOE guidance and to reflect current understanding, state and regional needs, and legal requirements. For example, DOE has recommended using GIS data as a best practice for states to improve energy planning and to direct resources to areas of highest need. Commerce is developing its understanding of locations that are most affected by severe weather, demographics, and outage trends. Commerce is working with the Minnesota Geospatial team (part of Mn.IT), and a critical infrastructure workgroup led by the University of Minnesota.

Minnesota also participates in the Midwest Regional Petroleum Shortage Collaborative. The collaborative was formed through a partnership between DOE, the National Association of State Energy Officials (NASEO), and National Emergency Management Association. The purpose of the framework is to codify guidance for coordinated response, prioritize response programs and actions, standardize information flows, and pre-identify tools and templates that may be necessary to respond to a petroleum shortage. During the heating season, October through March, Commerce collects pricing information and contributes it to U.S. Energy Information Administration (EIA)'s State Heating Oil and Propane Program (SHOPP) report, which is part of a national program of price collection and reporting.[xvi, xvii]

Reliability

Minnesota is part of a regional, national, and international electricity delivery system. Grid reliability refers to the electric system's ability to supply and deliver enough energy to meet consumer demand, and more specifically to the bulk power system of electricity delivery across high voltage transmission lines. Understanding the context of overall electric system reliability helps put the issue of the bulk electric system's reliability into perspective. For example, most Minnesotans are used to periodic, short-term electricity disruptions on the low-voltage distribution system due to local events like ice storms. Those sorts of disruptions are much more common than wide-scale disruptions to the regional high-voltage transmission system. Totally eliminating localized distribution-level outages due to these circumstances is typically not feasible due to the ratio of cost to benefit, so most live with periodic disruptions. Similarly, providing 100% reliability on the high-voltage transmission system, otherwise known as the bulk electric system, would be costly and therefore must be balanced with the impacts to customer utility bills.

The emergence of emerging electric generation technologies, the growing number of severe weather events, and increasing awareness of the environmental impacts of electricity generation, transmission, and distribution

are driving new challenges in electricity system planning. Many of these issues are addressed at the regional and federal level—not state by state—because the electric grid is not confined to the four corners of the state of Minnesota. However, some activities occur at the state level that can contribute to the strength and reliability of the overall grid.

Emerging electric generation technologies, a growing number of severe weather events, and increasing awareness of the environmental impacts of electricity generation, transmission, and distribution are driving new challenges in electricity system planning.

Roles and Responsibilities

As discussed in the introduction to Chapter 4, nearly all Minnesota electric utilities (and their transmission assets) are part of the RTO called MISO. As a result, many of the critical decisions regarding bulk energy system reliability and planning in Minnesota occur at the regional level, MISO, or at the federal agency that regulates MISO, FERC. Commerce, in cooperation with the PUC, participates actively in MISO and FERC decision-making processes on its own or as part of multi-state advocacy organizations.

Evolving Risks

Maintaining the reliability of the high-voltage transmission system has been—and will continue to be—an important component of a successful transition to low-carbon electricity generation. The high-voltage transmission system's reliability has always been subject to severe weather, large unplanned generator outages, and other risks. Recently, however, the risks are evolving due to generation resource and technology change, increasing severe weather events, transmission constraints, physical and cyber-attacks, new electrification of end-uses, and greater awareness of electricity generation's environmental impacts. Many of these risks are highlighted in the Midwest Reliability Organization's 2024 Regional Risk Assessment.[xviii] The list below shows the Midwest Reliability Organization's risk and priority categories for various threats and vulnerabilities.

Many of these issues are addressed at the regional and federal level—not state by state—because the high-voltage transmission system is not confined to the four corners of the state of Minnesota. Therefore, Commerce actively participates in regional and national forums. In addition, activities occur at the state level that contribute to the strength and reliability of the overall grid. This context is important to understanding the complexities of ensuring a reliable electric grid.

Climate Change and Extreme Weather Events

As the impacts of climate change intensify, the number of extreme weather events that threaten grid reliability is increasing. Data from the National Oceanic and Atmospheric Administration shows that, even while controlling for inflation, the number of extreme weather events in the United States that caused over one billion dollars in damages has increased in recent years. The annual average of billion-dollar events from 1980 to 2023 was 8.5 events, while 2019–2023 saw an average of 20.4. This includes the hailstorm that hit Minnesota on August 11th of 2023. While not every billion-dollar disaster has direct impacts on grid reliability, the uptick in extreme weather events brought about by climate change does pose challenges for grid reliability.[xix]

Uncertain energy availability

Over the past decade Minnesota's energy sources have become more diverse, as utilities have reduced their use of coal-fired power generation while increasing reliance on natural gas and renewables. This continues as utilities replace aging and uneconomic coal generating plants with solar and wind resources. Because solar and wind are variable and non-dispatchable power sources, they require new approaches to resource forecasting and system balancing. Adaptation planning may become an increasingly important part of Commerce's energy assurance work in the years to come. Investments in energy storage, transmission, virtual power plants, and grid enhancing technologies, can improve the reliability of the electric grid as the grid transitions.

Cyber and physical threats

Cyber and physical threats to the nation's electric grid security have received increased attention in recent years due to a variety of factors, particularly Russia targeting critical energy infrastructure in the preparation for, and execution of, its invasion of Ukraine. Countries' willingness to exploit vulnerabilities in cyber systems that support critical civilian infrastructure, combined with increasingly numerous and complex assets being interconnected to the U.S. transmission and distribution systems, led the federal government to revise its national cybersecurity strategy. In February 2022 the U.S. Department of Homeland Security Cybersecurity and Infrastructure Security Agency issued a Shields Up campaign, designed to raise awareness and provide resources to critical infrastructure sectors. The campaign also encouraged the establishment and enhancement of public-private partnerships between owner/operators and government agencies at the state and federal levels. These objectives increased resiliency and prepared state and federal entities and their partners for responding to, and recovering from, cybersecurity attacks.

Advanced persistent threat actors, allegedly associated with Chinese state intelligence services, have also been observed conducting espionage operations within U.S. domestic energy infrastructure and IT systems. Homeland security analysts assessed that these intrusions were probably intended to pre-position cyber-attacks against infrastructure in the U.S. This positioning could then deter U.S. military action at the start of a conflict by impeding decision making, inducing societal panic, and interfering with the deployment of U.S. forces.

Lastly, domestic violent extremists within the U.S. remain an active threat to the physical security of electric infrastructure. Observed internet forum and website activity indicate that these accelerationist groups see the destruction of critical energy infrastructure as a potential catalyst for the collapse of society and ignition of a large-scale racial conflict.

Commerce collaborates with the PUC in discussions with utilities related to cyber security threats and intrusion prevention measures. Commerce also participates in a variety of regular intelligence threat briefings conducted by the Department of Homeland Security, Minnesota Bureau of Criminal Apprehension, and the Electricity and Multi-State Information Sharing and Analysis Centers (E- and MS-ISACs), and regularly monitors ISAC advisories and alerts to maintain situational awareness of threats to Minnesota's electric grid.

Malicious insider threats

The Midwest Reliability Organization's 2024 Regional Risk Assessment assesses the risk to the region's electric system from malicious insider threats to be high, with a possible likelihood and major anticipated impact. While there have been no confirmed malicious insider threats to the bulk power system to date, security analysts have determined that the existing North American Electric Reliability Corporation Critical Infrastructure Protection standards provide limited controls for this particular risk and the ability of a malicious insider to cause damage to infrastructure and business operations via cyber or physical attacks is significant. Benchmarking tools and checklists are readily available for organizations to stand up and improve internal insider threat programs, and Commerce has been discussing the rate-regulated utilities' programs while conducting assessments of cybersecurity processes and procedures in coordination with the PUC.

Supply chain compromise and equipment unavailability

Maintaining access to parts and equipment is crucial to maintaining a reliable electric grid. As the Midwest Reliability Organization's 2024 highlights, many of the hardware, software, and other components that are necessary to keep the grid operating are manufactured by a select few companies. Accordingly, impacts on these companies' supply chains that are caused by a cyber or physical attack, or a broader scale disruption such as the Covid-19 pandemic can lead to disruptions in the electric grid and potentially impact reliability. The North American Electric Reliability Corporation and other entities have worked to reduce these risks by creating standards and voluntary programs that would enhance the resilience of supply chains and improve the security of suppliers.

Grid Congestion

Grid congestion is increasingly becoming a greater concern for system reliability. Future resource interconnections and retirements may increase congestion and lead to reduced system reliability. Increases to investment in transmission has been recommended by regional transmission organizations to reduce congestion. In October of 2023, DOE released a report on national transmission needs that highlighted the need for further investments in grid infrastructure.[xx]

Grid Partners North, a collection of 10 regional energy providers, is collaborating to build more transmission capacity to address grid congestion.[xxi] Commerce staff is supportive of these efforts and continues to monitor their developments.

In 2023, Commerce was awarded a $464 million grant from DOE for an innovative project to plan across regional transmission organizations for increasing transmission capacity to alleviate constraints in the interconnection queue. Commerce is partnered with the MISO, SPP, Great Plains Institute, and multiple transmission owners to deliver innovative interregional planning and future construction of several transmission lines in the Upper Midwest. This effort is funded by a grant from DOE and is anticipated to last through 2032.[xxii]

Planning Ahead

Commerce continues its work to further develop the MN State Energy Security Plan (SESP) while also providing situational awareness reports that inform both state agencies and private companies and organizations about issues affecting energy supply and delivery. This work requires ongoing research, monitoring, and engagement with numerous agencies, stakeholders, and information sources. The increasing complexity of Minnesota's energy economy calls for increasing staff resources focused on energy reliability and security efforts, as well as cross-training to strengthen the state's ability to monitor developments and respond accordingly.

Additional work also is needed to help guide investments in energy reliability, resilience, and security. Recommendations to pursue include, but are not limited to, the following:

- Studies, programs, incentives, guidelines, and criteria for investments in microgrids and other resilient electricity technologies for vulnerable populations as well as public facilities and businesses that are critical to the health and safety of Minnesota communities.
- Guidelines for community planning and building codes that ensure new subdivisions and buildings are designed with energy resilience in mind, and that they incorporate modern technologies enabling greater self-reliance and protection from large-scale emergencies.
- Expanded stakeholder and community engagement in the development and maintenance SESP and the Emergency Energy Conservation and Allocation Plan (Minn. Stat. § 216C.15).
- Devoted time and resources to building and maintaining a public-private partnership with critical energy infrastructure owner/operators.
- Advocacy on behalf of Minnesota at the regional and federal level to ensure adoption of near and long-term transmission infrastructure investments. Including recommendations made by the DOE in its National Transmission Needs Study published in October 2023.[xxiii]
- Improved visibility into energy infrastructure geospatial configuration in the state by obtaining Protected Critical Infrastructure Information clearances and access to federal data repositories such as the secure Homeland Infrastructure Foundation-Level Data ArcGIS platform.
- Policies, programs, and investments in innovative technologies such as energy storage, virtual power plants, and grid enhancing technologies to ensure a smooth energy transition and continued energy reliability. These tools can help the grid to better meet peak demands and adjust to a changing energy mix.

Initiatives such as microgrids and other resilient energy technologies, guidelines and building codes that encourage energy self-reliance, and strengthening partnerships with critical infrastructure owner-operators to facilitate prompt information exchange to inform risk and vulnerability assessments and improve situational awareness can position Minnesota for a more secure, reliable energy future.

Equitable implementation of such programs would support the health, safety, and economic security of all Minnesotans.

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[xxi] Projects, Grid North Partners (accessed March 7, 2024).
[xxii] MN Commerce Department and regional grid operators receive $464 million from U.S. Department of Energy for innovative electric grid project, MISO, October 18, 2023.
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Chapter 5: Power Generation, Consumption, and Energy Projections in Minnesota

Electricity generation in Minnesota has continued its rapid changes from previous years and decades. Landmark legislation, favorable economics, and persistent stakeholder work have resulted in renewables making a plurality of electricity generation in the state. Utilities have been charged with ambitious decarbonization goals, and while there is considerable work left to achieving those goals, electricity generation in Minnesota is poised to experience continued decarbonization in the coming years.

Power Generation Transition

History of power generation and progress towards related statutes

Renewable Electricity Standards

The state's current transition toward renewable energy and away from coal-fired power generation began in 1994, when the Minnesota Legislature established a wind power mandate. Minn. Stat. § 216B.2424 required Xcel Energy to acquire 825 megawatts (MW) of wind power by 2006. In 1994 the legislature also set a biomass power mandate, Minn. Stat. § 216B.2423, requiring Xcel Energy to acquire 110 MW of biomass power by the end of 2002. Legislation changes in 2017 allowed the early termination of power purchase agreements (PPAs) from two projects used to meet the biomass power mandate.

In 2001, the Minnesota Legislature also enacted renewable energy objectives in Minn. Stat. § 216B.1691. Originally this statute required electric utilities to make a good-faith effort to obtain one percent of their Minnesota retail energy sales from eligible energy sources starting in 2005, 10% starting in 2015, and to obtain 0.5% of their renewable energy from biomass technologies. Eligible energy technology was defined as coming from the following renewable energy sources: solar, wind, hydroelectric with a capacity of less than 100 MW, hydrogen produced from renewable sources, and biomass. The legislature updated these standards in 2007 with the Next Generation Energy Act, which amended Minn. Stat. § 216B to increase efficiency and renewable energy goals while reducing carbon emissions.

In 2007 a renewable electricity standard (RES) was also established, with mandated goals that began in 2010. The updated standard (Minn. Stat. § 216B.1691, subd. 2a) requires Minnesota utilities to ensure that a minimum percentage of their total retail electric sales to retail customers in the state is generated by eligible renewable energy technologies by the end of the specified year: 12% by 2012, 17% by 2016, 20% by 2020, 25% by 2025, and 55% by 2035.[i] As of March 2024, 15 generation and transmission utilities in Minnesota are subject to the RES.[ii, iii]

The RES statute required the Minnesota Public Utilities Commission (PUC) to establish a trading system for renewable energy credits, also called renewable energy certificates (RECs), to track compliance with the RES. In

2007 the PUC adopted the Midwest Renewable Energy Tracking System, where each certificate represents all the non-energy attributes of one megawatt-hour (MWh) of electricity generated by a power producer.[iv]

Since 2009, Minnesota utilities have registered renewable energy systems in the tracking system, tracked renewable generation from those facilities in the form of REC), and retired RECs to demonstrate compliance with the RES. All electric utilities subject to the RES have met their statutory milestones through 2022, and the utilities are on track to meet or exceed their 2025 targets.[v,vi]

What are RECs?

Once energy is added to the grid, renewable electrons cannot be distinguished from electrons generated from fossil fuels. However, when renewable electricity is generated, it can be metered to track two valuable components: the electricity itself and its renewable aspect. Renewable energy credits (RECs) allow tracking and verification of the environmental attributes associated with renewable energy. Utilities and other energy providers are required to procure and retire RECs each year to demonstrate compliance with the RES.

Utilities may petition the PUC for the modification or delay of a RES requirement, but none have done so to date. According to the most recent PUC order filed on August 1, 2023, in Docket No. E-999/PR-23-12, all utilities subject to the RES have met the annual requirements for 2022. Furthermore, based on communication with Commerce, utilities indicated that they expect to meet future RES compliance until various years, as indicated in Figure 5-A.

Biomass-fueled power plants provide a small portion of Minnesota's renewable electricity. Under the RES, the definition of biomass includes gaseous biofuels—such as landfill gas and anaerobic digester gas—as well as organic components of wastewater effluent from publicly owned treatment works (but not sludge incineration), municipal solid waste, and refuse-derived fuels from mixed municipal solid waste.

The biomass statute has been amended numerous times over the past 25 years, including amendments allowing or requiring different fuel sources and specific generating facilities. In 2017, the Minnesota Legislature passed an amendment allowing Xcel Energy to petition the PUC for approval of a new or amended PPAs, the early termination of a PPA, or the purchase and closure of certain biomass facilities.[vii] In December 2017, the PUC approved Xcel Energy's proposed contract buy-outs, based on estimated savings for ratepayers.[viii,ix]

All electric utilities subject to the Renewable Electricity Standard have met their statutory milestones through 2022 and are on track to meet or exceed their 2025 targets.

Utility[7]	Compliance through year… (As of 2018)	Compliance through year… (As of 2020)	Compliance through year… (As of 2022)
Heartland Power District	2045	2044	2044
Dairyland Power Cooperative	2030	2040	2040
Southern MN Municipal Power Agency	2040	2040	2040
Xcel Energy	2040	2040	2037
Great River Energy	2039	2055	2035
Minnesota Power	2053	2053	2035
Central MN Municipal Power Agency (CMMPA)	2028	2033	2035
Otter Tail Power Company	2034	2028	2035
East River Power Cooperative	2025	2025	2035
Minnkota Power Cooperative	2025	2025	2035
Minnesota Municipal Power Agency (MMPA)	2020	2023	2030
Basin Electric	2030	2030	2029
Southern Minnesota Energy Cooperative (SMEC)[8]	2019	2023	2025
Missouri River Energy Services (MRES)	2020	2021	2024
L&O Power Cooperative [9]	2025	2023	2022

Figure 5-A: Utility Renewable Electricity Standard Compliance Outlook

In even-numbered years, utilities are required to report on the estimated year that they can continue to comply with the RES using existing and planned resources. Figure 5-A shows the change in utilities' reported estimates from 2018 through 2022. Most utilities have secured sufficient resources to achieve compliance through the mid-2020s, with some prepared for compliance through the 2030s and 2040s.[x] Cells are colored based on how far out the given utility anticipates remaining in compliance with the RES based on existing and planned resources, with darker green cells indicating RES compliance through years further in the future, and lighter yellow cells indicating RES compliance through more upcoming years.

Source: Utility communications with Minnesota Department of Commerce

Additional information about the RES can be found in Chapter 1.

[7] Sixteen utilities were subject to the RES before its revision in 2023. Fifteen are included in Figure 5-A. The sixteenth subject utility, Northwestern Wisconsin Electric Company (NWEC), serves approximately 98 Minnesota customers. The PUC permits NWEC to comply with the MN RES requirements with the submission of its Wisconsin Renewable Portfolio Standard compliance report.

[8] This utility will cease to exist in 2025 and its load will get transferred to GRE and Dairyland.

[9] This utility gets its RECs from Basin. For 2023 compliance, it will get the RECs in April 2024.

Carbon-free Energy Standards

In 2001, the legislature passed Minn. Stat. § 216B.1692, establishing an emission-reduction rider program to encourage large electricity generation sources in the state to undertake emission reduction projects. As a result, Xcel Energy replaced two coal-burning units at its Black Dog Plant with a natural gas-fired turbine generator in 2003. Xcel Energy in 2008 replaced the coal-fired High Bridge Plant with a natural gas fired combined-cycle turbine generator, and the following year did the same at the coal-fired Riverside Plant. The last two coal-fired generators at Xcel Energy's Black Dog Plant were retired in 2015.

In 2007, the legislature amended Minn. Stat. § 216C.05 to establish a goal of 25% of *total* energy consumption from renewable sources by 2025. For more details about the progress towards this statute, see Chapter 1.

Also in 2007, Minn. Stat. § 216H.02 was adopted to reduce greenhouse gas (GHG) emissions across the state. Accordingly, electric utilities in Minnesota, from 2005 through 2020, reduced carbon emissions by 54%. In 2023, a 100% carbon-free electricity standard was adopted under Minn. Stat. § 216B.1691, subd. 2g, providing the framework for Minnesota's utilities to get to 80% carbon-free electricity by 2030, 90% by 2035, and 100% by 2040. Also in 2023, the state's GHG emissions goals in Minn. Stat. § 216H.02, subd. 1(a), were updated to reflect the most current science. The GHG emissions reduction goals set increasing GHG reduction goals compared to 2005 emissions levels: 30% by 2025, 50% by 2030, and net zero by 2050. See the *Planning for Carbon-Free Electricity* section later in this chapter for utilities' carbon-free electricity projections.

Solar Electricity Standards

In 2013, the legislature amended the RES that had been codified by Minn. Stat. § 216B.1691 to include a solar electricity standard (SES). Only investor-owned utilities are subject to the SES, specifically Minnesota Power, Otter Tail Power Co., and Xcel Energy. The SES required that by the end of 2020 these utilities were to generate or procure 1.5% of retail electricity sales from solar energy, and 10% by 2030.

Initially, the SES included a 10% carve-out for small-scale solar photovoltaic (PV) projects with a capacity under 20 kilowatts (kW). The Minnesota Legislature increased that to 40 kW for all utilities subject to the standard. By law, a public utility with 50,000 and 200,000 retail electric customers is required to meet at least 10% of the 1.5% goal with solar energy from devices that have a nameplate capacity of 40 kW or less.

Cooperative and municipal utilities are excluded from the SES requirements. In addition, for the 1.5% calculation, the statute excludes retail sales to iron mining extraction and processing facility customers as well as paper mills, wood products manufacturers, sawmills, and oriented strand board manufacturers.

The three utilities subject to the SES have pursued different paths to meeting their solar requirements. Minnesota Power and Xcel Energy have either built or acquired PPAs from utility-scale solar facilities. Otter Tail Power continues to evaluate utility-scale projects. In the meantime, the utility purchased solar RECs to meet its 2020 compliance requirement.

All three utilities subject to the SES met the 2021 non-small requirements. Otter Tail partially complied with 2021 small-scale SES requirements through the purchase and retirement of solar RECS at a cost of $75,531.

Otter Tail also proposed to meet the small-scale SES requirement going forward through the construction and ownership of up to 1.2MW of solar projects.[xi]

Green Pricing Programs

The first utility green pricing programs in Minnesota were offered in 1999 by Great River Energy and Moorhead Public Service, providing consumers with the option to purchase electricity made from renewable and high-efficiency energy sources. A 2001 law required all utilities operating at retail in Minnesota to offer green pricing programs that allow customers to encourage additional renewable energy production above and beyond the utilities' renewable energy objectives. Starting in 2010, Minnesota laws changed green pricing programs from a mandatory utility service to a voluntary one, leaving the decision whether to offer a green power option up to utilities.

Currently, Minnesota's voluntary green pricing program gives consumers the option of purchasing renewable energy beyond the minimum standard set by the state. By paying a premium on their electricity bill, consumers support increased development of renewable energy projects and reduce their reliance on fossil fuels. Increased use of renewable energy sources also benefits the local economy and improves Minnesota's energy security.

The PUC regulates green pricing programs (Minn. Stat. § 216B.169) in the state with input from Commerce to protect consumer interests. Renewable energy procured on behalf of green pricing customers cannot be sold twice or counted toward any state's Renewable Electricity Standard. Utilities are required to report on renewable energy procured for green pricing customers to verify that green pricing sales do not exceed green pricing generation. Utilities record RECs for green pricing generation in the Midwest Renewable Energy Tracking System to verify compliance and ensure that the energy is not double counted.

Emissions Reduction Progress

The Minnesota Pollution Control Agency, in collaboration with Commerce, reports on Minnesota's progress towards GHG goals in its *GHG Emissions Inventory Report* every two years (Minn. Stat. § 216H.07, Subd. 3). According to the most recent report, released January 2023 for the calendar year 2020, Minnesota was on track to meet its GHG reduction goals for the first time in 2020.[xii] Part of this decline is attributed to changes in local, state, and national policies as well as the decarbonization of the electric grid. In 2020, however, the COVID-19 pandemic also drove emissions down, particularly in the transportation sector, when vehicle and airline travel dropped considerably.

Minnesota is on track to meet GHG reduction goals for the first time.

The COVID-19 pandemic doesn't explain all of the drop in emissions though. Minnesota's reduced emissions from electricity generation have resulted primarily from increased reliance on renewable electricity and reduced coal-fired generation primarily within state borders. Before 2016, electricity consumption was the largest source of GHG emissions in Minnesota. As of 2020, electricity generation was the third largest source of GHG emissions in Minnesota, having dropped 54% from the 2005 baseline. With continued adoption of renewable electricity generation, emissions from electricity generation could be expected to drop below emissions from the industrial sector, which currently ranks fourth in the state.

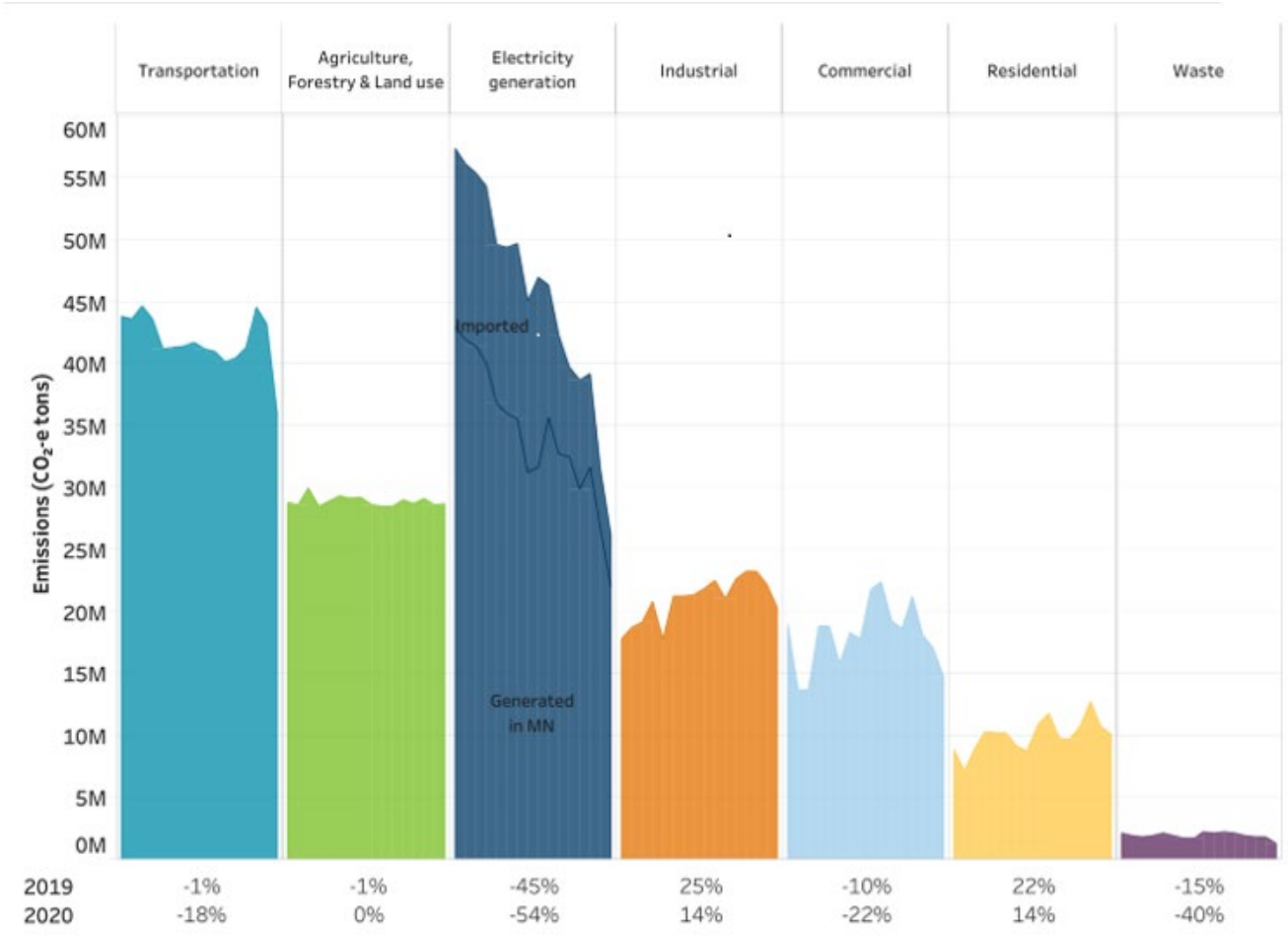


Figure 5-B: Minnesota's GHG Emissions by Activity (2005–2020)

Figure 5-B compares changes in Minnesota's GHG emissions attributable to various activities during the period from 2005 through 2020. Emissions from power consumption have declined substantially, while emissions from other sectors have declined slightly or even increased during the same period. The blue line in the column for the electricity generation sector represents the division between emissions from electricity generated in Minnesota below the line and emissions from net-imports of electricity above the line.[xiii]

Source: Minnesota Pollution Control Agency

Declining Carbon Intensity

Facing the threat of extreme weather and damages from climate change, local governments, institutions, and businesses are setting targets to reduce GHGs and increase reliance on renewable energy beyond business-as-usual scenarios. Efforts to reduce the carbon intensity of Minnesota's economy are being led by the State of Minnesota, 148 participants in the Minnesota GreenStep Cities voluntary program, and roughly half of the Fortune 500 companies based in the state.[xiv,xv,xvi]

As they manage and measure the results of planning decisions and efforts to meet their sustainability goals, governments and businesses are seeking data from utilities on GHG emissions from electricity generation.[10] In response, the Edison Electric Institute released a database in June 2020 with carbon emissions intensity rates for individual utilities, including the carbon dioxide (CO_2) offset by participation in green pricing programs.[xvii] As of October 2023, three Minnesota utilities had entered their emissions data into the database.

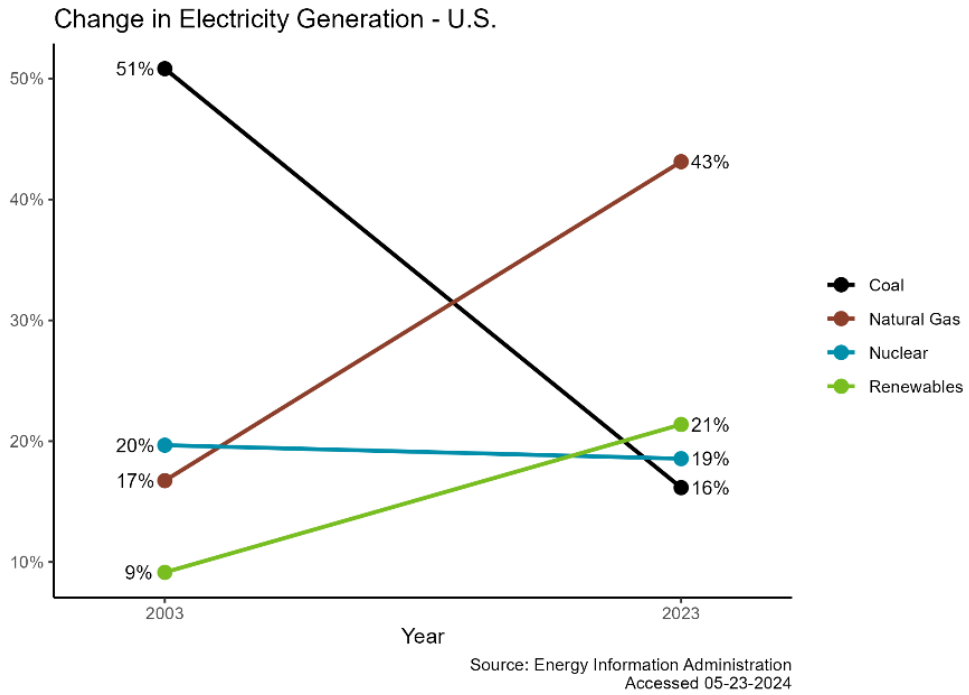


Figure 5-C: United States Electricity Generation Mix (2003 and 2023)

Figure 5-C compares the mix of U.S. power generation from various sources in 2003 and 2023. Nationwide, coal's share declined by more than half from 51% to 16%, while the share of generation from natural gas and renewables both more than doubled, from 17% to 43% and 9% to 21%, respectively.

Source: U.S. Energy Information Administration

[10] For example, to track progress of those involved in the GreenStep Cities Program, the Regional Indicators Initiative collected city-wide data in four primary areas: energy, water, travel, and waste, using this information to calculate GHG emissions and cost information for informed city planning.

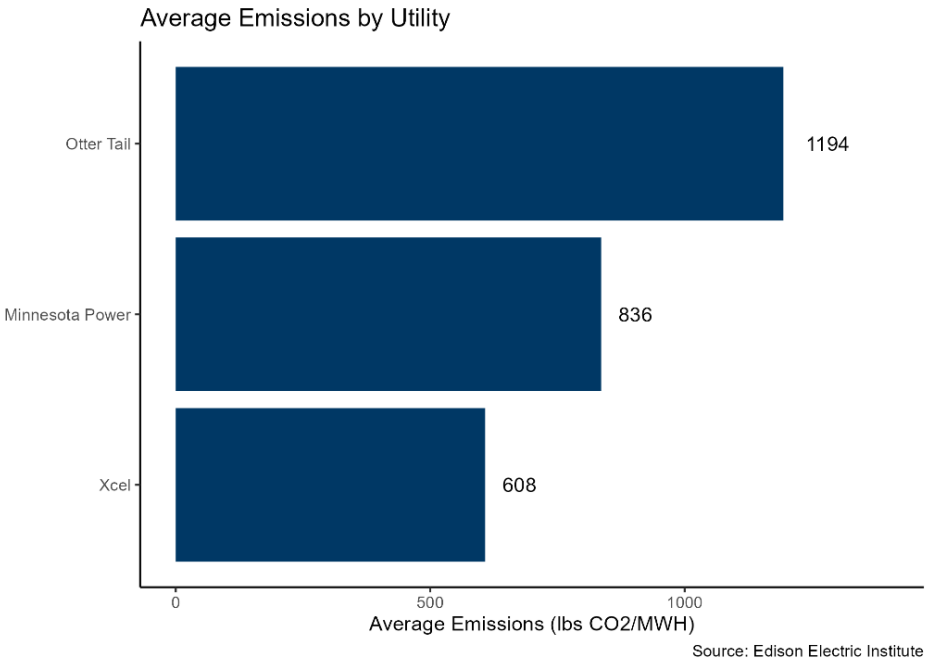


Figure 5-D: Average Emissions by Utility

Figure 5-D shows utility emissions intensity for Xcel Energy, Minnesota Power, and Otter Tail Power for the year 2022. Xcel Energy's generation is the least carbon intensive with 608 lbs. of carbon dioxide (CO_2) per MWh of electricity generated. Otter Tail Power's generation is the most carbon intensive of the three utilities, producing 1194 pounds of CO_2 per MWh of electricity generated.

Source: Edison Electric Institute

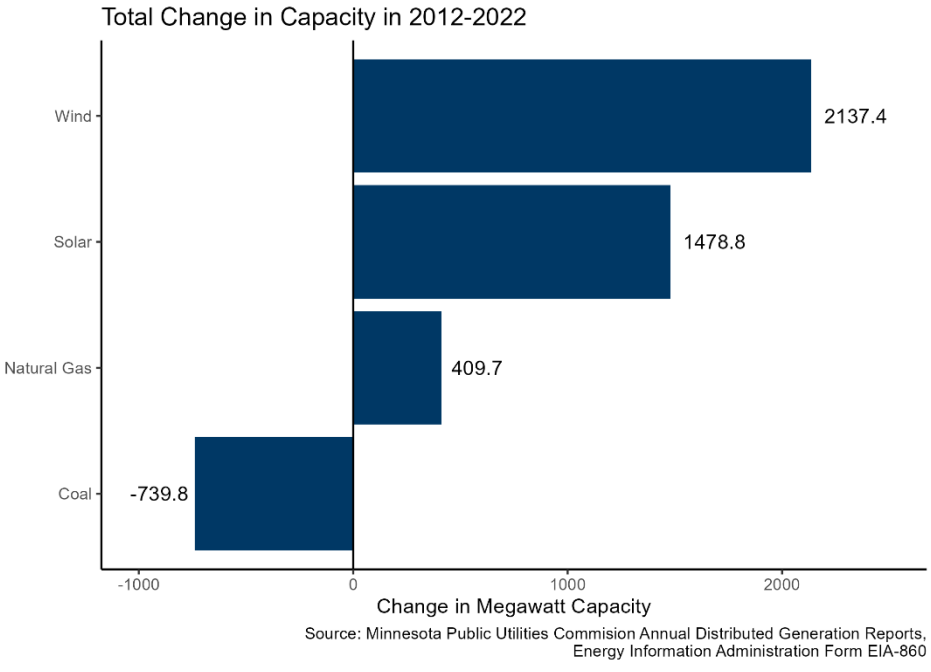


Figure 5-E: Minnesota Capacity Additions and Retirements (2012–2022)

Figure 5-E shows cumulative power plant additions and retirements from 2012 through 2022. Wind power and solar power have topped Minnesota's power capacity additions from 2010 onwards. Capacity retirements over the same period were primarily coal-fired plants, except starting in 2019 when some of the oldest wind generators were retired.

Sources: U.S. Energy Information Administration 860m Generator Inventory and Minnesota Dept. of Commerce.

Electricity generation

Historically coal has been the primary fuel source for electricity generation in many U.S. regions. Over the past decade, the ongoing need to replace aging power plants, a drop in natural gas prices, and concerns about toxic air emissions and GHGs from coal all contributed to a shift toward natural gas for electricity generation nationally.

Minnesota has no local fossil fuel reserves to supply its energy needs; however, Minnesota has an abundant supply of wind, solar, and bio-based energy. Minnesota ranks among the top five in the nation in ethanol production capacity, according to data from the U.S. Energy Information Administration (EIA). In addition, Minnesota ranks among the top 10 states in electricity generation from wind, and renewable resources continue to make up an increasing share of the state's energy supply.

As described in Chapter 3, nearly all Minnesota utilities are part of the regional transmission organizations Midcontinent Independent System Operator (MISO) or Southwest Power Pool (SPP). On a day-to-day basis MISO and SPP manage the dispatch of electricity generation across the region's electric grid. Accordingly, the electricity delivered to any specific part of Minnesota may be made up of electricity produced in any number of states that also participate in MISO and SPP. Similarly, the electricity that is produced in Minnesota is not necessarily all consumed within Minnesota. See Figures 5-F and 5-G for details about MISO.

Minnesota's energy policies before 2016, along with the low cost of natural gas and ongoing reductions in renewable energy technology costs, led to a rapidly changing mix of resources used to generate electricity within state borders. As a result, renewable sources became the single biggest source of electricity generation within Minnesota, and as of 2023, roughly 32.2% of electricity generated in Minnesota came from renewable sources, up from 27.6% in 2020. Wind generation makes up the bulk of renewable generation in the state, with solar increasing slowly.

Minnesota's utilities continue retiring coal-fired power plants and replacing them with a mix of renewables and natural gas. The proportion of electricity generated in Minnesota from coal decreased from 65% in 2003 to 22% in 2022. In the same timeframe, renewable sources increased from 5% to 32%. In the coming years, with the adoption of the 2040 Carbon-free Electricity Standard and the *Climate Action Framework*, new generation is projected to increasingly consist of renewable energy sources.

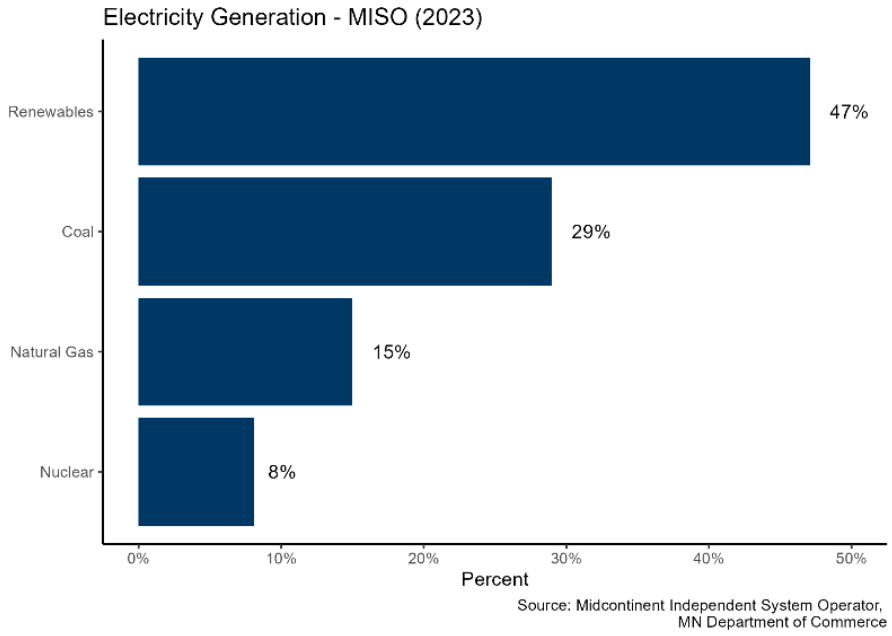


Figure 5-F: MISO North Electricity Generation Mix (2023)

Figure 5-F shows the proportions of renewables, natural gas, coal, nuclear, and other sources of power generation in the MROW subregion of the Midwestern grid in 2023. Renewables now dominate the region's power supply with 47%, and coal has dropped to comprise 29% of the total.

Source: U.S. Environmental Protection Agency

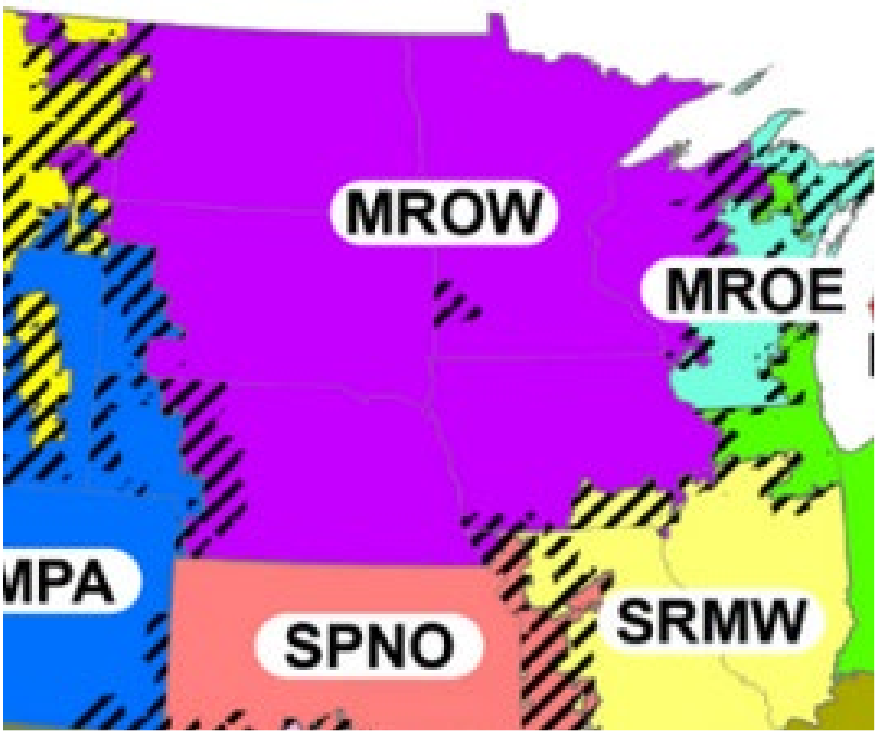


Figure 5-G: Midwest Power Grid Subregions

Figure 5-G illustrates the Midwestern U.S. subregions delineated by the EPA in its Emissions & Generation Resource Integrated Database (eGRID). Crosshatching indicates that an area falls within overlapping eGRID subregions due to the presence of multiple electric service providers.

Source: U.S. Environmental Protection Agency[xviii]

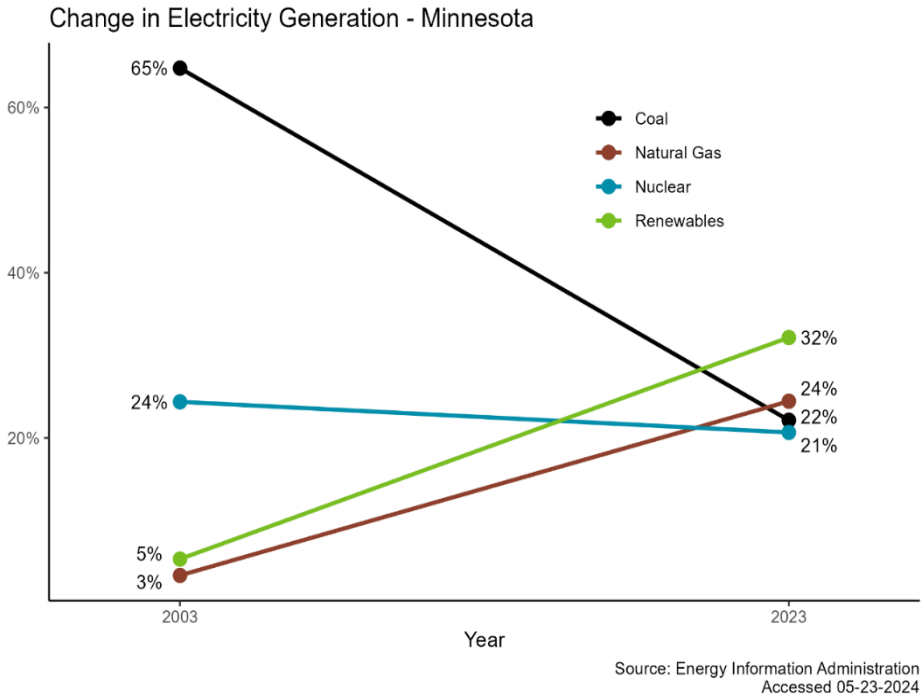


Figure 5-H: Electricity Generated in Minnesota (2003 vs. 2023)

Figure 5-H compares the mix of resources generating electricity in Minnesota between 2003 and 2023. During that 20-year period, coal's share declined from 65% to 22%, while the share of generation from natural gas and renewables increased from 3% to 24% and 5% to 32%, respectively. Renewables in 2023 were the state's single largest source of electricity.

Source: U.S. Energy Information Administration.

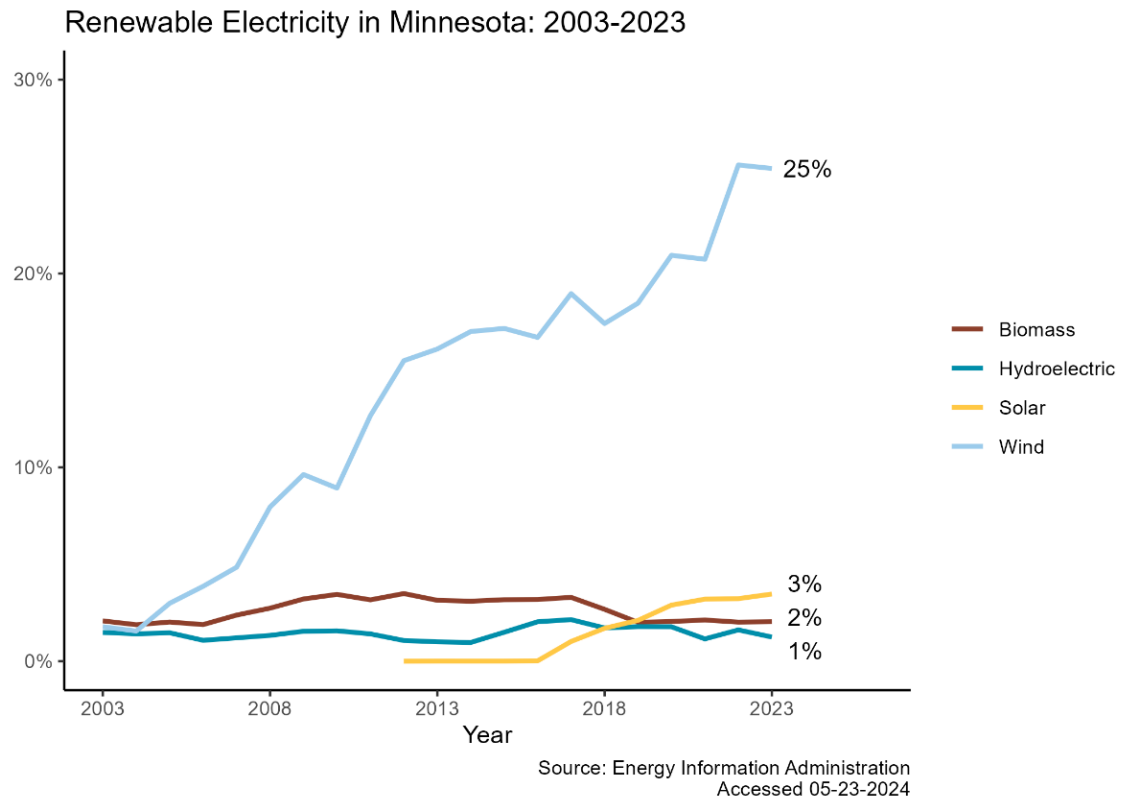


Figure 5-I: Minnesota Renewable Electricity Generation (2003–2023)

Figure 5-I illustrates 20-year trends in electricity generation in Minnesota from various renewable energy sources. From 2003 through 2023 wind energy's share grew rapidly, from less than 2% in 2003 to 25% in 2023. Meanwhile most other renewable sources of generation remained relatively flat until 2016, when solar power began growing from a fraction of a percent to reach nearly three percent of the total in 2020. Since then, hydroelectric and biomass generation have leveled off with solar generation increasing slowly.

Source: U.S. Energy Information Administration.

Minnesota's electric power sector emissions reductions are the result of statewide policies working in tandem with market forces. While most of the United States has turned primarily to natural gas generation while coal plants shut down, Minnesota has taken advantage of low-cost wind resources within the region to meet electricity demands in the transition away from coal. With the rollout of Inflation Reduction Act (IRA) funds, it's possible that electricity generation in the U.S. will switch to renewables, closing the gap with renewable electricity generation in Minnesota.

As of 2023, roughly 32.2% of electricity generated in Minnesota came from renewable sources, up from 27.6% in 2020.

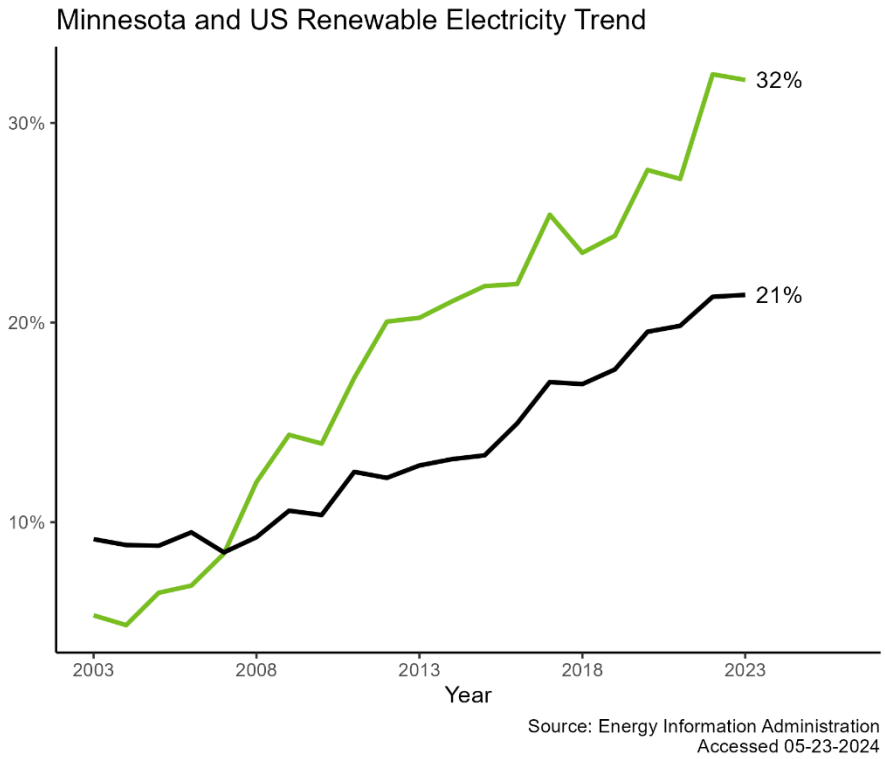


Figure 5-J: Minnesota and U.S. Renewable Electricity (2003–2023)

Figure 5-J illustrates how growth in renewable-powered electricity in Minnesota has outpaced the national average in most years since 2003. The 2023 percentage figures are based on preliminary data.

Source: U.S. Energy Information Administration.

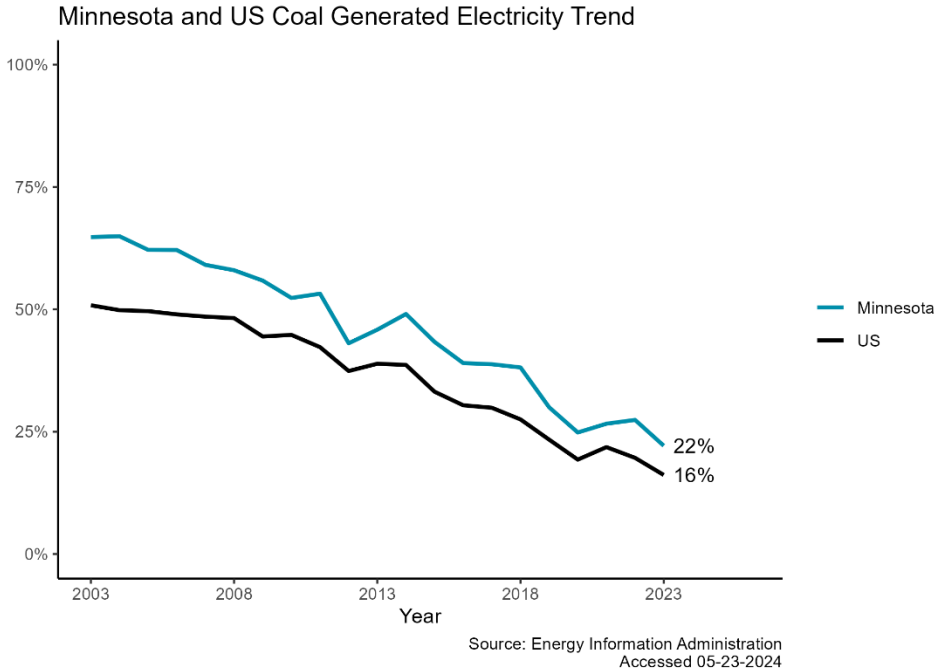


Figure 5-K: Minnesota and U.S. Coal Electricity (2003–2023)

Figure 5-K illustrates the narrowing gap between Minnesota's use of coal-fired electricity and the national average, with coal's share in the state's electricity supply declining from roughly 65% in 2003 to 22% in 2023, while the national average declined from just over 50% to about 16% during the same period. Like the rest of Midwest, Minnesota uses more coal than the rest of the country for electricity generation, but the state is rapidly reducing coal-powered electricity. The 2023 percentage figures are based on preliminary data.

Source: U.S. Energy Information Administration.

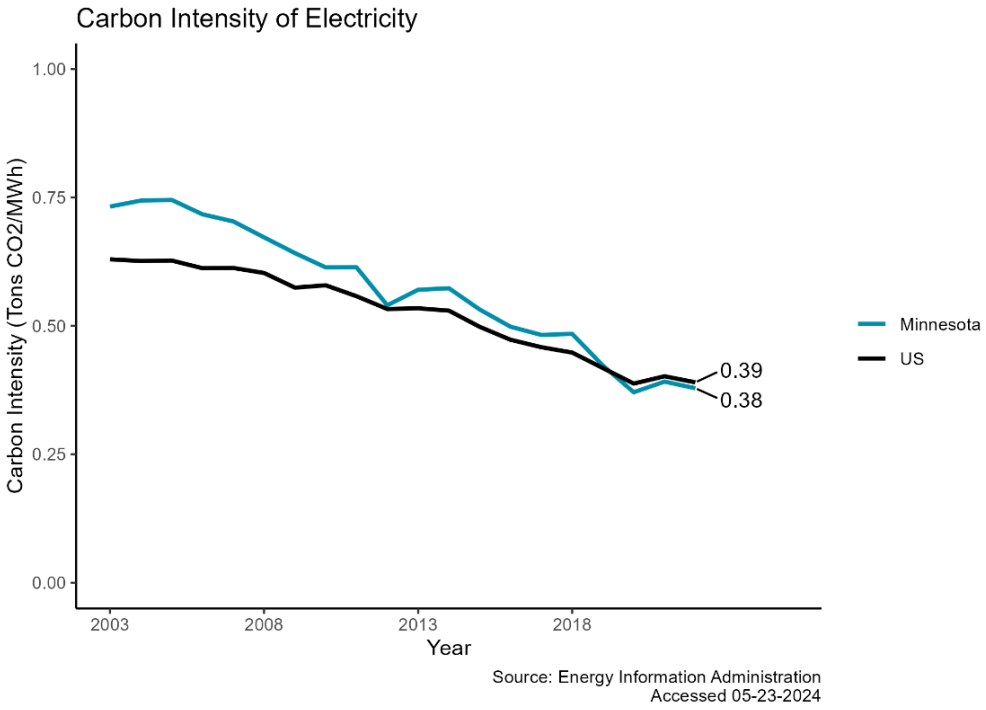


Figure 5-L: Minnesota and U.S. Carbon Intensity of Electricity (2003–2022)

Figure 5-L compares the declining carbon intensity of electricity in Minnesota to the national average, in terms of metric tons of CO_2 per megawatt-hour. Increased renewable generation and decreased coal generation put Minnesota on roughly the same trajectory to reduce its emissions from electricity generation as the national average.

Source: U.S. Energy Information Administration

Changing Coal Plant Operations

In the previous quadrennial report, Commerce reported that low wholesale electricity prices prompted Minnesota's utilities to change how their coal plants are run to improve economic operations with the potential for lower emissions. In 2019, Xcel Energy transitioned some of their coal plants from must-run to economic dispatch based on market prices, resulting in fewer operating hours for two coal plants. Also in 2019, Xcel Energy proposed a seasonal operation plan for two of its coal power units: Allen S. King Generating Station and Unit 2 of the Sherburne County Generating Station. Reflecting these policies, monthly generation data indicates that coal generation spikes in late winter and summer, whereas in the spring coal generation falls considerably, as shown in Figure 5-M.

Beyond the seasonal use of coal power generation, utilities are planning on a future without relying on coal electricity generation. Xcel Energy retired one unit of its Sherco Coal plant at the end of 2023, with additional units slated to be retired in 2026 and 2030. Xcel Energy also plans on retiring the Allen S. King Generating Station, another coal power plant, in 2028.[xix] Likewise, Minnesota Power will cease operations at its Boswell Unit 3 power plant by the end of 2029 and at its Boswell Unit 4 power plant by 2035.[xx] These planned retirements, along with requirements set forth by the 2040 Carbon-free Electricity Standard, are projected to dramatically reduce the amount of coal powered electricity generation in the state in the coming years.

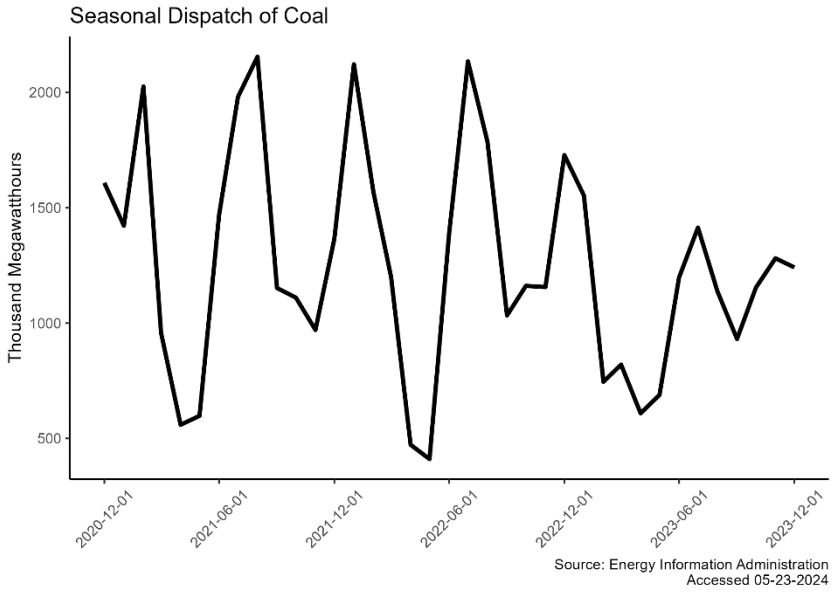


Figure 5-M: Economic and Seasonal Dispatch of Coal

Figure 5-M depicts seasonal trends in power generation in Minnesota for coal, renewable, and natural-gas fueled generation from the end of 2020 through 2023. Starting in 2019 the change in coal-fired power plant operation from must-run to seasonal dispatch is evident in the shift from historic pattens of seasonal energy generation.

Source: U.S. Energy Information Administration

Facility	Capacity (MW)	Status
Minnesota Power		
Boswell unit 3	365	Retiring by 2029
Boswell unit 4	558	Retiring by 2035
Taconite Harbor Energy Center unit 1 & 2		Retired
Otter Tail Power Company		
Hoot Lake 2	54	Retired
Hoot Lake 3	75	Retired
Xcel Energy		
Sherburne County 1	680	Retiring by 2026
Sherburne County 2	682	Retired
Sherburne County 3	876	Retiring by 2030
Allen S. King	511	Retiring by 2028

Figure 5-N: Upcoming Retirements of Coal-Fired Power Plants in Minnesota

Figure 5-N outlines the upcoming retirements of coal-fired power plants in Minnesota. If current plans are carried out, all power plants in Minnesota that use coal as their primary source of electricity generation will be retired by the end of 2035.

Source: Resource plans from Minnesota Power, Otter Tail Power Company, and Xcel Energy

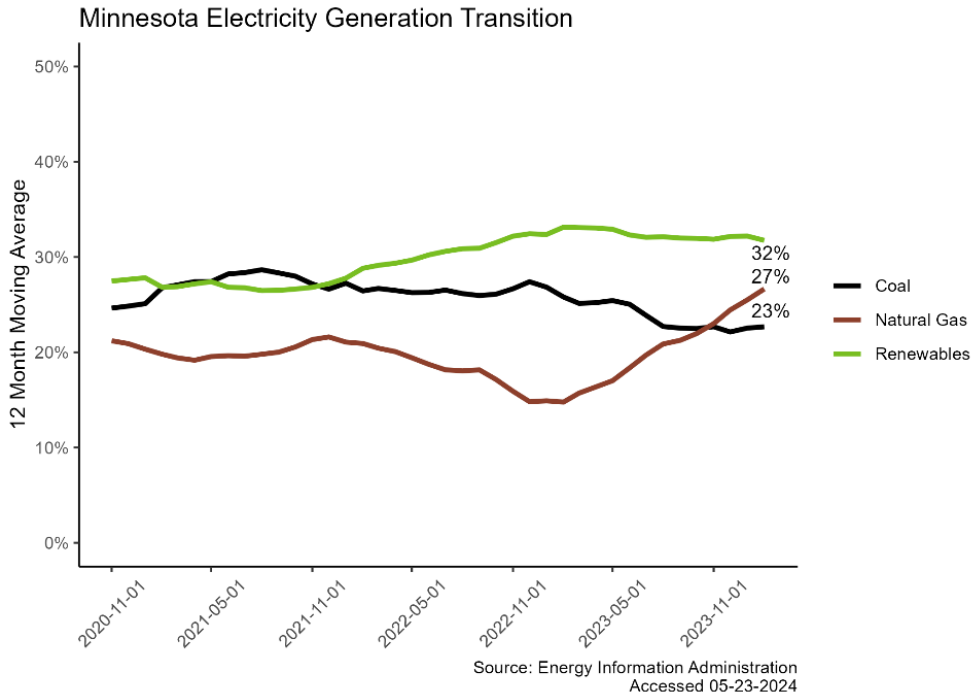


Figure 5-O: Power Generation Transition in Minnesota (2020–2023)

Figure 5-O illustrates the average share of total electricity generation in Minnesota by renewable energy, coal, and natural gas-fueled power plants from the end of 2020 through 2023. Starting at the beginning of 2022, renewable generation consistently made up the largest share of electricity generation in the state.

Source: U.S. Energy Information Administration

Natural Gas

The past four years have been marked by particularly turbulent natural gas prices, which in turn has affected natural gas use for electricity generation. In early 2021, unusually cold weather interrupted natural gas production while simultaneously causing a spike in demand, leading to near record high spot prices for natural gas.[xxi] In February of 2022, Russia's invasion of Ukraine sparked global disruption of natural gas use and trade, leading to the U.S. exporting record amounts of Liquefied Natural Gas to Europe to replace natural gas imports that had previously come from Russia.[xxii]

Following Russia's invasion of Ukraine, the 12-month moving average of the share of electricity generated by natural gas in Minnesota began to decline, reaching a low of 15% of electricity generation in February of 2023. Since then, natural gas prices have fallen back to prices typical of the pre-2021 period, coinciding with a rebounding of electricity generation from natural gas in Minnesota.

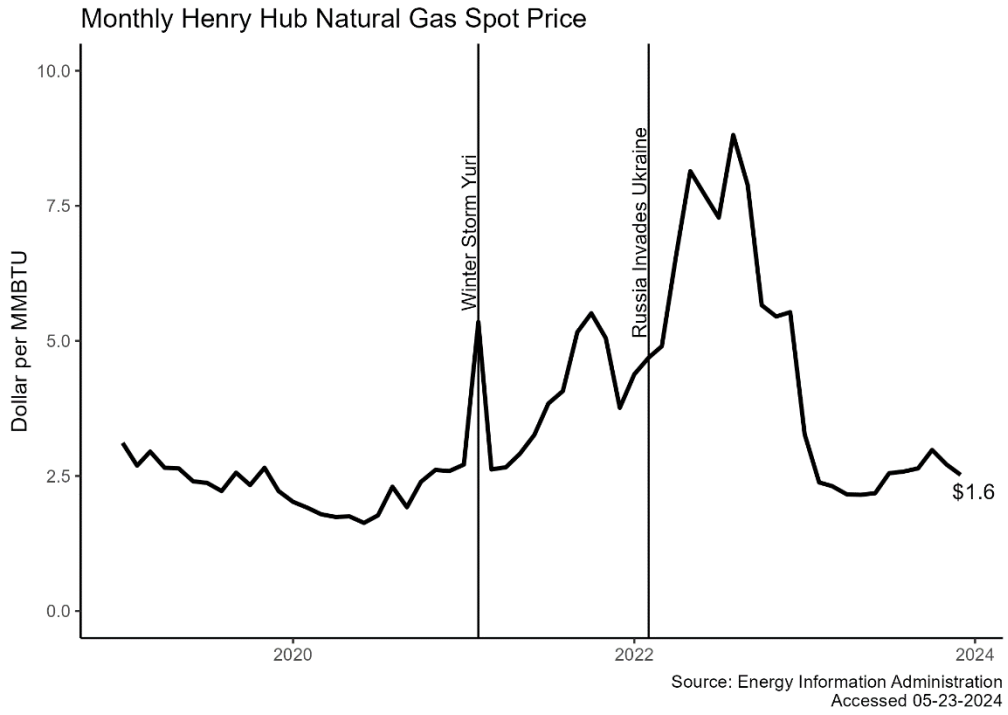


Figure 5-P: Monthly Henry Hub Natural Gas Spot Price (Past 60 Months)

Figure 5-P illustrates the price of natural gas measured in dollars per one million British thermal units (MMBtu) from 2019 through 2023. Although spot prices for natural gas declined in the first half of 2020, they recovered to normal levels by 2021.

Source: U.S. Energy Information Administration

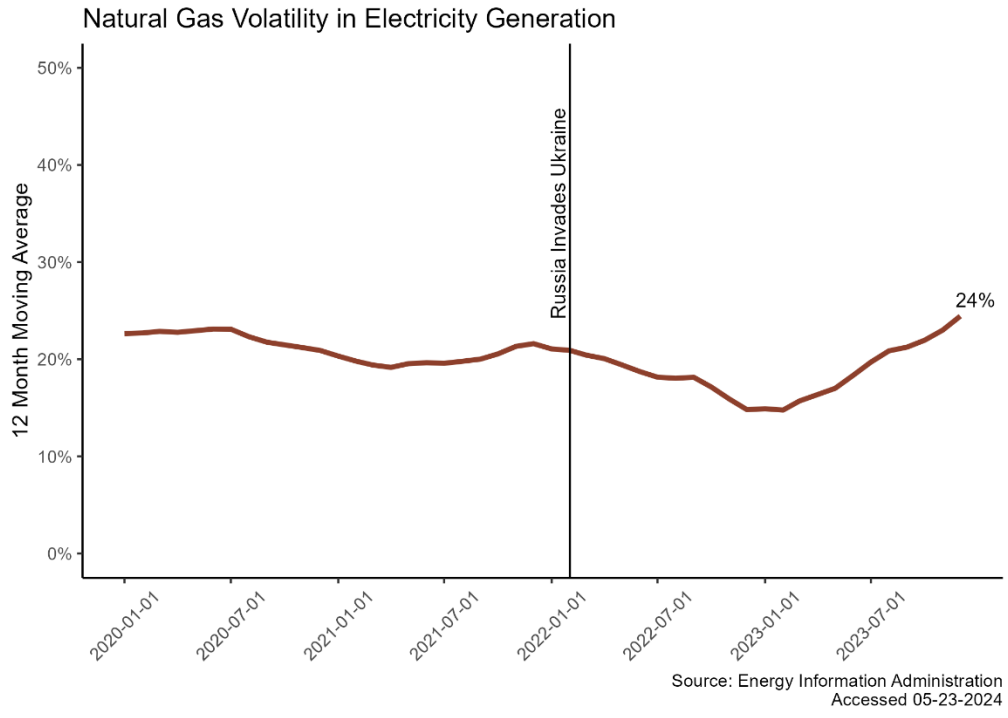


Figure 5-Q: Natural Gas Volatility in Electricity Generation

Figure 5-Q illustrates the 12-month moving average of the percent of electricity generated in Minnesota by natural gas. Following Russia's invasion of Ukraine and the subsequent price spike of natural gas, Minnesota saw a decline in the percent of electricity produced by natural gas. The price of natural gas has since fallen, which has coincided with a rebound in the share of electricity generated by natural gas in Minnesota.

Source: U.S. Energy Information Administration

Nuclear Generation

Nuclear generation remains an important source of carbon-free power in Minnesota. Xcel Energy operates nuclear plants at Monticello and Prairie Island. The Monticello reactor is currently licensed so that it can continue operation through 2040. Xcel Energy's current resource plan requests an additional 10-year license extension for Monticello. In 2023, the PUC approved additional spent nuclear fuel storage sufficient for Monticello to operate through 2040. Xcel Energy's resource plan also requests a 20-year license extension for the two Prairie Island reactors; their current licenses are set to expire in 2033 and 2034. Xcel Energy has requested approval for additional spent nuclear fuel storage sufficient to operate Prairie Island through 2054. The outcomes of Xcel Energy's license applications will affect Minnesota's power generation emissions. (See Chapters 3 and 4 for details on utility resource planning and siting processes.)

Like coal, nuclear power faces challenging economics due to low costs for natural gas and utility-scale renewables. Compared to 2014, the capacity of the U.S. nuclear power fleet decreased about 3% and the energy output decreased about 13%.[xxiii]

Renewable Generation

The percentage of electricity generated from renewables within state borders is an indicator of progress on the renewable electricity standard, but not a direct measure. Minnesota consumes more electricity than is generated in-state and imports electricity from both renewable and non-renewable sources. Accordingly, the percentage of renewable energy in retail electricity sold and delivered to consumers does not equate to the amount of renewable electricity generated in Minnesota.

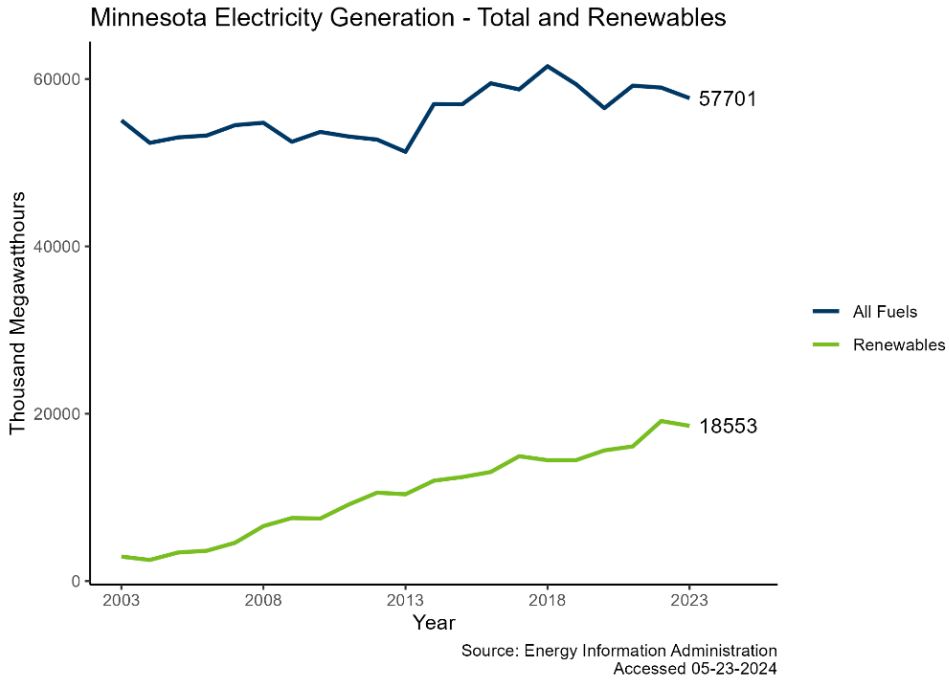


Figure 5-R: Minnesota Electricity Generation—Total and Renewables

Figure 5-R shows the trend of total electricity generation in Minnesota, along with generation from renewable sources. While total electricity generation has been relatively stable, the total among of electricity generated from renewable sources has increased steadily for the past 20 years. Most of this generation is from wind generation.

Source: U.S. Energy Information Administration

Between 2005 and 2023, the percentage of renewable electricity generated within the state's borders increased from 6% to 32%, while the percentage of coal decreased from 62% to 22%. In 2023, the total electricity generated in Minnesota decreased roughly 6% from its peak in 2018, although in general total generation is stable. In-state electricity generation from renewable sources came primarily from wind (25%), followed by solar (3%), biomass (2%), and hydropower (1%) in 2023.

The continued low-cost of renewable generation, particularly onshore wind and utility scale solar,[xxiv] along with government subsidies for such technologies has driven the projected expansion in renewable and storage capacity both nationally and in the MISO region.[xxv] At the beginning of 2024, the MISO interconnection queue reflected this reality, with solar, wind, and battery projects comprising 76% of projects waiting to be interconnected, representing 138.5 gigawatts of increased solar and wind capacity along with 34.1 gigawatts of increased storage capacity.[xxvi]

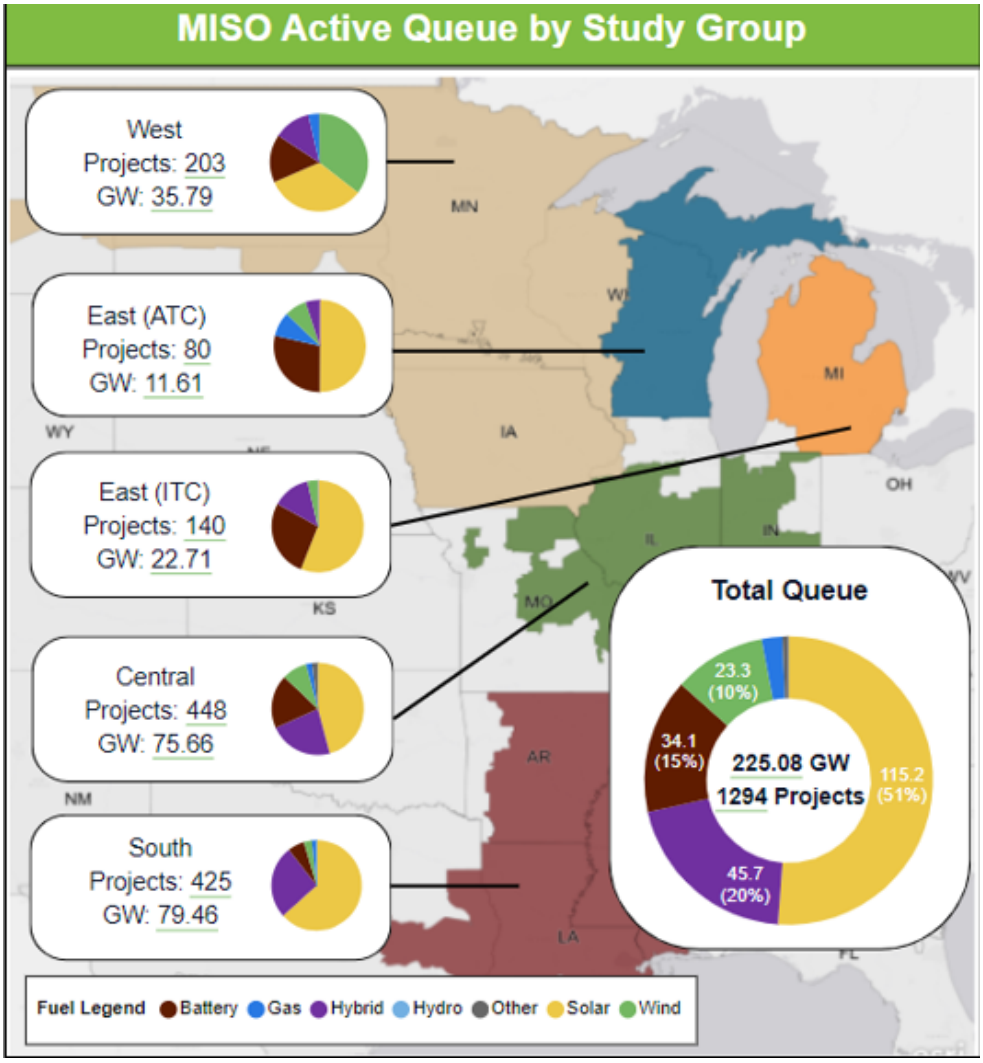


Figure 5-S: MISO Active Queue by Study Area

Figure 5-S shows the share of various energy resources in the Midcontinent Independent System Operator (MISO) interconnection queue for five regions. The interconnection queue represents new generation projects seeking utility interconnection approvals, and projects a dramatic expansion of wind, solar, and battery storage in Minnesota and neighboring states. Of 225 gigawatts of queued capacity, 115.2 GW or 51% is comprised of solar projects (shown in yellow on the pie charts), with another 23.3 GW or 10% represented by wind power proposals (shown in green on the pie charts).

Source: MISO Generator Interconnection Queue Web Overview, Feb. 20, 2024.

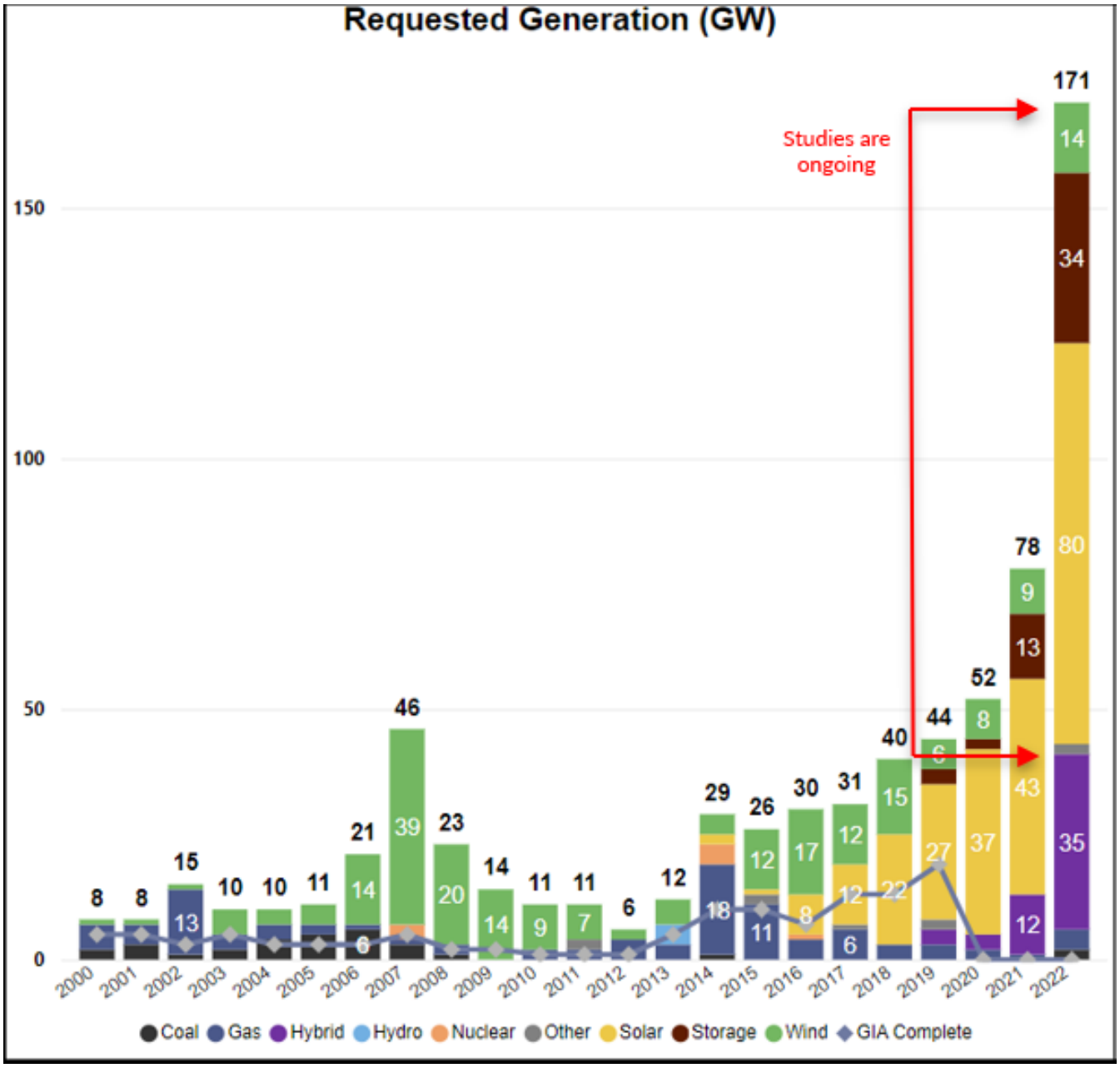


Figure 5-T: MISO Queue Historical Trend

Figure 5-T illustrates interconnection queue trends in the Midcontinent Independent System Operator (MISO) grid from 2000 through 2022. Wind projects dominated in the late 2000s, and natural gas surged in 2014 and 2015, after which wind and increasingly solar projects dominated the queue. In the past two years, hybrid resources have gained prominence in the interconnection queue.

Source: MISO Generator Interconnection Queue Web Overview, Feb. 20, 2024.

Wind Energy

Minnesota has the advantage of winds moving unobstructed across broad southern prairies. Additionally, the Buffalo Ridge geologic formation causes strong and steady winds in the southwestern portion of the state. In 2020, wind supplied 19% of the state's net electricity generation, according to EIA, which also placed Minnesota in the top 10 states nationwide for installed generating capacity and net generation from wind.[xxvii]

Technological advancements and declining wind prices have made wind generation at favorable resource sites economically competitive with coal and natural gas generation. Minnesota embraced wind energy early on, and several companies based in the state have since become national leaders in the industry. They include the construction companies Mortenson in Golden Valley and Blattner Energy in Avon, and the wind turbine component transporter Anderson Trucking Service based in St. Cloud.[xxviii,xxix,xxx]

New wind capacity in the state has been driven by planned coal plant retirements as well as extensions of the federal production tax credit.[xxxi] Regionally, wind energy growth also was facilitated by the 800-mile CapX2020 transmission project, completed in September 2017, one of the largest energy infrastructure investments in Minnesota history.[xxxii]

There is some evidence suggesting that wind prices have risen in recent years, although prices in general remain lower than other electricity sources. According to the U.S. Department of Energy (DOE), wind PPAs hit an all-time low around 2018 but have since increased some to roughly $20 per MWh in the central portion of the U.S. Most of the inflation appears to be driven by supply chain interruptions and general inflationary conditions that have affected the economy in general.[xxxiii] Regardless of inflationary pressure wind-generated electricity remains among the lowest-cost resource for new capacity along with utility scale solar. Lazard's annual levelized cost of energy analysis showed in 2023 that onshore wind maintained competitiveness with the marginal cost of conventional generation technologies (see figure next page),[xxxiv] and the DOE's analysis reports that with federal tax incentives, wind energy is cheaper than producing energy with natural gas.[xxxv]

Increasingly, wind is being chosen over natural gas generation facilities in resource planning scenarios. In addition, the combination of declining natural gas and wind prices has encouraged utilities to limit coal generation facilities' operation to annual peak demand periods, or to retire them altogether. By the end of 2020, Minnesota had a total installed wind capacity of 4,310 MW.[xxxvi]

In December 2020, Minnesota Power activated the Nobles 2 wind farm. This brought the utility's owned and contracted wind power to around 870 MW and increased the utility's percentage of electricity from renewable sources to 50%—which includes 250 MW of hydropower from Manitoba Hydro, delivered via the Great Northern Transmission line that was completed in June 2020.[xxxvii] Minnesota Power became the first utility in the state to reach the 50% renewable milestone.

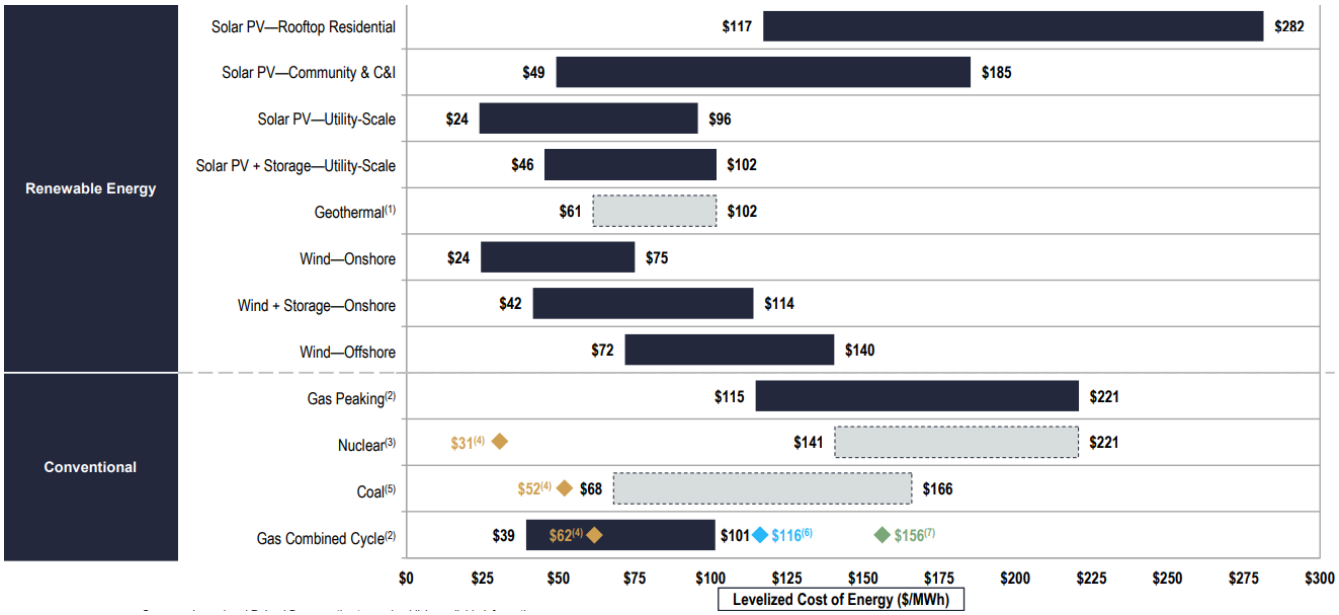


Figure 5-U: Levelized Cost of Energy Comparison

Figure 5-U compares the levelized unsubsidized cost of energy from various generation technologies. Onshore wind and utility scale solar continue to be the lowest cost resources for new capacity.

Source: Lazard's Levelized Cost of Energy Analysis version 16.0 [xxxviii]

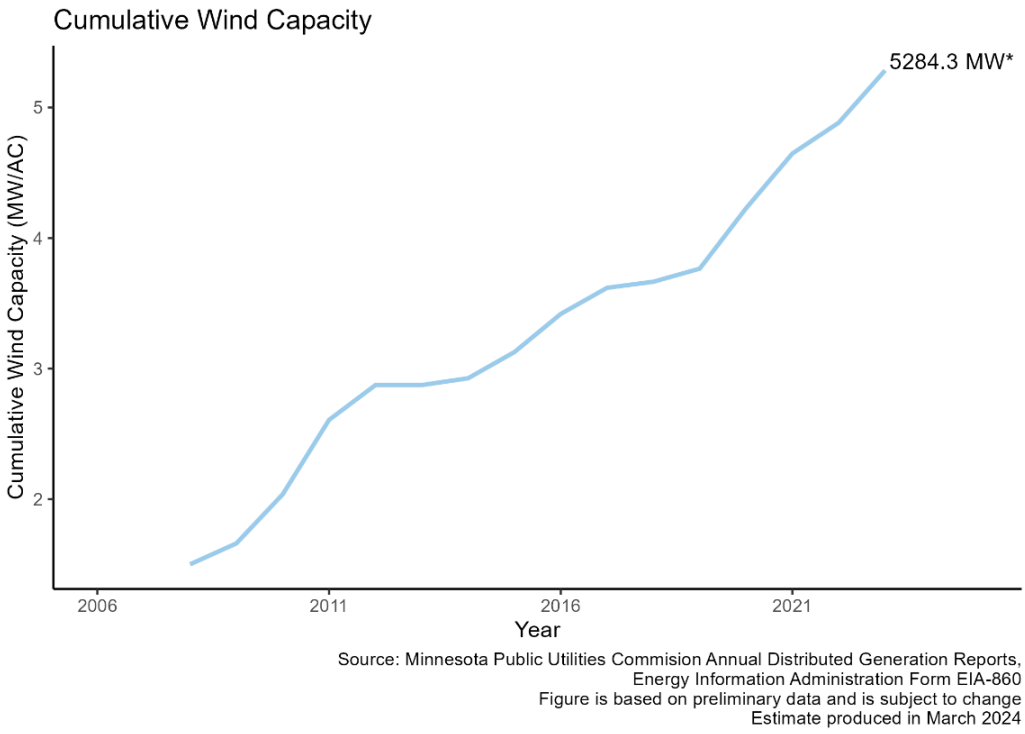


Figure 5-V: Minnesota Wind Power Capacity (2007–2023)

Figure 5-V shows the annual growth of Minnesota wind power capacity from 2007 through the end of 2022. During this period, wind generation capacity grew from roughly 1000 MW to more than 5,200 MW.

Source: Minnesota Department of Commerce

Solar Energy

Power generated from solar energy in the state has increased in recent years. According to preliminary data from the EIA, in 2022, solar electricity accounted for over three percent of Minnesota's net generation.[xxxix]

Data from Commerce show that solar market activity in the state grew rapidly in 2016 and 2017, with considerable utility-scale solar additions those years. Between 2017 and 2020 there was considerable growth in community-scale solar installations, with installations in 2018, 2019, and 2020 almost entirely made up of community-scale solar. Solar installations in 2021 and 2022 slowed from the meteoric levels of 2017 and 2018, while still maintaining a consistent pace and mix of installation types. This is reflected in the cumulative solar capacity of Minnesota (Figure 5-X), which began increasing quickly around 2016.

As with wind, the cost of solar energy has declined. Nationally, the installed price of utility solar fell from more than $6 per Watt in 2010 to $1.06 per Watt in 2022.[xl] Lazard's levelized cost analysis shows how both crystalline and thin-film utility-scale solar-PV technologies have become competitive with conventional generation technologies. In Minnesota, the Solar Energy Industries Association found that solar prices dropped 45% over the past five years.

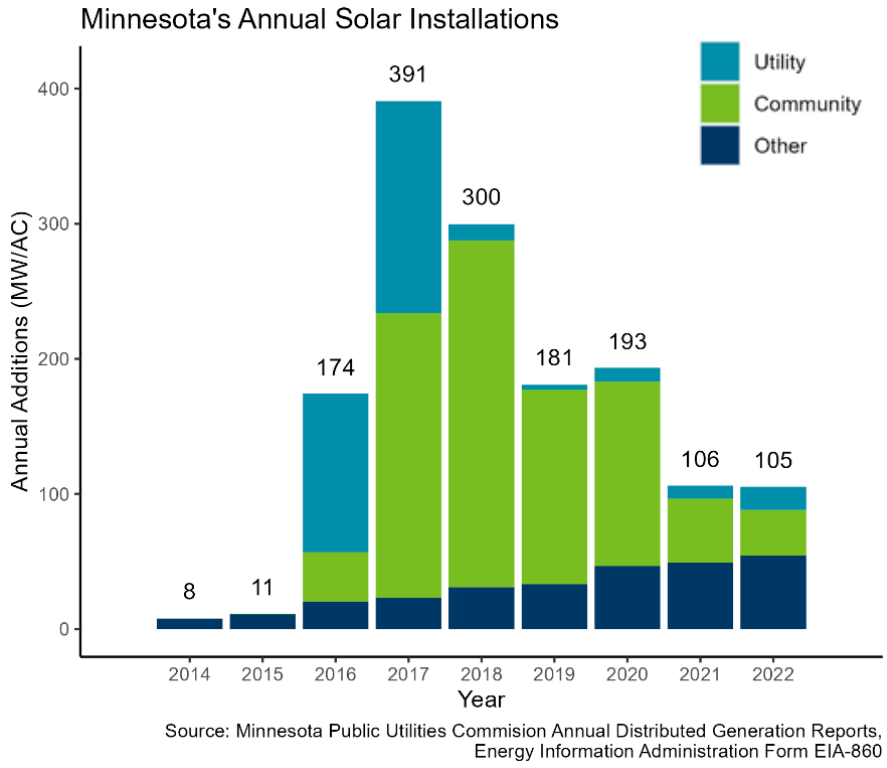


Figure 5-W: Minnesota Annual Solar Installations (2013–2022)

Figure 5-W shows the annual solar power capacity added per year from 2014 through 2022 (preliminary estimate).

Source: Minnesota Department of Commerce

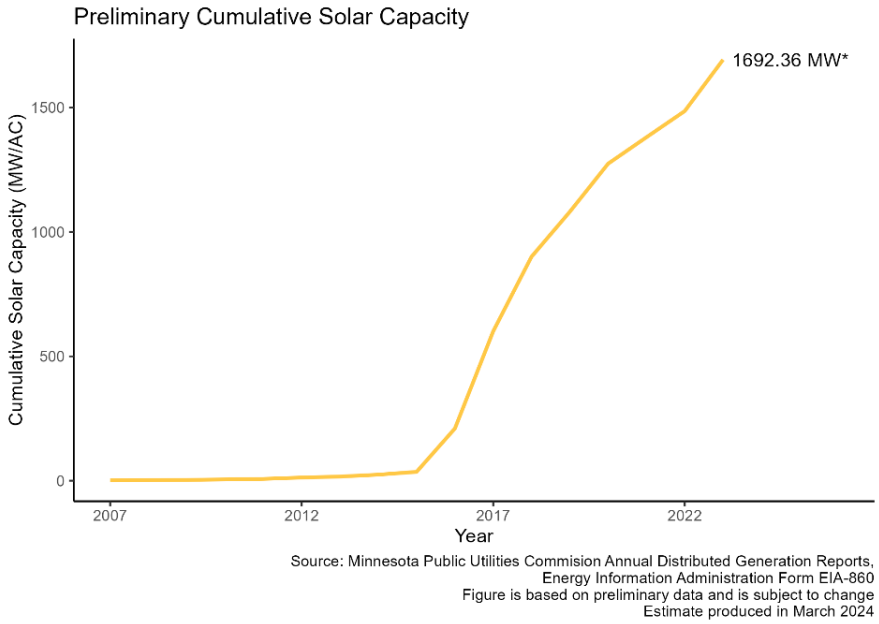


Figure 5-X: Minnesota Solar Power Capacity (2013–2023)

Figure 5-X shows the annual growth of solar power capacity from 2013 through 2022 (preliminary estimate). Growth is projected to continue at recent rates.

Source: Minnesota Department of Commerce

Biofuels

Biofuels are one of many tools for achieving Minnesota's renewable energy development and independence. Biofuels primarily include ethanol and biodiesel, and now increasingly compressed renewable natural gas. Minnesota legislation promotes renewable liquid fuels under Minn. Stat. § 239.7911, which set petroleum replacement goals of 25% for 2020 and 30% for 2025. Also, Minn. Stat. § 239.791 created a biofuels content mandate and Minn. Stat. § 297.77 created a content mandate for biodiesel.

Minnesota has three biodiesel plants, with a combined production capacity of approximately 85.5 million gallons per year, or enough supply to require that No. 2 diesel be blended with at least 20% biodiesel for over five months of the year each summer (B20).[xli] Biodiesel reacts differently than diesel under freezing conditions, so lower blends are required during the fall and winter months. Minnesota remains one of the top five ethanol-producing states in the country, according to the latest EIA data.[xlii] The state's 18 fuel ethanol production plants use corn as a feedstock.[xliii] In May 2020, the federal government introduced the Higher Blends Infrastructure Incentive Program (HBIIP), offering $100 million in funding for activities to expand the sale and use of ethanol and biodiesel fuels.[xliv] Funding of the HBIIP has since expanded to over $450 million with an injection of funds from the IRA. Awardees have used the funds to upgrade E85 and B20 dispensers, storage tanks, circulation lines, and other biofuel infrastructure.[xlv]

An August 2019 report from the Minnesota Department of Transportation described how biofuels could be used in the transition to electric vehicles fueled by renewable grid energy. The report stated that "modeling showed that action is needed across all vehicle classes and sectors, including increased use of biofuels, to achieve the state's [Next Generation Energy Act] GHG goals."[xlvi]

In 2023, the Minnesota Legislature established a clean transportation standard (CTS) work group.[xlvii] A CTS could be the largest single policy for reducing carbon pollution from transportation in Minnesota, and, if structured

properly, could reduce transportation GHG, create jobs, attract investments to Minnesota, reduce air and water pollution, and improve soil and water health in Minnesota. The legislature set initial goals for carbon intensity fuel reduction of at least 25% by 2030, 75% by 2040, and 100% by 2050, when compared to a 2018 baseline.[xlviii] The CTS work group and steering committee had over 40 members, including representatives from the Minnesota Departments of Agriculture, Commerce, Transportation, and the Pollution Control Agency. They submitted a report and recommendations to the legislature on February 1, 2024, after extensive meetings and scenario modeling. The group determined that GHG reductions from biofuel production are abundant, via adoption of low-carbon farming practices, incorporation of renewable energy and energy efficiency measures at biofuel production facilities, and build-out of carbon capture and utilization technologies; however, Minnesota is unlikely to meet the carbon intensity reductions as mandated. Modeling suggested that Minnesota could achieve carbon intensity reductions in the realm of 13-17% by 2030 and 40-50% by 2040 with a CTS. Uncertainty beyond 2040 limits predictability, but modeling suggested only a 30% decline in carbon intensity by 2050 if a CTS is not adopted.[xlix]

Emerging Fuels

As the discussion about gas system decarbonization has gained momentum, multiple emerging fuels are being explored that have the potential to reduce system emissions. Renewable natural gas (RNG) is pipeline-quality gas, sometimes called upgraded biogas or biomethane, produced from biomass sources, such as livestock manure, food waste, or wastewater treatment plant biosolids, using a biochemical process.[l] Some Minnesota utilities are pursuing RNG programs where the gas is sourced primarily from landfill methane capture.

The PUC approved CenterPoint Energy's plan to create a renewable natural gas supply system, interconnecting prospective producers with its distribution network.

Public discussion of RNG began intensifying in 2018. CenterPoint Energy filed a green tariff proposal with the PUC in August of that year that would give customers the option of purchasing RNG produced from livestock manure or organic landfill waste.[li] The PUC unanimously rejected the proposal in July 2019, citing concerns about the increased cost to ratepayers with even a voluntary program, but urged CenterPoint Energy to continue working on the concept.[lii] In November 2020, the PUC approved CenterPoint Energy's plan to create an RNG supply system in the state, interconnecting prospective producers with its distribution network.[liii]

On June 26, 2021, Governor Walz signed the Natural Gas Innovation Act (NGIA), that allowed natural gas investor-owned utilities (IOUs) to file five-year innovation plans where they can propose to incorporate various fuels like RNG, hydrogen, ammonia, and biogas into their portfolio. CenterPoint filed their first plan on June 28, 2023,[liv] while Xcel Energy filed their first plan on December 15, 2023.[lv] Both of these plans are currently under review and the PUC is expected issue an order later in 2024. Both NGIA plans include various emerging fuels and have the potential to reduce Minnesota's emissions.

On June 2, 2022, CenterPoint announced that it started producing green hydrogen at its downtown Minneapolis facility.[lvi] The project's one-megawatt electrolyzer can produce up to 60 dekatherms (432 kilograms) of hydrogen gas per day, using approximately two gallons of water per minute. In a response on September 15,

2023, CenterPoint stated that between August 2022 and August 2023 the facility has produced 2,027 dekatherms of hydrogen, or 10% of the unit's projected output over the past year.

Energy Storage

As renewable capacity grows to capture a greater share of Minnesota's power market, utilities will need more fast-ramping resources to maintain system balance, given the variable and non-dispatchable nature of solar and wind power capacity. Energy storage technologies may become increasingly capable of serving those balancing requirements, especially for supporting short-term peak demand conditions. Instead of dispatching relatively inefficient simple-cycle gas-fired turbine generators, utilities can discharge batteries or other systems that store power either from the grid or from directly connected renewable energy facilities.

Minnesota had roughly 16 MW of utility-managed battery storage at the end of 2023, and Minnesota homeowners are increasingly choosing to install small battery storage units, often paired with rooftop solar systems. Storage technologies have evolved considerably since 2020, with a variety of types and lengths of storage duration available, being researched, and being brought to commercialization, as described below:

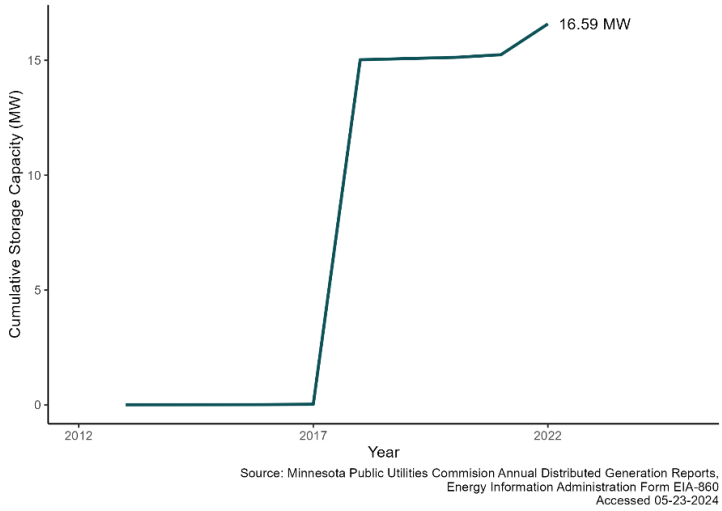


Figure 5-Y: Cumulative Storage Capacity

Source: U.S. Energy Information Administration

- Maturing storage technologies include lithium-ion batteries, which are not limited by topology or geology and are increasingly common in both vehicle and land-based application. They have experienced rapid cost improvements since 2020 due to a growing market and continuous research. Lithium-ion batteries have relatively small capacity and duration though, and the capacity of lithium-ion batteries declines over time based on use cycles, so the useful life is generally considered to be 10 years.
- Many storage technologies are currently being developed, with a few of them in pilot-phase installations. These technologies include flow, iron-air, gravity, zinc-based, and liquified-air energy storage. As of early 2024, Great River Energy and Xcel Energy are both scheduled to install 100-hour iron-air batteries within the next few years.
- Hydrogen and its derivative products, discussed more in *Hydrogen as a Source of Clean Energy* below, can also serve as an energy storage technology. By using electrolyzers and renewable power, hydrogen production can be zero-carbon, and can allow renewable energy generation to be stored for later use and shipped to other parts of the state for use in areas with less renewable energy sources.

- Storage technologies such as pumped hydro energy storage and compressed air energy storage have been in use for decades but are limited by local topography and geology. Both of these options generally require high elevations or underground caverns, so are not likely to be used in Minnesota.

Studies prior to 2020 concluded that building extra solar and wind capacity and curtailing the excess generation in some conditions could be a more cost-effective alternative than pairing renewables with storage. In 2023 the legislature enacted HF2310, which in part required Commerce to engage stakeholders and complete a study on the potential storage amounts necessary for Minnesota to meet its clean energy targets.[lvii] Commerce engaged consulting firm Siemens PTI and delivered the report to the legislature in March 2024. The study found that build out of energy storage technologies, beyond what current utility integrated resource plans (IRPs) call for, can lead to lower costs for Minnesota ratepayers. This is due to storage providing less need for REC purchases and less transmission upgrades, which can decrease costs and limit uncertainty for utilities. The Energy Storage System Capacity Study Report also called for the build-out of clean dispatchable resources, which can include a variety of technologies, not solely battery storage.[lviii]

Build out of energy storage technologies and other clean dispatchable resources, beyond what current utility IRPs call for, can lead to lower costs for Minnesota ratepayers.

Overall, energy storage has the potential to generate revenues from multiple sources:

i) Energy arbitrage, when the unit charges during low prices and discharges during high prices;
ii) Capacity payments by offering firm capacity to allow the system to navigate ramp up and down periods; and
iii) Ancillary services revenues by helping with grid stability.

The kind of energy storage technology Minnesota needs with respect to size, duration, and location will evolve as renewable penetration increases in the generation mix. The policy environment has to simultaneously evolve to ensure the market is able to recognize the value of services provided by energy storage.

Behind the meter storage is currently in the early adoption stage in the State of Minnesota. In 2023, the Minnesota Legislature passed legislation to invest $7 million towards the adoption of on-site energy storage paired with solar for up to 50 kWh sized systems. In 2024, Xcel Energy will be administering the program for applicants in their territory with a maximum grant award of $5,000. Commerce is developing the program for applicants outside Xcel Energy territory. Behind the meter storage has the potential for grid benefits including peak shaving and solar time shifting. Benefits can also include the creation of Virtual Power Plants which could lower customer electricity costs once established. Some Minnesota utilities are in the early stages of developing energy storage demand response programs where utilities provide incentives for the energy a customer provides to the grid during demand response events. These programs show promise for larger system benefits. As storage technologies evolve, policymakers and markets will need to adapt to enable efficient deployment of various energy storage technologies. This will require a variety of initiatives, such as effective battery operating controls, incentives, and targets; engaging with MISO to ensure storage technologies can effectively participate in markets and monetize their value; and lessening or removing barriers to storage deployment.

The effect of energy storage on GHG emissions in Minnesota hasn't yet been thoroughly quantified. As part of the Energy Storage Capacity Study, Siemens PTI modeled potential emissions reductions from installation of

additional clean dispatchable resources such as storage. Key variables in the model did not reflect how MISO dispatches energy resources though, so real-world emissions reductions, particularly in the early years of the model, will not likely be as substantial as implied in the report.[lix] This intersection between energy dispatch and emissions reductions in Minnesota could use further study and research.

Hydrogen as a Source of Clean Energy

In the last 10 years, hydrogen (H_2) has emerged as a promising energy source. Because hydrogen can be used to decarbonize hard-to-abate sectors, such as long-distance transport, and heavy industry, such as steelmaking, it could help decarbonize sectors that "standard" electrification cannot reach. It can also be used to support the integration of renewables and provide long-duration energy storage to increase power system flexibility. Since it can replace fossil fuels as a zero-carbon source (also known as feedstock) in chemical and fuel production, hydrogen could be a "missing link" in the decarbonization roadmap for governments and industry sectors alike.

The different sources of feedstock and processes to obtain hydrogen have been historically labeled with colors, which may not completely explain the carbon intensity of each alternative. To clarify these differences, Cheng and Lee[lx] created the following table:

	Terminology	Technology	Feedstock/ Electricity Source	GHG Footprint[11]
PRODUCTION VIA ELECTRICITY	Green Hydrogen	Electrolysis	Wind, Solar, Hydro, Geothermal, Tidal	Minimal
	Purple/Pink Hydrogen		Nuclear	
	Yellow Hydrogen		Mixed-origin grid energy	Medium
PRODUCTION VIA FOSSIL FUELS	Blue Hydrogen	Natural gas reforming + CCUS Gasification + CCUS	Natural gas, coal	Low
	Turquoise Hydrogen	Pyrolysis	Natural gas	Solid carbon (by-product)
	Grey Hydrogen	Natural gas reforming		Medium
	Brown Hydrogen	Gasification	Brown coal (lignite)	High
	Black Hydrogen		Black coat	

Figure 5-Z: The hydrogen color spectrum and indications for carbon emissions

Source: 'How Green Are the National Hydrogen Strategies,' ResearchGate. Lincensed under Creative Commons 4.0.[lxi]

[11] GHG footprint given as a general guide, but it is accepted that each category can be higher in some cases.

The State of Minnesota began exploring the potential of hydrogen as a renewable energy source in early 2020. Recognizing its potential to decarbonize sectors like agriculture, transportation, heating and steel, companies like Xcel Energy, CenterPoint Energy, and Cummins, Inc. would invest in research, development, and infrastructure in the state, exploring the use of hydrogen for heating by blending it with natural gas for domestic consumer use.

The high cost of production, storage and transportation of hydrogen compared to traditional fuels poses a barrier, and building the necessary infrastructure for widespread use would require considerable investment but a clear and supportive policy framework is still under development, creating uncertainties for potential investors in hydrogen technologies. Public awareness and trust in hydrogen as a safe and reliable energy source will need to be fostered for wider adoption.

The Future of Hydrogen In MN

Building on the initial steps taken between 2020 and 2022, Minnesota saw increased developments in the potential of hydrogen as a renewable energy source. In 2023, momentum was seen with federal support as a boost came in the form of a $7 billion DOE grant via the Infrastructure Investment and Jobs Act (IIJA) signed by the Biden administration in November 2021, to establish the Heartland Hydrogen Hub with Xcel Energy as the recipient.[lxii]

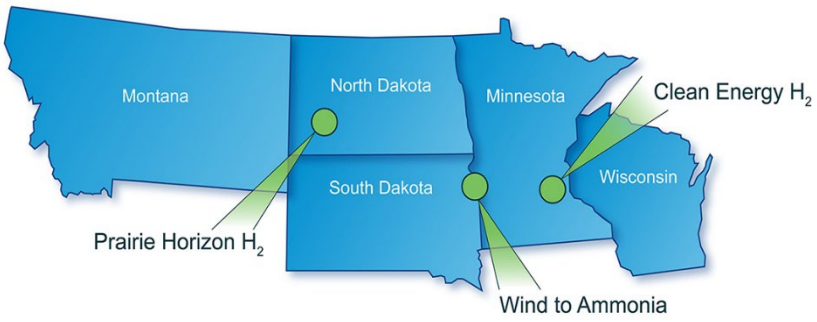


Figure 5-AA: Heartland Hydrogen Hub as initially planned

Source: Energy and Environmental Research Center, University of North Dakota, Heartland Hydrogen Hub

The Hub is slated to be a regional initiative encompassing Minnesota, Wisconsin, South Dakota, North Dakota, and Montana. This project aims to produce and utilize low carbon hydrogen at commercial scale, potentially reducing carbon emissions by the equivalent of 126,000 homes' annual CO_2 output by transforming renewable energy sources into hydrogen and utilizing it to decarbonize. As of March 2024, the Heartland Hydrogen Hub is still in the early negotiation phases, and no projects have started the contract or building stages.

The Agricultural Utilization Research Institute's 2023 Minnesota Renewable Energy Roundtable emphasized the potential of hydrogen to complement existing renewable energy sources like wind and solar, particularly in the agricultural and biofuel sectors in focus areas such as green hydrogen (produced through electrolysis using renewable electricity) to minimize the carbon footprint of hydrogen production. Exploration continues utilizing hydrogen across various sectors. The transportation industry has been testing hydrogen fuel cells as power sources for medium and heavy-duty vehicles, while the Iron and steel production sectors are exploring the potential to use green hydrogen for their high temperature processes.

One of the many ways of encouraging the decarbonization of the country's energy and industry sectors was included in the IIJA—specifically, the establishment of a process for tax credits for hydrogen producers. A maximum credit of $3 per kilogram of hydrogen generated is scheduled to be distributed to those producers who comply with the U.S. Internal Revenue Service (IRS) guidelines which are known by their section number, 45V.

As of March 2024, IRS guidance on the application of the 45V tax credit has not been finalized, and the comment period has closed. Some published comments mention how the current set of tax credit guidelines would hurt those producers that are set to start generating blue or pink hydrogen; there are expectations from the state of Minnesota and at a national level for the final version of these guidelines and how they might affect or encourage the growth of the hydrogen sector as a pathway to decarbonization.

Despite this progress, challenges for hydrogen persist. Bringing down the cost of hydrogen production, storage, and transport, along with building the necessary infrastructure, remains a hurdle.

Workforce Development

While Minnesota has made strides in developing its hydrogen industry as a source of renewable energy, concerns about workforce development and environmental justice have emerged alongside the technological advancements. Acknowledgement for the need to prepare a skilled workforce for the emerging hydrogen economy has been growing. As an initial answer to these concerns, the University of Minnesota Morris has developed a research and education program. As a recommendation, curriculums and training programs in hydrogen technologies and partnerships between industry, government, and educational institutions would make an important advance towards workforce development. Ensuring the communities where the upcoming projects will be located are the ones who take priority on these new initiatives can help enforce the concept of hydrogen as a green, equitable and responsible energy future for the state.

Establishing a clear, socially equitable, and supportive policy framework at the federal and state level is crucial for attracting long term investments in hydrogen technologies to the state. Raising public awareness and building trust in the safety and reliability of hydrogen is essential for wider public acceptance. Overall, there has been an acceleration in Minnesota's journey towards utilizing hydrogen as a renewable energy source. With continued efforts in research and infrastructure development, Minnesota has the potential to become a leader in the clean hydrogen revolution.

Energy Consumption

Renewable energy consumed for heating and electricity generation in Minnesota comes primarily from wind, wood, ethanol, and by-products of ethanol production re-purposed as an industrial energy source. In 2022, roughly 13% of the total energy consumed in Minnesota came from renewable sources, compared with a U.S. average of 9% renewable consumption (Figure 5-BB). Minnesota is at risk of missing the state's goal of 25% of total energy consumption from renewable sources by 2025, but reaching this goal could be possible with a long-term decrease in total energy consumption or a roughly 12 percentage point increase in renewable energy consumption.

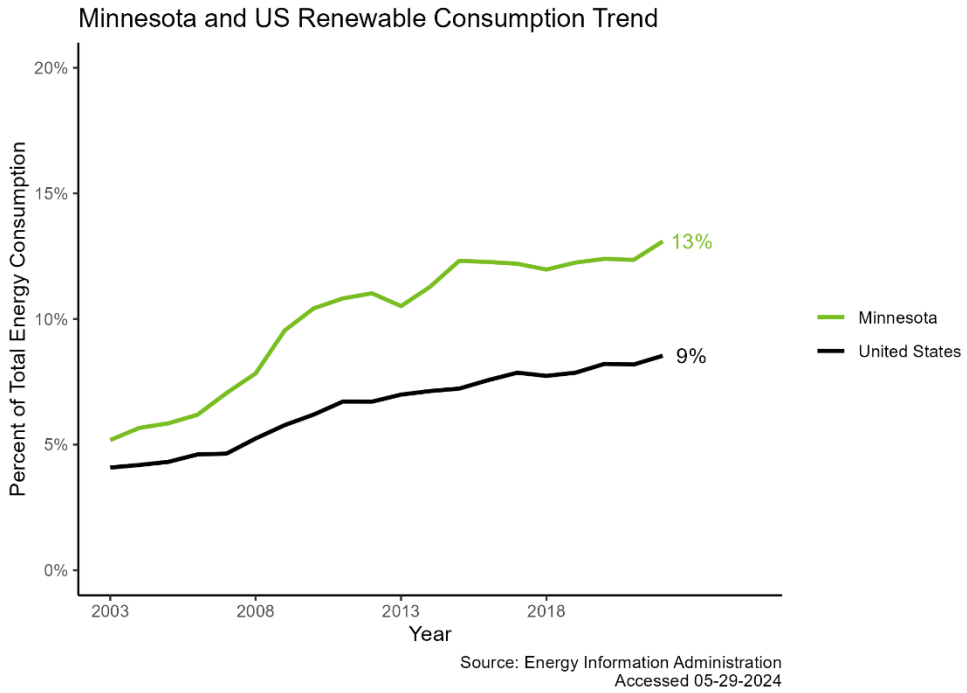


Figure 5-BB: Renewables as % of Minnesota's Total Energy Supply (2003–2022)

Figure 5-BB shows the percentage of Minnesota's total energy supply derived from renewable sources compared to the national average, during the period from 2003 through 2022.

Source: U.S. Energy Information Administration

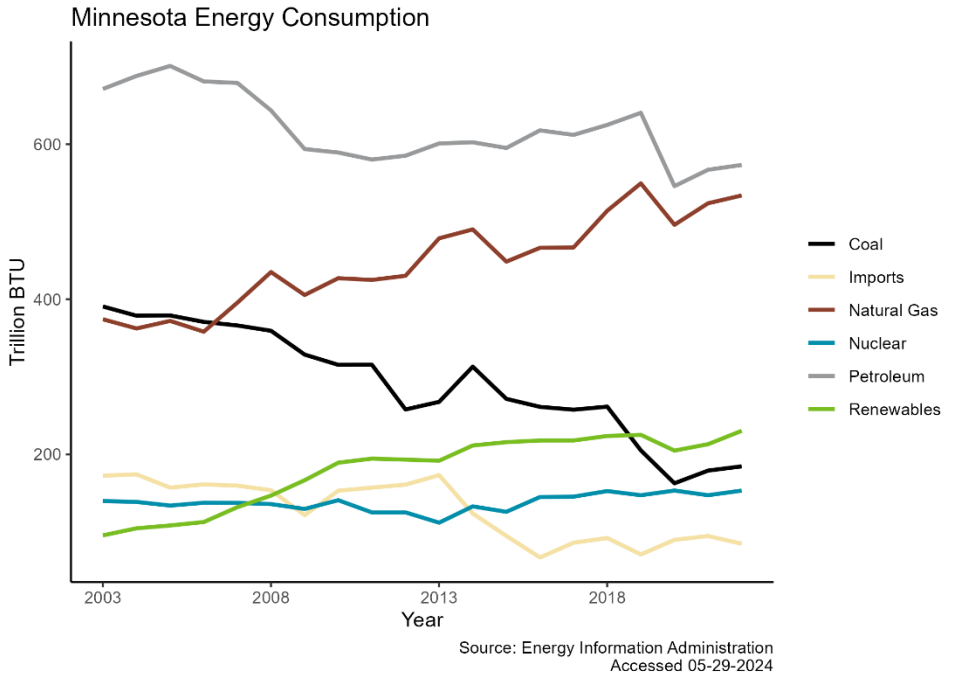


Figure 5-CC: Minnesota Total Energy Consumption by Source (2003–2022)

Figure 5-CC illustrates Minnesota's total energy consumption by source, from 2003 through 2022. Coal energy consumption has dropped considerably, with natural gas consumption rapidly increasing.

Source: U.S. Energy Information Administration

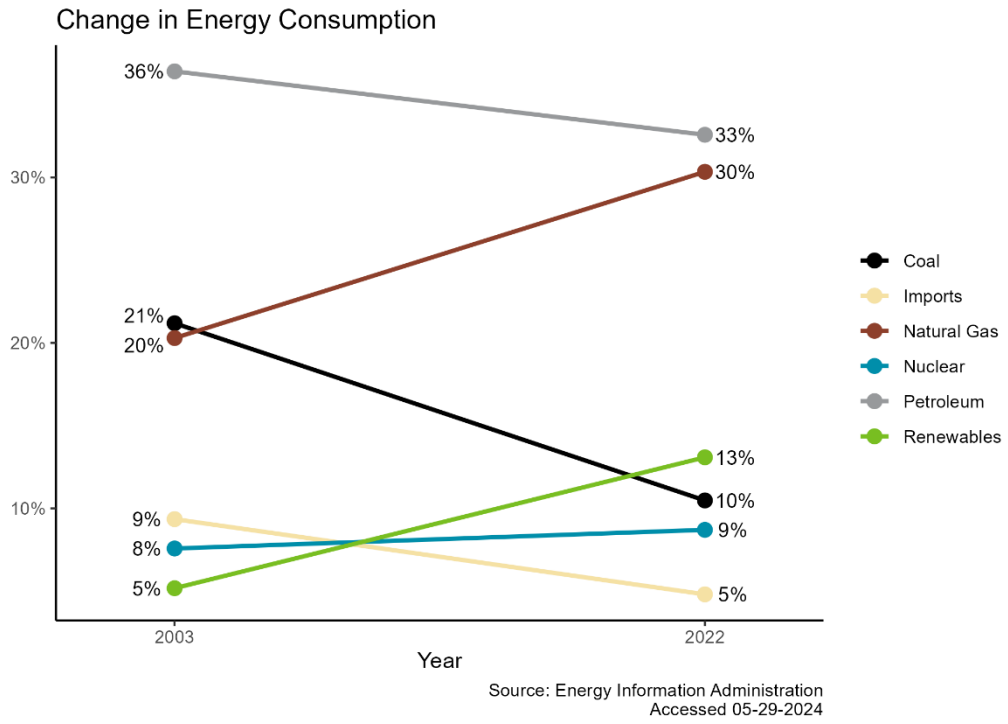


Figure 5-DD: Minnesota Total Energy Consumption by Source (2003 vs. 2022)

Figure 5-DD compares the percentage by source of total energy consumed in Minnesota, for the years 2003 and 2022. Renewables' share of energy consumed grew from 5% to 13%, while natural gas grew from 20% to 30%, while coal's share declined from 21% to 10%, and petroleum declined from 36% to 33%.

Source: U.S. Energy Information Administration

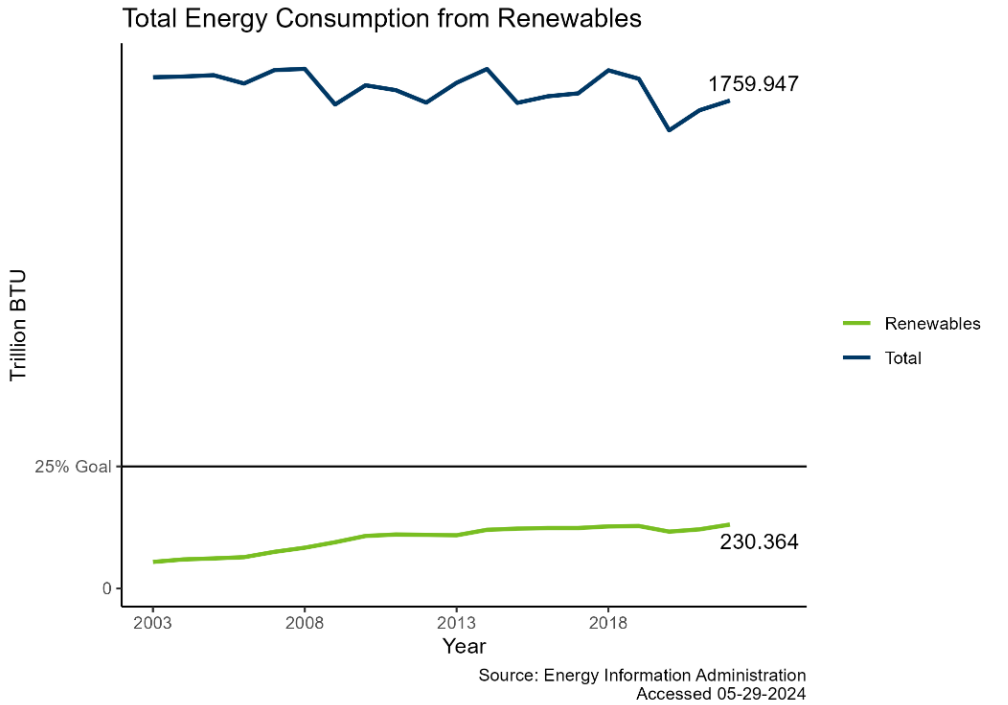


Figure 5-EE: Minnesota's Total Energy Consumption from Renewables (2003–2022)

Figure 5-EE illustrates that if the current trend continues, Minnesota is at risk of missing the state's goal of 25% of total energy consumption from renewable sources by 2025.

Source: U.S. Energy Information Administration

Demographic and Energy Use Trends

Minnesota's population has had a period of uneven growth since 2020. From 2021 to 2022, Minnesota experienced a moderate decline in population, and at the end of 2023 the state ended with a population of approximately 5,373,000, less than oner percent larger than the state's population in 2020.[lxiii] From 2022 to 2040, Minnesota's population is estimated to increase by eight percent.[lxiv] Much of the gain in population is expected to be in the urban centers of the state, with some of the state's more rural counties projected to decline in the coming years.[lxv]

Initial analysis shows that in 2022 electricity use was slowly rebounding from the height of the COVID-19 pandemic in 2020. EIA estimates that in Minnesota, industrial and commercial electricity use were up roughly six percent and five percent respectively from 2020, although both sectors remained below their 2019 usage levels. Residential electricity use was up roughly two percent in EIAs figures between 2020 and 2022. Detailed utility level data available through Minnesota Regional Energy Information System allow for a closer look at these trends. EIA estimates that natural gas consumption in Minnesota was up roughly 14% from 2020. Natural gas use varies year-to-year based on weather, which is discussed in greater detail below.

Using utility data broken out by non-farm residential customers, commercial customers, and industrial customers, a few trends related to these customer types emerge. First, and perhaps unsuprisingly, industrial customers used the most electricity in 2021 (the most recent year that complete data is available), consuming 22,105,901 MWh, or roughly 2278 MWh per customer. Total non-farm residential use was nearly identical to commercial use (19,735,002 compared to 19,654,122), but the number of residential cumsomers totalled just under 2,300,000, compared to roughly 282,000 commercial customers, meaning that the average non-farm residential customer consumed roughly nine MWh of electricity compared to 70 MWh of electricity for the commercial customers.

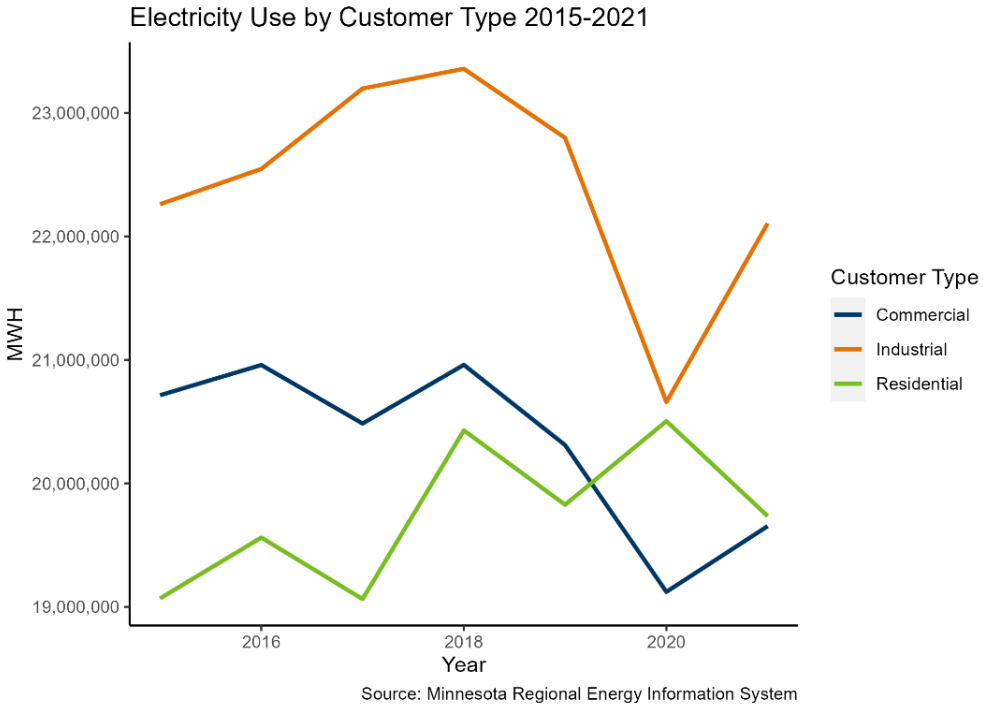


Figure 5-FF: Minnesota Electricity Use by Customer Type (2015–2021)

Figure 5-FF shows total electricity use in Minnesota among commercial, industrial, and residential customers. Commercial and industrial customers saw a dramatic decline in total electricity used in 2020, while residential customers saw a slight increase in electricity use.

Source: Minnesota Regional Energy Information System 2017–2021

The second trend that emerges is that while industrial and commercial customers show some signs of using less electricity per-customer over time, per-customer electricity use among residential customers is remarkably stable over time. Per-customer commercial electricity use did dip, but much of that appears to be related to the COVID-19 pandemic. Per-customer residential electricity use remained unchanged, however, during the 2015–2021 period.

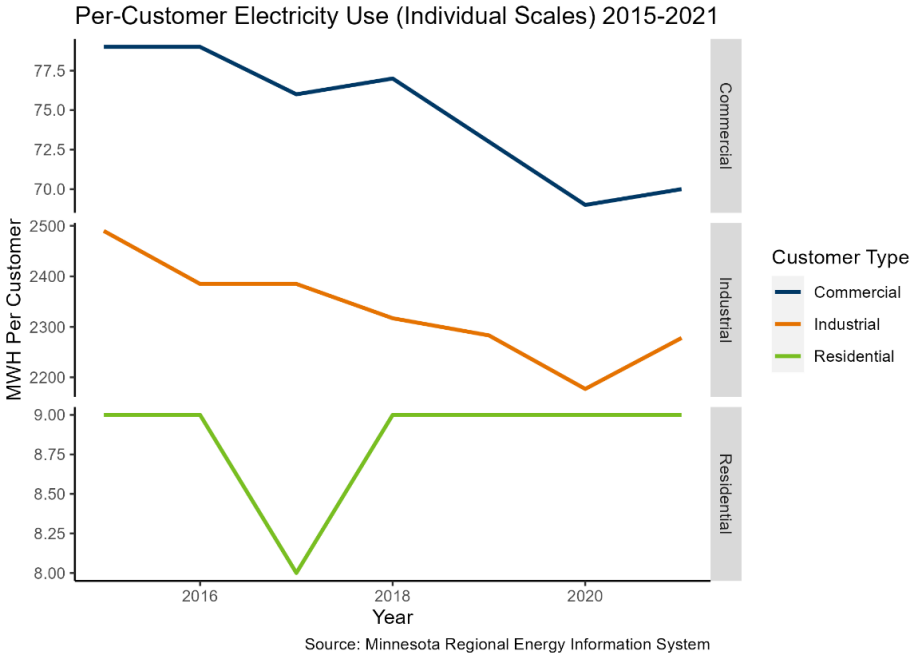


Figure 5-GG: Minnesota Per-Customer Electricity Use by Customer Type (2015–2021)

Figure 5-GG shows the per-customer megawatt hour usage among commercial, industrial, and residential customers in Minnesota from 2015–2021. While per-customer electricity use among commercial and industrial customers is down some, partially due to the pandemic in 2020. Residential electricity use is largely flat on a per-customer basis.

Source: Minnesota Regional Energy Information System 2017–2021

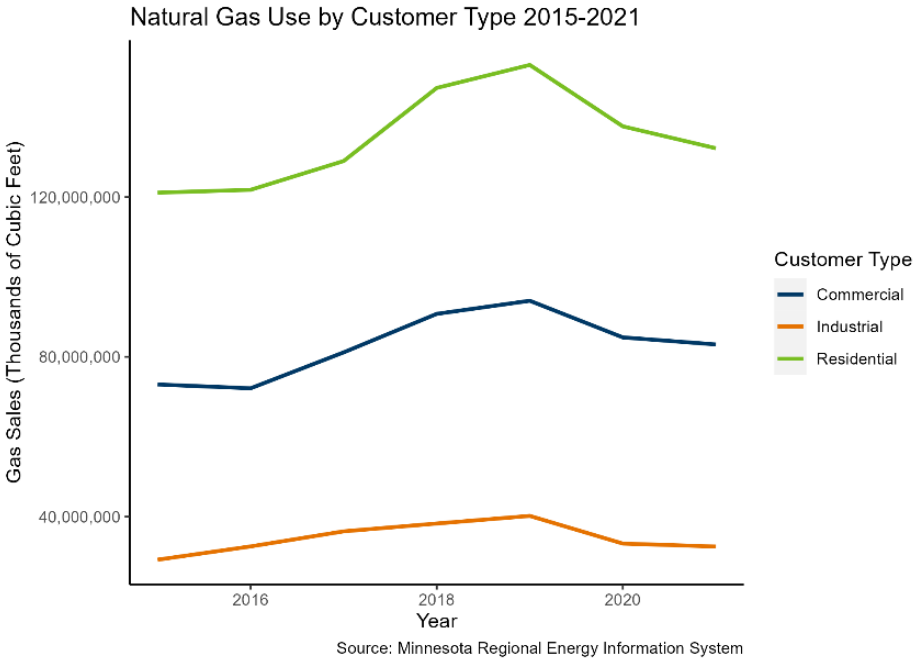


Figure 5-HH: Minnesota Natural Gas Use by Customer Type (2015–2021)

Figure 5-HH shows total natural gas use from 2015–2021 among commercial, industrial, and residential customers. Residential customers as a whole use the most natural gas.

Source: Minnesota Regional Energy Information System 2017–2021

The trend in natural gas use looks more unusual, with total gas use increasing among all customer types before decreasing ahead of the pandemic. Statewide, residential customers use the most natural gas, followed by commercial and then industrial customers, although the number of residential customers is also much larger than the number of commercial and industrial customers.

Natural gas use in Minnesota's residential and commercial sectors appears to be increasing, even when weather is taken into account.

The overall trend in natural gas use is unsurprising given that in Minnesota natural gas is largely used to heat, and some winters are colder than others. When compared to annual heating degree days (a measure of how cold a given year is), colder years see higher natural gas use, and relatively warmer years see less natural gas use. Indeed, the trend in heating degree days from 2015–2021 matches the trend of natural gas use. When the number of heating degree days is accounted for, natural gas use among residential and commercial customers appears to be increasing from 2015–2021, while the trend in industrial natural gas use is less clear.

These trends mirror findings from a 2023 report from the Regional Indicators Initiative that closely examined GHG emissions and energy use among 31 cities that participate in the GreenStep Initiative. While these 31 cities aren't a complete representation of Minnesota as a whole, the study does provide a helpful benchmark to see if statewide trends are also occuring among cities that are deliberately working to curb energy use and carbon emissions. Among this sample of cities, electricity use did appear to be declining from 2007 to 2020, reflecting the statewide trend. Natural gas use in these cities, however, *increased* three percent since 2007, even when weather was taken into account.[lxvi]

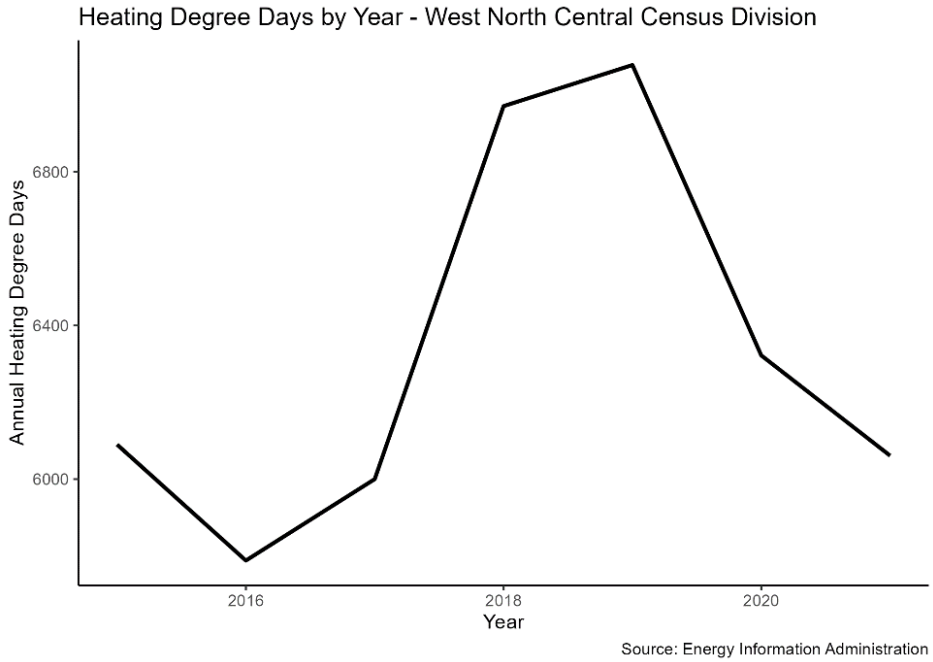


Figure 5-II: Heating Degree Days in the West North Central Census Division – 2015–2021

Figure 5-II shows the number of heating degree days from 2015–2021. The number of heating degree days each year closely matches the amount of natural gas used by customers in Minnesota.

Source: U.S. Energy Information Administration

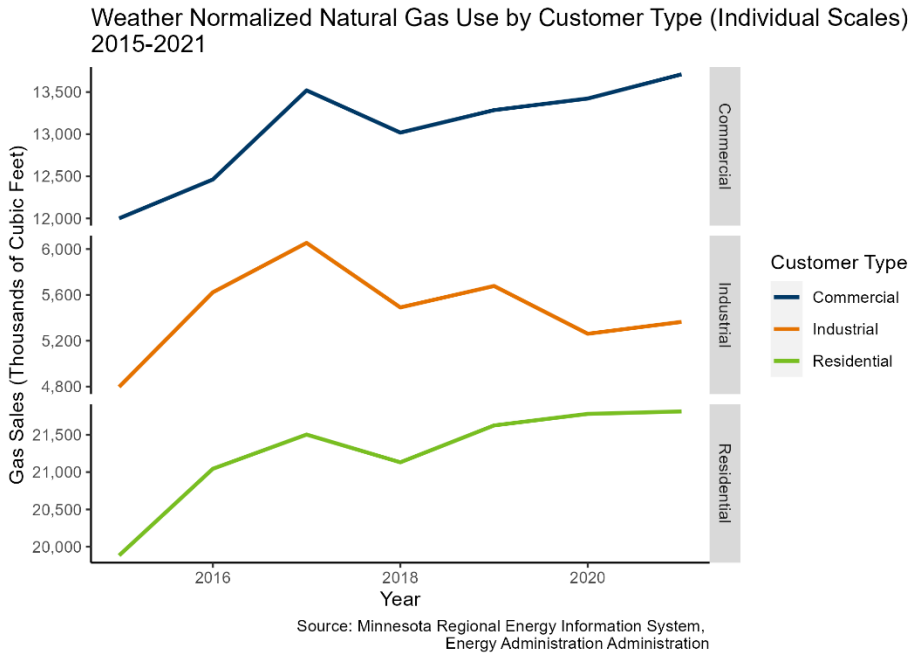


Figure 5-JJ: Weather Normalized Natural Gas Use by Customer Type (2015–2021)

Figure 5-JJ shows the amount of natural gas use by customer type normalized by the number of heating degree days in a given year. When accounting for the weather in a given year, the amount of natural gas used by residential and commercial customers appears to be increasing slightly over time.

Source: U.S. Energy Information Administration

Projections

Future emissions reductions in Minnesota's power sector depend on which resources enter the market as utilities retire aging power plants. In Minnesota and across the MISO region, utilities have favored new natural gas combined-cycle plants for intermediate capacity and resource adequacy as they retire uneconomic coal plants. Ongoing investments in wind and solar power, as well as transmission systems to bring those resources

to load centers, can meet energy needs at costs that are competitive with natural gas.[lxvii] However, near-term transmission capacity constraints remain a key barrier to the large amounts of solar and wind capacity in the interconnection queue. See the *Site and Route Permitting* section of Chapter 4 for more details about transmission challenges and possibilities looking forward.

Planning for Carbon-Free Electricity

As discussed in the *Carbon-free Energy Standards* section earlier, Minnesota's utilities have been directed to reach 100% carbon-free electricity generation by 2040. Per Minn. Stat. § 216B.2422, subd. 4, certain electric generation and transmission utilities that serve load in Minnesota are required to file long-term plans on the resources needed to meet customer needs. Utility integrated resource planning forecasts through 2035 indicate that wind and solar resources will steadily increase to displace declining fossil-fired sources of electricity, particularly coal. By 2035, renewable sources are expected to generate more than 50% of the electricity in the Upper Midwest.

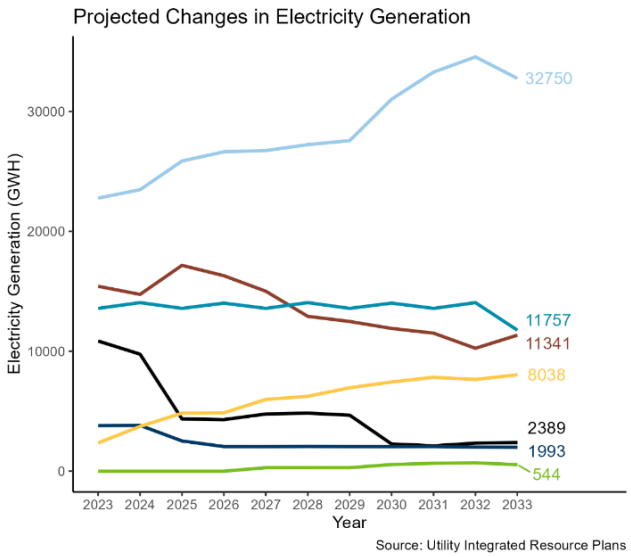


Figure 5-KK: Energy Generation by Source (2023–2033)

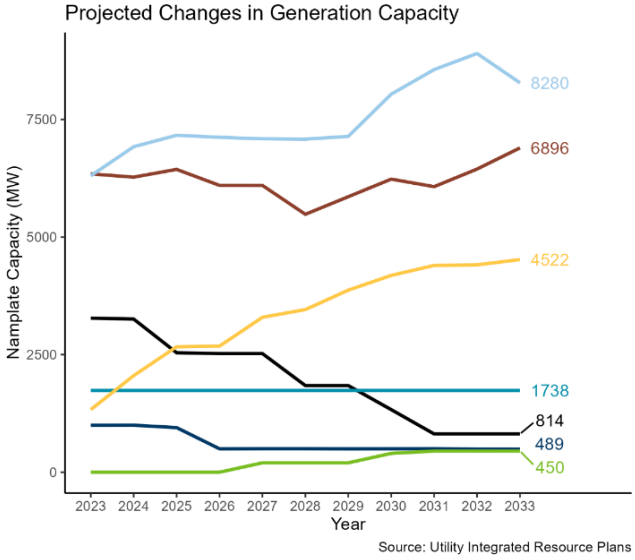
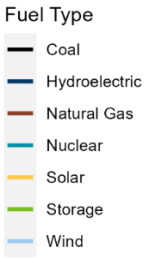


Figure 5-LL: Generation Capacity Changes by Sources (2023–2033)

Figures 5-KK and 5-LL provide two illustrations of the same data: forecasted Upper Midwest electric energy generation in MWh and generating capacity additions and subtractions in MW, respectively, from 2023 through 2033. Figures are drawn from utility integrated resource plans and represent planned changes in generation capacity at the time that the resource plans were approved. The figures show how coal-fired generation is expected to continue declining until it reaches a plateau in 2030, due to anticipated coal-fired power retirements. Capacity additions are dominated by wind, solar, and some natural gas-fired generation, with other firm dispatchable (e.g., storage) resources coming online starting in 2027.



Sources: Resource plans from Xcel Energy, Minnesota Power, Otter Tail Power Company, and Great River Energy

Utility resource plans submitted by Xcel Energy, Great River Energy, and Minnesota Power project that by 2033, total wind nameplate generation capacity will grow 31% to 8,280 megawatts, and solar nameplate generation capacity will grow 240% to 4,522 megawatts. In addition to variable solar and wind generation, energy storage—or other firm dispatchable technologies'—capacity is projected to grow to 450 MW of nameplate capacity.

Coal capacity, on the other hand, is projected to drop 75% to 814 megawatts of capacity. Additionally, in current resource plan projections natural gas capacity is expected to grow 9% to 6,896 megawatts of capacity. It's possible that the new 2040 carbon-free standard will affect planned utility investments in natural gas capacity, but any such changes are not reflected in the resource plans available to Commerce as of spring 2024.

Based on aggregated resource plans and announced retirements by Xcel Energy, Minnesota Power, Otter Tail Power, and Great River Energy—including energy generated both inside and outside of Minnesota—utilities are forecasting electricity mix that includes more than 80% carbon-free resources by 2035, as shown in figure 5-MM, below. With the proposed changes in generation capacity, by 2035 coal-fired power will contribute only 1% of the total electricity generation among the utilities that submitted resource plans, while wind will account for 51% and solar 13% of total generation.

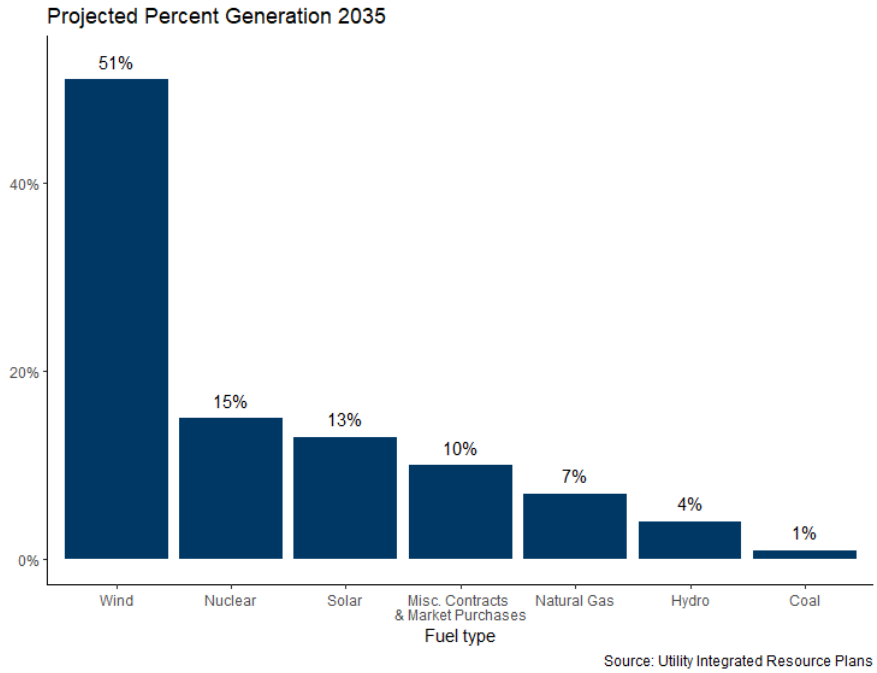


Figure 5-MM: Utilities are planning to transition to an energy mix that is over 80% carbon free by 2035

Figure 5-MM shows the projected electricity generation mix in 2035—including energy generated both inside and outside of the state. Data is drawn from integrated resource plans from Xcel Energy, Minnesota Power, Otter Tail Power, and Great River Energy and represent planned changes in generation capacity.

Sources: Resource plans from Xcel Energy, Minnesota Power, Otter Tail Power Company, and Great River Energy

Recent utility proposals, pending evaluation and approval, may further reduce GHG emissions. The PUC in 2018 issued an order increasing the social cost of carbon (SCC) that utilities are required apply when planning for new resources to serve the state's energy requirements.[lxviii] The PUC uses the SCC values—$9.05 to $43.06 per short ton, up from $0.44 to $4.53—in evaluating and selecting resource options. The updated price signals are expected to prompt continued focus on energy conservation and carbon-free resources to meet the state's energy needs.

Such efforts continue the state's progress toward a more sustainable and diverse electricity supply. In 2005, Minnesota Power generated 95% of its electricity from coal-fired power plants. Over the past seven years, the utility has retired seven of nine coal plants. In January 2021, Minnesota Power announced plans to eliminate coal from its operations by 2035, in pursuit of its goal to achieve 100% carbon-free electricity by 2050. These trends, combined with other plans to retire coal-fired plants, indicate that utilities are forecasting electricity mix for delivery to Minnesota customers that includes more than 80% carbon-free resources by 2035. The state is on track to reduce emissions from electric power generation in the next 10 to 15 years.

Utilities are planning to transition to an energy mix that is more than 80% carbon-free by 2035.

One of the goals of adopting renewable and carbon free sources of electricity is to reduce the total emissions generated by electricity production. While the carbon intensity of electricity generation in Minnesota has already dropped, there is still room for additional decarbonization. Minnesota's recently adopted *Climate Action Framework* outlines several strategies that, if implemented, are projected to dramatically reduce carbon emissions in the state. The framework includes several energy-related policies such as improving building efficiency, transitioning to carbon-free electricity generation, and electrifying transportation.[lxix]

Policies similar to those outlined in Minnesota's *Climate Action Framework* were modelled by staff supporting Minnesota's Climate Change Subcabinet. The resulting analysis projected a roughly 32% decrease in carbon emissions in the state. The analysis did not include all of the proposed actions outlined in the *Climate Action Framework*, and the analysis did find that the timing of specific actions such as increased transmission capacity matters greatly to the projected outcomes.[lxx]

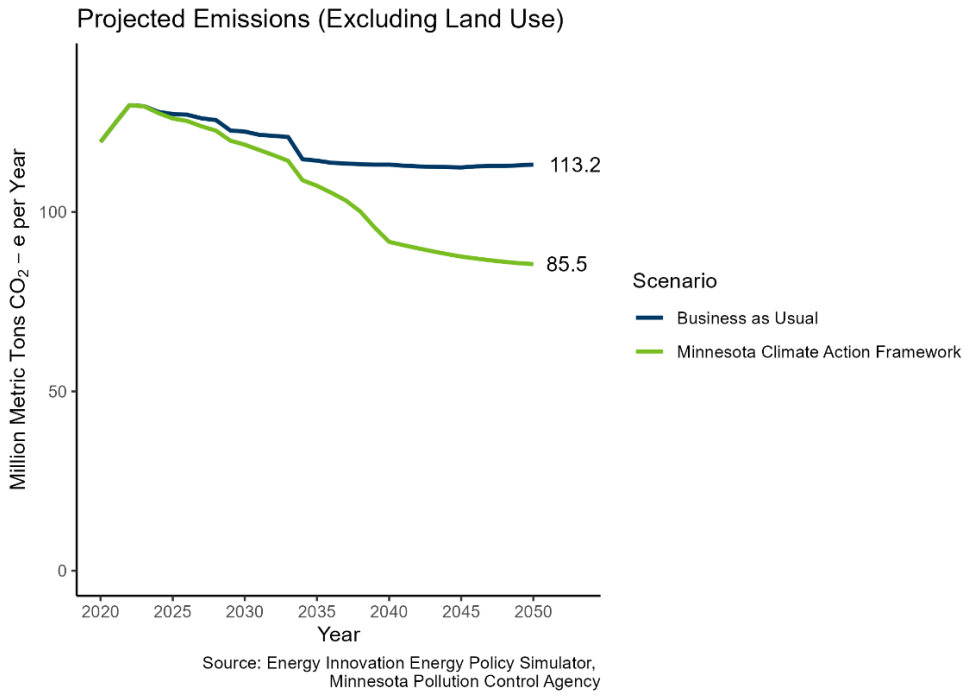


Figure 5-NN: Projected CO_2 Emissions under Minnesota's Climate Action Framework

Figure 5-NN illustrates projected changes in emissions using policies similar to those outlined in Minnesota's Climate Action Framework.

Source: Energy Innovation Policy Simulator, Minnesota Pollution Control Agency

Projections for Energy Use

Energy use is currently entering a period of competing forces that will influence future electricity and natural gas demand in Minnesota. For example, emerging building technologies allow buildings to use electricity more efficiently, but the current policies that incentivize electrification could ultimately mean that Minnesota buildings use more electricity overall in the coming years. Forecasts from Minnesota's largest electric utilities indicate that between 2022 and 2037, total electricity use in Minnesota is expected to rise roughly five percent, from roughly 48 million megawatt hours to over 50 million megawatt hours.[lxxi]

While some of this increase is from industrial customers, much of the increase is concentrated in the residential sector, which is forecasted to increase its electricity use by 16% by 2037. While the forecasts don't necessarily outline why a sector's use increases or decreases, increased electrification presents a plausible explanation for such a rise.[lxxii]

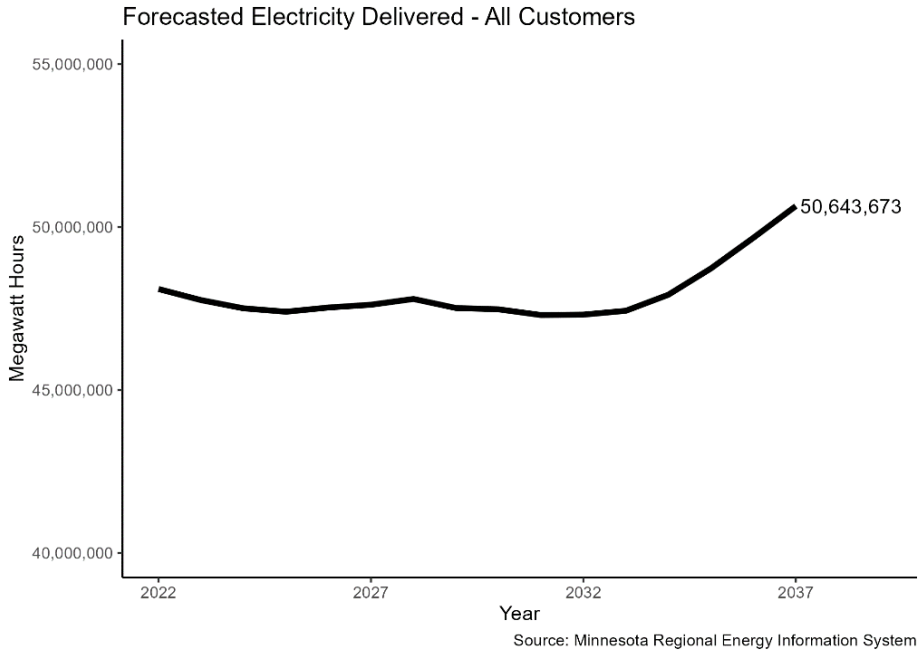


Figure 5-OO: Projected Electricity Use in Minnesota

Figure 5-OO shows forecasted electricity use for all customers in Minnesota through 2037. Values are derived from forecasts submitted to the Minnesota Department of Commerce through the Regional Energy Information System.

Source: Minnesota Department of Commerce

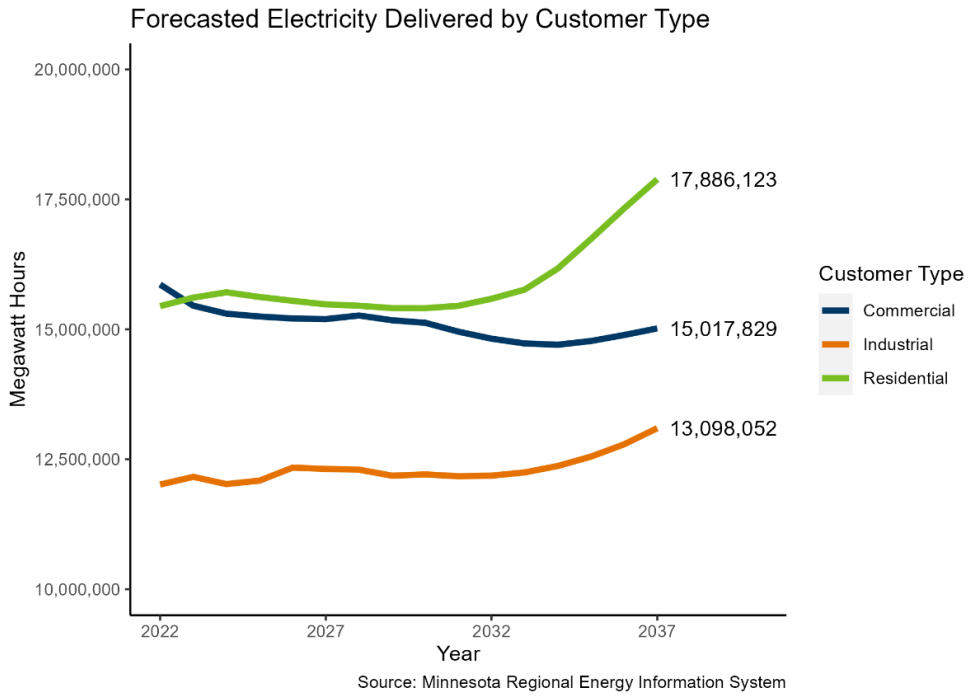


Figure 5-PP: Projected Electricity Use in Minnesota by Customer Type

Figure 5-PP shows forecasted electricity use for commercial, industrial, and residential customers in Minnesota through 2037. Utilities project that residential electricity use in particular will increase in the next 15 years. Values are derived from forecasts submitted to the Minnesota Department of Commerce through the Regional Energy Information System.

Source: Minnesota Department of Commerce

Current gas forecasts submitted by utilities provide forecasted sales data through 2027. The 2021 forecast data (the year with the most complete forecast data) show a six percent increase in total gas consumption in the state. This increase is driven by a projected increase in residential gas use (roughly an 11.5% increase), followed by commercial gas use (a 9% increase) and industrial gas use (a 5% increase).

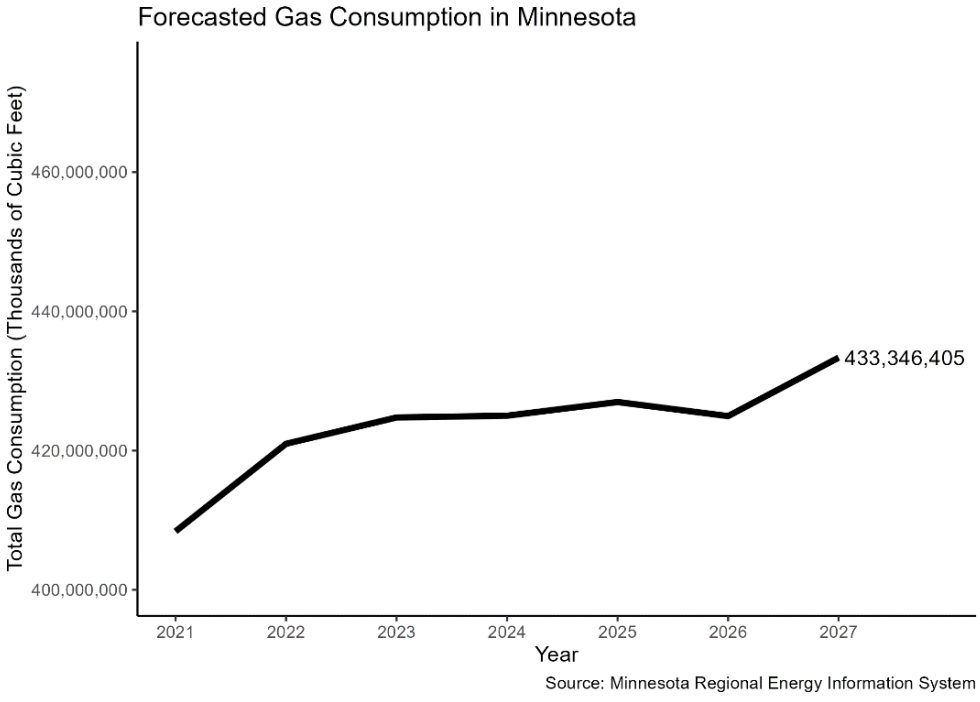


Figure 5-QQ: Projected Gas Use in Minnesota

Figure 5-QQ shows forecasted gas use for all customers in Minnesota through 2027. Values are derived from forecasts submitted to the Minnesota Department of Commerce through the Regional Energy Information System.

Source: Minnesota Department of Commerce

Supply Chain Disruptions

U.S. Trade Disputes

The National Renewable Energy Laboratory assessed IRA and IIJA and found that the provisions in those acts could boost annual wind and solar deployment rate in the U.S. between 44 GW and 93 GWs between 2023 and 2030, with a cumulative 850 GW of solar, wind, and storage by 2030.[lxxiii]

Together with the federal programs, Minnesota's GHG reduction goals and RES, and a forecasted 17% global renewable sector growth, concern around supply chain constraints and disruptions remains high. The solar sector is highly dependent on imports currently, but there are efforts to establish domestic supply, particularly in the upstream components. Minnesota will start to see upstream component suppliers in 2024 that could strengthen resilience. Trends to watch that will reinforce the supply chain for domestic components are strategic partnerships, digitalization, and recycling of critical minerals.

The current buildout of renewables and the domestic supply chain will also be highly dependent on developing a skilled workforce. As the domestic supply chain develops, skilled labor shortages could pose an additional challenge for project development.

The last two years have seen $227 billion in public and private investments in utility scale solar, hydrogen, wind, and energy storage which will bolster the supply chain sector to meet the demand. The bulk of these investments are flowing to states that have ambitious decarbonization targets and more attractive permitting and siting costs.

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Chapter 6: Energy Efficiency and Affordability

Commerce implements policies and programs to support efforts to improve efficiency and conserve energy in Minnesota's households and businesses. Commerce has a particular focus on reducing the energy cost burdens of Minnesota's low- and moderate-income households. Commerce's energy efficiency and affordability program work fulfills requirements established under federal and state law and is funded by the federal government, the state government, and Minnesota utility ratepayers.

Energy Conservation and Optimization Program

Minnesota's Energy Conservation and Optimization (ECO) Program is a ratepayer funded utility-administered program with regulatory oversight provided by Commerce. Utility ECO portfolios promote energy-efficient technologies and practices by providing rebates, marketing, and technical assistance to utility customers. ECO programs help Minnesota households and businesses lower their energy costs by using electricity and natural gas more efficiently. They also support reductions in carbon dioxide (CO_2) and other emissions and help utilities to optimize or defer investments in distribution system capacity. Commerce reviews and approves utility ECO regulatory filings to ensure that energy savings are calculated accurately, statutory requirements are met, and programs meet cost-effectiveness standards. The programs are intended to incentivize energy savings by consumers and businesses through activities such as installing energy-efficient equipment and changing behaviors.

Typical programs for residential customers include energy audits, rebates, and air conditioner cycling programs. For each energy audit, a trained energy consultant examines the home and shares specific advice on energy improvements. Rebates are offered on high-efficiency heating, cooling, and water heating appliances, as well as LED lighting, and low-flow showerheads and faucet aerators. Air-conditioner cycling programs allow the utility to manage its peak energy demand in return for electric bill discounts.

Common programs for commercial and industrial customers include rebates, building recommissioning studies, and manufacturing process improvements that reduce energy intensity and improve productivity. Rebates are offered for high-efficiency boilers, chillers, and air-handling units, high-efficiency motors and drives, and high-efficiency lighting and lighting control systems.

An independent study in 2020 found that each dollar spent on Conservation Improvement Program investments generates $3.75 in benefits to society.

As part of a Conservation Applied Research and Development (CARD) study, the Cadmus Group consulting firm conducted a quantitative economic analysis of ECO investments from 2013 through 2018.[i] The study found that each dollar spent on ECO generates $3.75 in benefits to society. The study also showed that ECO generates numerous immediate and persistent positive economic impacts to customer energy bill savings, job growth, and environmental benefits.

Regulatory Requirements

As summarized in the below figure, ECO type programs began in Minnesota in the 1980s with the intention of motivating utility spending on energy efficiency. The passage of the 2007 Next Generation Energy Act established Minnesota's Energy Efficiency Resource Standard, which required utilities, beginning in 2010, to develop plans to achieve energy savings equal to 1.5% of average annual retail sales each year, unless adjusted by Commerce's commissioner to no less than 1.0%.

On May 25, 2021, the ECO Act was signed into law by Governor Tim Walz. The ECO Act primarily serves to modernize what was the Conservation Improvement Program (CIP) to provide a more holistic approach to energy efficiency programming. Notable highlights of the ECO Act include:

- Providing participating electric and natural gas utilities the opportunity to optimize energy use and delivery through the inclusion of load management and efficient fuel-switching programs.
- Raising the energy savings goals for the state's electric investor-owned utilities (IOUs).
- More than doubling the low-income spending requirement for all IOUs.
- Providing greater planning flexibility for participating municipal and cooperative utilities.
- Including activities to improve energy efficiency for public schools.

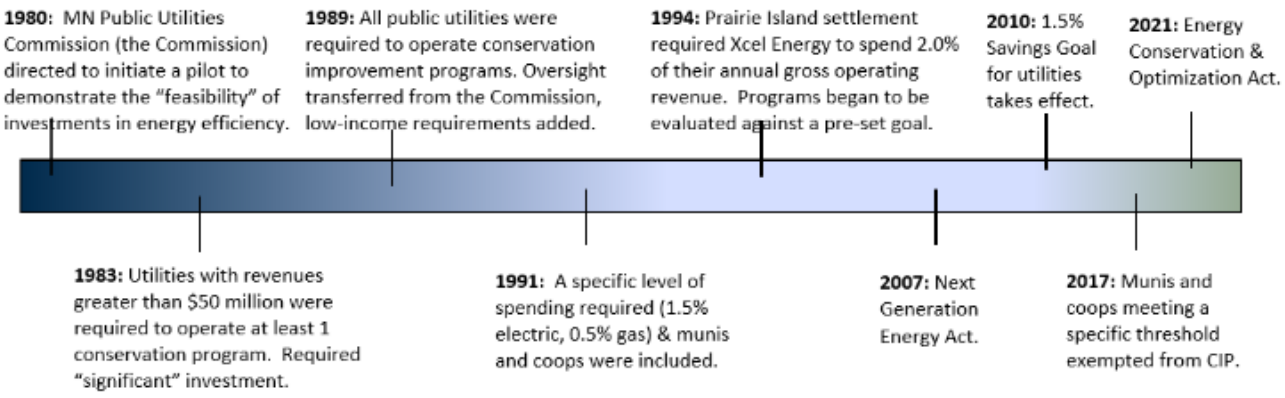

Figure 6-A: CIP/ECO Program History

Source: Minnesota Department of Commerce

Utilities are required to submit ECO plans to Commerce for review and approval prior to implementation, and they are subsequently required to report their ECO Plan's annual spending and savings performance to demonstrate compliance with the requirements in Minn. Stat. §§ 216B.241 and 216B.2403.

Energy Savings Requirements

Minnesota Statutes § 216B.241, subd. 1c(b) and subd. 1c(d) establish annual savings goal of 1.75% for electric IOUs and one percent for gas IOUs based off the three-year average weather-normalized retail sales at the generator, less sales to exempt customers and eligible electric vehicle charging sales.

For electric IOUs, 1.0% of the goal must be met with energy conservation improvements, 0.75% of goal can be met with additional energy conservation improvements, electric utility infrastructure projects, or combined heat and power projects, and savings above 1.75%, can include energy savings from efficient fuel-switching improvements. Electric IOUs may carry forward energy savings in excess of 1.75% for a year to the succeeding three calendar years, except that savings from electric utility infrastructure projects may be carried forward for five years.

For gas IOUs, 1.0% of the goal must be met with energy conservation improvements, and proposed programs that offer gas-to-electric efficient fuel-switching improvements will be considered energy conservation improvements and can count toward the utility's energy savings goal. Gas IOUs may carry forward energy savings in excess of one percent for a year to the succeeding three calendar years.

Program Spending Requirements

Gas and electric utilities are subject to low-income spending requirements. Minn. Stat. § 216B.241, subd. 7(a) requires that each electric IOU spend at least 0.6% of average residential gross operating revenue on income-eligible programs. Similarly, each gas IOU must spend a minimum of 1.0% of average residential gross operating revenue on income-eligible programs.

Minn. Stat. § 216B.241, subd. 7(f) allows each utility to spend up to 15% of income-eligible program spending on pre-weatherization measures. However, the utilities are prohibited from claiming energy savings from pre-weatherization measures toward the energy savings goal. Utilities may contribute money to the Healthy AIR (Asbestos Insulation Removal) account to provide pre-weatherization measures to households eligible for weatherization assistance. These funds count toward the minimum low-income spending requirement and the pre-weatherization spending cap.

Minn. Stat. § 216B.241, subd. 1c(g) outlines the Efficient Fuel-Switching Spending Cap for Minnesota's IOUs. Until July 1, 2026, spending on efficient fuel-switching improvements must not exceed 0.35% per year, averaged over three years, of the utility's gross operating revenue from non-exempt customers. Efficient fuel-switching spending in IOU plans is to be prorated for January 1 - June 30, 2026. This spending cap applies to electric utilities implementing electric end use efficient fuel-switching improvements through Minn. Stat. § 216B.241, subd. 11 and natural gas utilities implementing electric end use efficient fuel-switching improvements through Minn. Stat. § 216B.241, subd. 12. The spending cap applies to utility-administered programs. Efficient fuel-switching spending from Alternative ECO programs and from the Minnesota Efficient Technology Accelerator does not count toward a utility's spending cap.

Each utility is allowed to spend as much as 10% of the utility's minimum spending requirement on research and development (R&D) projects under Minn. Stat. § 216B.241, subd. 2(e). At the same time, Minn. Stat. § 216B.241, subd. 1(a), subd. 1(b), and subd. 1(c) allow each utility to spend as much as 5% of the utility's minimum spending requirement on distributed and renewable generation.

Minn. Stat. § 216B.241, subd. 1f(c) and subd. 9(e) require that each utility and association offer one or more programs that support the green building certification of commercial buildings along with goals consistent with Sustainable Building 2030 performance standards.

Activity and Policies

Minnesota's electric utilities have met or exceeded 1.5% annual energy savings each year since 2011. Additionally, the state's natural gas utilities have generally met or exceeded 1.0% energy savings each year.

In total, in years 2020 and 2021, ECO programs benefited Minnesota's environment and economy by:

- Saving around 14.4 trillion British thermal units (Btus) of energy—enough energy to heat, cool and power more than 147,000 Minnesota homes for a year.[ii]
- Reducing CO_2 emissions by 1.46 million tons, equivalent to removing over 296,000 gasoline-powered passenger vehicles from the road for one year.[iii,iv,v]
- Saving Minnesota's businesses and residents over $287

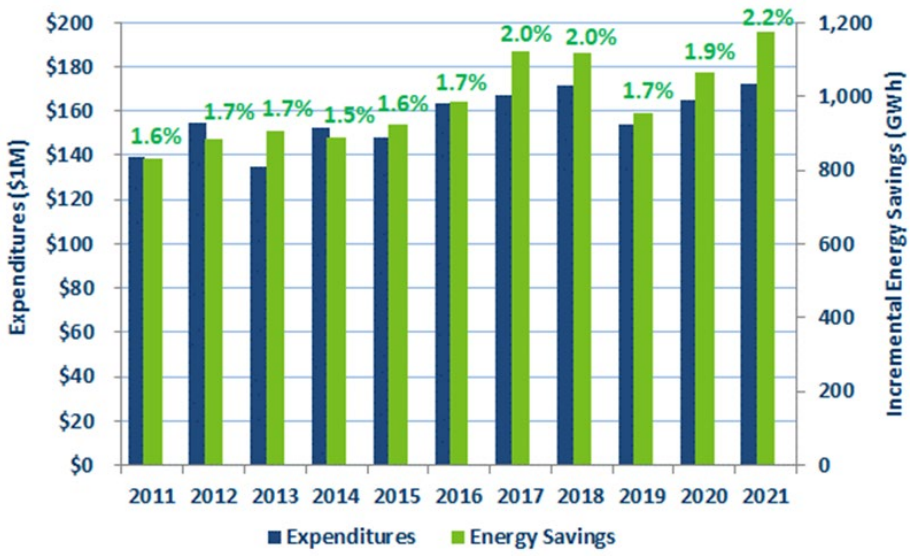

Figure 6-B: ECO Electric Results 2011–2021 (energy savings achievements as percentage of utility sales above green bars)

Source: Minnesota Department of Commerce

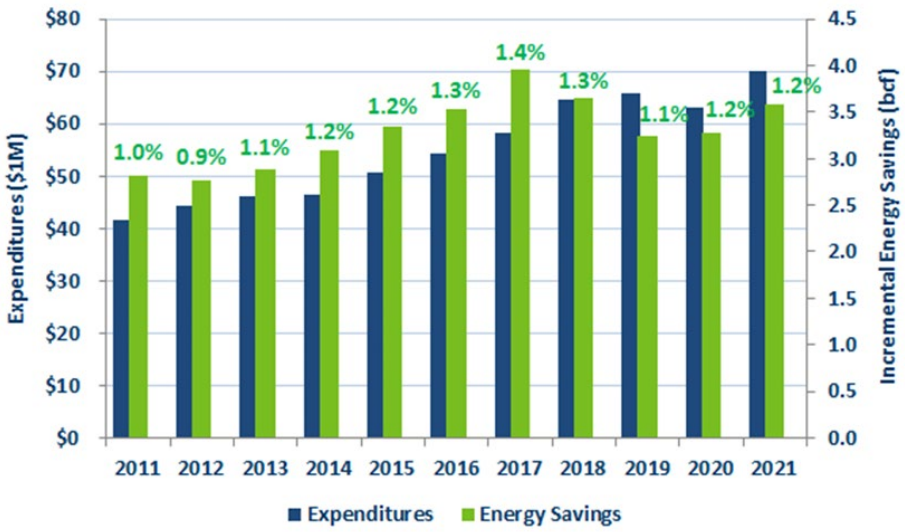

Figure 6-C: ECO Natural Gas Results 2011–2021 (energy savings achievements as percentage of utility sales above green bars)

Source: Minnesota Department of Commerce

million in energy costs.[12]

- Supporting over 43,000 energy efficiency jobs, representing the largest sector of Minnesota's clean energy employment.[vi]

ECO brings economic and societal benefits to Minnesota. An independent 2020 study estimated the net economic impacts of ECO investments made from 2013–2018. The study found that each dollar spent on ECO generates $3.75 in benefits to society.[vii] The study also showed that each year of ECO investment generates numerous immediate and persistent positive economic impacts to customer energy bill savings, job growth, and environmental benefits.

Income-Eligible Assistance

Current statutory requirements place a minimum spending requirement on income-eligible or "low-income" programs for residents, including renters. A "low-income" household is defined as making 80% or less of area median household income or meeting the income eligibility standards for other financial assistance programs designated by Commerce.[viii] Commerce ECO program guidance regarding the definition of low-income or income-eligible household, dated December 2023, includes details as to how to determine area median income and includes the following list of financial assistance programs approved by Commerce to qualify a household:

A "low-income" household is defined as 80% or less of area median household income or meeting the income eligibility standards for other financial assistance programs designated by Commerce.

- Weatherization Assistance Program (WAP)
- Low Income Home Energy Assistance Program (LIHEAP)
- Supplemental Nutrition Assistance Program (SNAP), formerly known as Food Stamps
- Medicaid/Medical Assistance
- MinnesotaCare
- Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
- Supplemental Security Income (SSI) - 1 and 2 person households
- Minnesota Family Investment Program (MFIP)
- Federal Public Housing Assistance (FPHA) (including Housing Choice Voucher (HCV) Program (Section 8 Vouchers), Project-Based Rental Assistance (PBRA)/202/811, Public Housing, and Affordable Housing Programs for American Indians, Alaska Natives or Native Hawaiians)
- Lifeline (discounted phone and internet service)
- Telephone Assistance Plan (TAP)
- Veterans Pension and Survivors Benefit
- Head Start - only those meeting its income eligibility standard

[12] Estimated energy cost savings were calculated by multiplying the average price per dekatherm (Dth) of natural gas and the average price per kWh of electricity in Minnesota by the corresponding Dth and kWh ECO energy savings achievements for 2020 and 2021. This calculation does not net out conservation cost recovery adjustments or conservation cost recovery charges to customers.

- Received a Federal Pell Grant in the current award year - Documents must be from the student's school (college or university, community college, or career school) or the Department of Education and show the student has received a Pell Grant for the current award year.

Additional qualifying programs for persons living on a reservation:

- Bureau of Indian Affairs General Assistance
- Tribally administered Temporary Assistance for Needy Families (TANF) - only those meeting its income eligibility standard
- Tribally administered Head Start - only those meeting its income eligibility standard
- Food Distribution program on Indian Reservation (FDPIR)[ix]

Utilities have the discretion to design program eligibility requirements within this definition. Utilities tend to use the Weatherization Assistance Program (WAP) and Energy Assistance Program (EAP) eligibility thresholds. WAP eligibility is based on the greater of either 200% of the federal poverty income guidelines or eligibility for EAP, which currently supports households with income at or below 50% of the state median income. Minnesota's statutory provision for low-income programs is aimed at improving equity by requiring utilities to ensure that income-eligible customers benefit from ECO investments. Utilities typically provide a mix of programs that exclusively serve income-eligible households and programs that serve a mix of income-eligible and non-income-eligible customers. Commerce also now allows utilities to propose use of geographic eligibility methods in their programs.[13]

Examples of income-eligible programs include energy audits followed by air sealing, weatherization, and equipment replacement. Some utilities provide furnace replacements and tune-ups or customer rebates for purchasing and installing energy efficiency measures in multifamily buildings or nonprofit affordable housing. Typically, ECO income eligibility is proposed by utilities and evaluated by Commerce during the plan review process. Commerce also works with utilities to identify other programs with established income thresholds and verification procedures that could be used. Examples include such programs as WAP and EAP, discussed later in this chapter, as well as subsidized affordable housing programs. Most utilities are meeting or exceeding their low-income spending requirements.

Commerce is in the process of establishing a standing work group made up of utilities and interested parting to facilitate ongoing development and feedback concerning ECO income-eligible programing. This work group will build on similar activities during 2023, where utility and interested parties discussed elements in the ECO Act and how these might be incorporated into forthcoming 2024–2026 utility ECO Triennial Plans. At that time utilities also presented their plans for income eligible programs, prior to the formal filing of their 2024–2026 ECO Triennial Plans. Commerce's intention is to create an environment where interested parties can make comments far enough in advance that they can have a meaningful impact on utility program development.

[13] For an overview of geographic eligibility methods see page 8, *Geographic Proxy Methods*, in the following Commerce guidance document: https://mn.gov/commerce-stat/pdfs/low-income-in-mf-bldgs-15Mar2022.pdf.

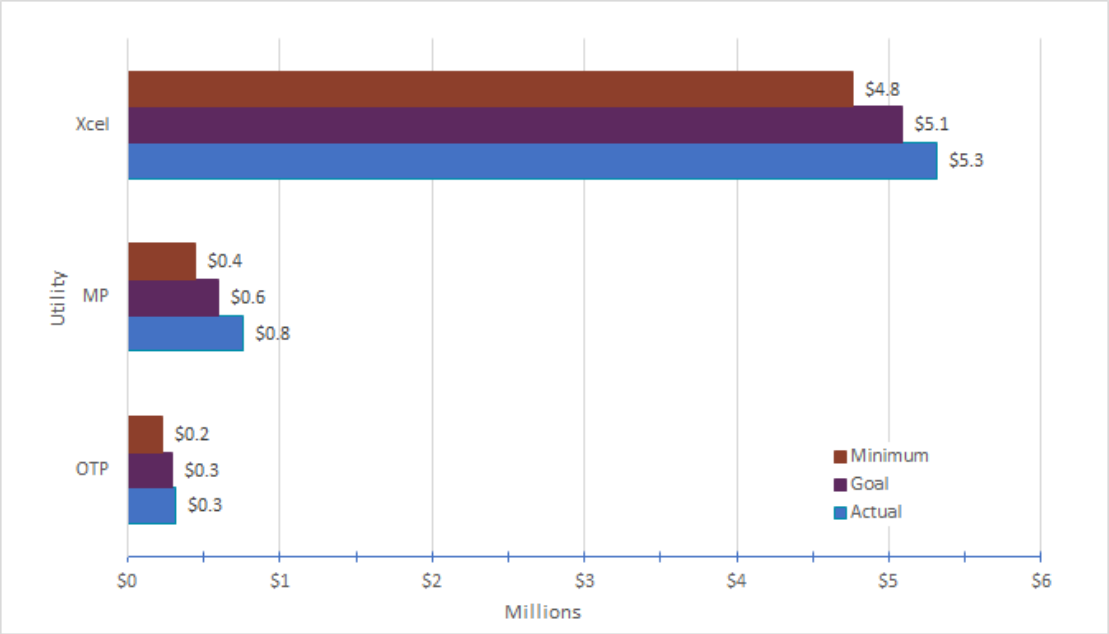

Figure 6-D: 2022 Electric Income-eligible ECO Spending (Total $6.4 million)

Figure 6-D shows the 2022 electric ECO spending by Xcel Energy, Minnesota Power (MP), and Otter Tail Power (OTP). Values for Xcel Energy and MP for goal and actual spending include a mix of spending associated with income-eligible customers in programs that exclusively serve income-eligible households and programs that serve a mix of income-eligible and non-income-eligible customers.

Source: Minnesota Department of Commerce

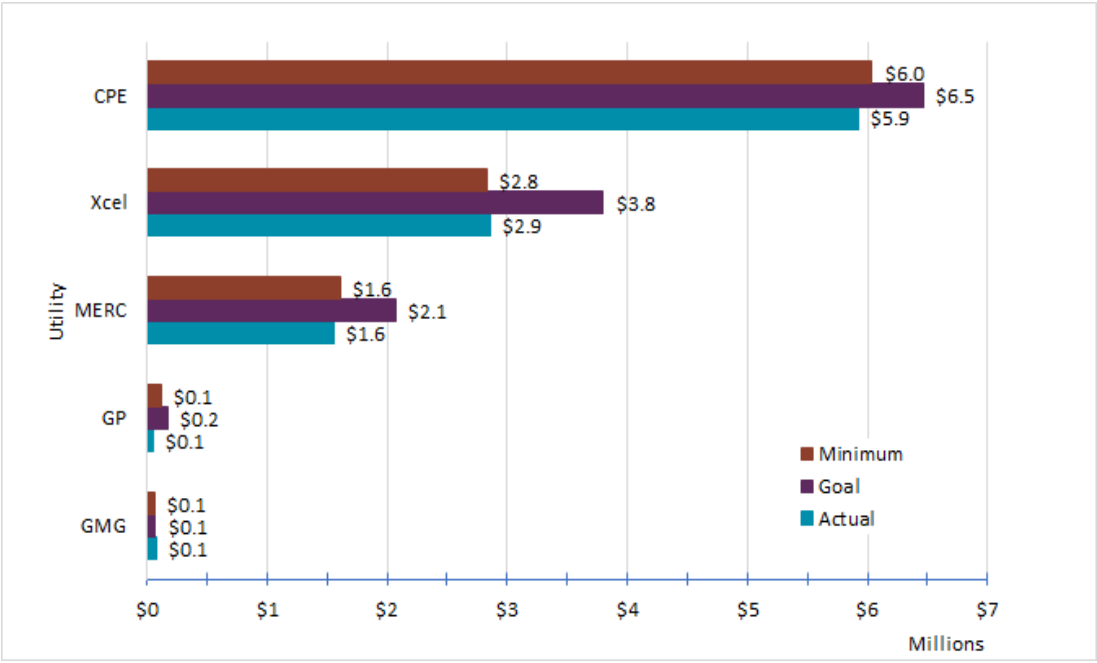

Figure 6-E: 2022 Natural Gas Income-eligible ECO Spending (Total $10.5 million)

Figure 6-E shows the 2022 CIP spending by Minnesota natural gas utilities—CenterPoint Energy (CPE), Xcel Energy, Minnesota Energy Resources Corp., Great Plains (GP), and Greater Minnesota Gas (GMG). Values for CPE, Xcel Energy, and MERC for goal and actual spending include a mix of spending associated with income-eligible customers in programs that exclusively serve income-eligible households and programs that serve a mix of income-eligible and non-income-eligible customers.

Source: Minnesota Department of Commerce

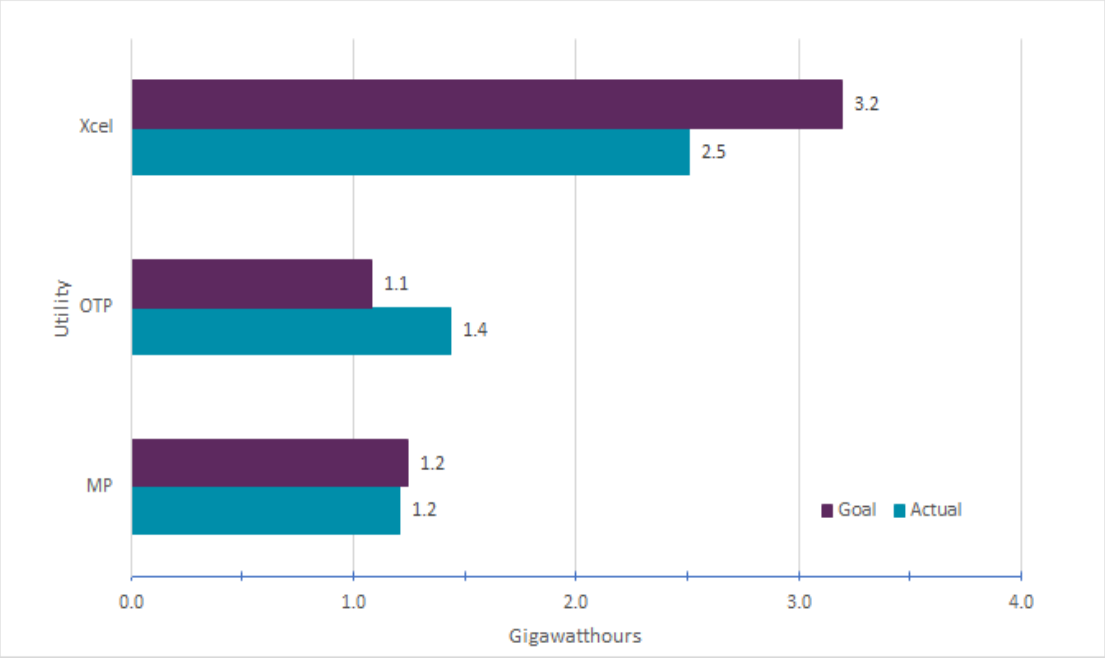

Figure 6-F: 2022 Electric Income-eligible ECO Savings (Total 5.1 GWh)

Figure 6-F shows the 2022 electric energy saved (in gigawatt-hours) through CIP measures implemented by Xcel Energy, Minnesota Power (MP), and Otter Tail Power (OTP). Values are based on programs that exclusively serve income-eligible customers.

Source: Minnesota Department of Commerce

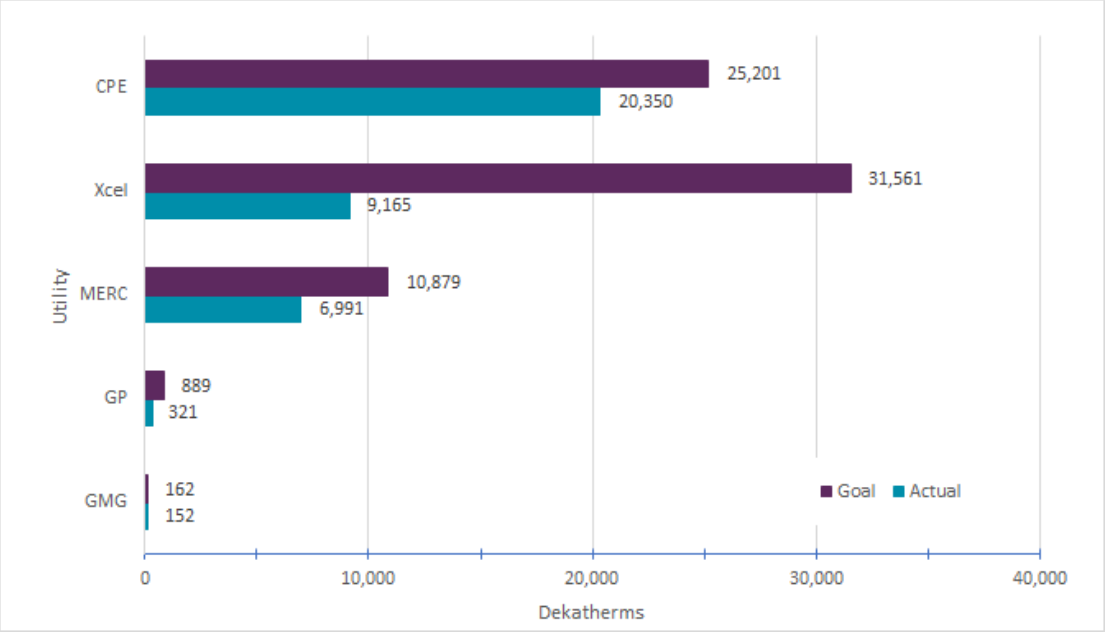

Figure 6-G: 2022 Natural Gas Income-eligible ECO Savings (Total 36,979 Dth)

Figure 6-G shows the 2022 energy saved (in dekatherms) through CIP measures implemented by Minnesota natural gas utilities—CenterPoint Energy (CPE), Xcel Energy, Minnesota Energy Resources Corp. (MERC), Great Plains (GP), and Greater Minnesota Gas (GMG). Values are based on programs that exclusively serve income-eligible customers.

Source: Minnesota Department of Commerce

Technical Reference Manual

The Minnesota Technical Reference Manual (TRM) comprises a set of standard methodologies, inputs, and assumptions for calculating the energy and demand savings impacts of individual measures used within ECO programs in Minnesota. The first MN TRM was version TRM v1.1 which was valid Jan. 1, 2014, through Dec. 31, 2014, and has been updated several times to include revisions and new measures. TRM v4.1 is the most recent version of the TRM and is valid Jan. 1, 2025, through Dec. 31, 2025.

To ensure that the TRM continues to accurately reflect current technologies, markets, codes, and standards, Commerce has established the TRM Advisory Committee, consisting of ECO stakeholders, to review and update the TRM on an annual basis. For the most recent update process, Commerce worked with more than 25 stakeholder organizations throughout the state to complete updates. These organizations included representatives from Minnesota utilities, advocacy groups, engineering consultants, and non-profit organizations. The process included committee meetings and public comment periods which ensured everyone has a chance to contribute. Recordings and slide decks from committee meetings can be found on the MN TRM Webpage[x] and access to public comments can be found on docket no. 18-694.

The TRM does not represent an exclusive set of measures that may be applied within ECO programs. Minnesota utilities may propose additional measures as standard offerings in their ECO plans or implement custom measures without pre-approval from Commerce.

Conservation Applied Research and Development Program

To help achieve the state energy conservation goal on a sustained basis, the Next Generation Energy Act of 2007 authorized the commissioner to assess utilities $3.6 million annually for grants for applied research and development projects. That total included $500,000 to fund activities coordinated by the Center for Sustainable Building Research related to Sustainable Building 2030 Building Standards. Another $500,000 funds community energy technical assistance and outreach through Clean Energy Resources Teams.[xi] The remaining $2.6 million funds the CARD grant program, which awards research grants in a competitive request for proposal process. CARD projects identify new technologies or strategies to maximize energy savings, improve the effectiveness of energy conservation programs, and document CO_2 reductions from energy conservation projects. Results from CARD research provides utilities with timely information to enhance energy-efficiency program designs within their CIP portfolios.

In addition to demonstrating innovative technologies and providing data to enhance utility programs, the CARD program regularly contributes to TRM development as well as funding for efforts such as assessing the economic effects of ECO, determining statewide demand-side management potential for energy efficiency and carbon savings, and exploring barriers to robust utility codes and standards.

Examples of projects that were ongoing from 2021 to 2024 include:

Heat Pump for ACs: Energy Savings and Modernization of Single-Family Cooling Systems:
Several CARD projects have focused on air source heat pump technologies, but those projects predominately targeted heating load. This project instead focused on a new market opportunity where air source heat pump

products are specifically designed to integrate with existing natural gas furnaces to displace central air conditioning systems. This configuration allows the operation of either the gas furnace or air source heat pump for space heating, depending on economic conditions and customer priorities. This study, completed in 2022, included 438 customer surveys and interviews with 30 contractors, three distributors, and five manufacturers to understand the existing and potential market for this application. The study also conducted detailed equipment performance modeling. The final report is available at this link.

Project Overcoat: Investigation of a process for affordable high-performance enclosure upgrades for multifamily buildings:

The existing multifamily housing stock in Minnesota provides rich opportunities for energy efficiency improvements that could reduce electrical and natural gas demand, improve indoor air quality and occupant comfort, and add functional lifespan to these structures. This white paper describes the Overcoat Panel System, a system that combines a prefabricated whole-wall retrofit concept with the "perfect wall" arrangement of cladding, insulation, and weather barrier to ensure long-term energy performance and durability. This report, completed in 2023, described the panel, its energy and thermal performance, proposed manufacturing and installation techniques, required mechanical system modifications, and cost-effectiveness. The final report is available at this link.

Energy Savings from Residential Zoned Air Distribution Systems:

Unlike commercial buildings, in which space heating and cooling is often optimized by zone, many Minnesota homes have forced air distribution systems with constant flows to all branches or zones. The entire house is heated or cooled based on the needs of the space where the thermostat is located. This white paper, completed in 2022, included an assessment of the energy savings opportunities for residential multizone air distribution systems. The results included findings from interviews with equipment distributors; heating, ventilation, and air conditioning (HVAC) contractors; and utilities. Energy simulations helped evaluate the impact of over- and under-heated and cooled areas on annual energy use and estimated the potential energy savings that multizone systems can achieve with more strategic temperature setbacks for individual zones. The final report is available at this link.

Measuring the Equivalent Full Load Heating and Cooling Hours for Residential HVAC Equipment in Minnesota:

According to the Minnesota Energy Efficiency Potential Study, residential smart thermostat measures make up a large portion of residential natural gas and electric potential in Minnesota (25% and 10%, respectively). However, the current TRM v3.32 thermostat savings are informed by savings from other states and base consumption values that may not be representative of Minnesota's climate and population. Additionally, residential HVAC equipment measures make up a large portion of potential savings in Minnesota (28% of natural gas potential and 22% of electric potential). However, the TRM v3.3 cooling and heating equivalent full-load hours values used for these measures are not Minnesota-specific or recent. This 2023 study conducted a statistically rigorous billing analysis to obtain Minnesota-specific baseline consumption and savings for homes receiving thermostats. It also determined HVAC equipment equivalent full-load hours for residential natural gas-fired furnaces and boilers and electric central air conditioners and heat pumps. The final report is available at this link.

Overcoming the Market Barriers for RTU Retrofit Enhancements:

A packaged rooftop unit (RTU) is an HVAC system that provides heating and cooling equipment packaged in a single box to fully condition a space. These systems are found on a wide variety of building types throughout Minnesota, including office, retail, industrial, and other various commercial buildings. Rooftop unit retrofit technologies have demonstrated the potential to offer energy savings for a large portion of existing units throughout Minnesota. Many products have been introduced to the market that can provide energy savings as well as non-energy benefits. The results of this project and past research have proven that these technologies can achieve substantial energy savings; however, they have not been widely adopted due to lack of market awareness. This study, completed in 2023, sought to determine market barriers to implementing retrofit technologies available for rooftop units and determine ways to overcome them. The final report is available at this link.

How Smart Do Intelligent Buildings Need to Be?:

Intelligent buildings have enhanced operation, monitoring, and control, and promise greater energy efficiency, business productivity, and building security and safety. However, increased complexity and energy overhead—resulting from the supporting networking, sensors, and controls—is an overlooked consequence of connected devices and systems. This study, completed in 2023, used analysis and modeling to weigh the energy costs of building intelligence against the benefits that are provided to determine both opportunities and constraints of these technologies. Lab testing was also performed to investigate potential opportunities for office plug load control. A market analysis investigated the factors that may be needed to promote wider adoption of intelligent building technologies. The final report is available at this link.

Commercial and industrial refrigeration market assessment:

The Minnesota Energy Efficiency Potential Study showed that refrigeration represents nearly 20% of the potential electric commercial and industrial program savings in Minnesota through 2029. Yet a recent review of ECO programs indicated that refrigeration represents less than five percent of the combined total electric commercial and industrial ECO savings achieved by Minnesota's three largest electric investor-owned utilities. This study helped utilities tap into this area of opportunity by generating comprehensive information about the state's medium- and large-sized commercial and industrial refrigeration market and by identifying specific program measures and approaches. The project was completed in the first quarter of 2021. The final report is available at this link.

Minnesota Codes and Standards

Codes and standards (C&S) programs include strengthening energy efficiency regulations, improving compliance with existing C&S, and assisting local governments to develop ordinances that exceed statewide minimum requirements and coordinate with other programs and entities to support state policy goals. At some level, a Minnesota C&S program would affect all new residential, commercial, and industrial buildings, as well as building retrofits of significant magnitude—not just energy retrofits—and most new energy-using equipment purchased in the state.

A Lawrence Berkeley National Laboratory report from June 2018 found that C&S programs are the most cost-effective of any energy efficiency program funded by utility customers in the U.S.[xii] Specifically, the program

administrator cost of saved electricity for C&S programs (approximately $0.0028 per kilowatt-hour (/kWh)) is nearly an order of magnitude less than the U.S. average for all efficiency programs ($0.025/kWh), and 83% lower than the Minnesota state average ($0.016/kWh). Commerce funded a study to explore the regulatory, institutional, and market barriers to developing a Minnesota C&S program and to provide specific recommendations for addressing potential barriers. The project builds on past and current C&S efforts and focuses on comprehensive program issues that were not previously addressed. A report detailing the findings of this study was pending at the time this report was being produced.[xiii]

Projections

To continue maximizing the benefits of cost-effective energy efficiency resource acquisition by utilities, a project team consisting of consulting firm Optimal Energy and the non-profit organizations Center for Energy and Environment and Seventhwave was funded through CARD to estimate the statewide electric and natural gas energy efficiency and carbon-saving potential for 2020 through 2029.[xiv] This study also produced data-driven and stakeholder-informed resources defining market segments, end uses, measures, and programs that could be targeted in the next 10 years to realize Minnesota's cost-effective energy efficiency potential.

The study estimated that by 2029 state-wide the economic potential of energy efficiency could decrease the forecasted electric load by 33%, and that program potential could reduce the load by 14%. ("Economic potential" represents the total potential if all possible measures were installed that meet cost-effectiveness criteria. "Program potential" is the subset of economic potential that can be achieved with specific program funding levels, designs, and considering market barriers.)

Residential electric programs will need to transition from lighting to cold-climate air-source heat pumps to capture the largest potential savings.

Within end uses, space heating is responsible for nearly half of residential savings at the end of the study period, while lighting declines to a small fraction of total savings. Therefore, residential electric programs will need to transition from lighting to cold-climate air-source heat pumps to capture the largest potential savings. In the commercial and industrial sector, lighting, refrigeration, and system energy are expected to account for approximately 60% of total program potential in 2029.

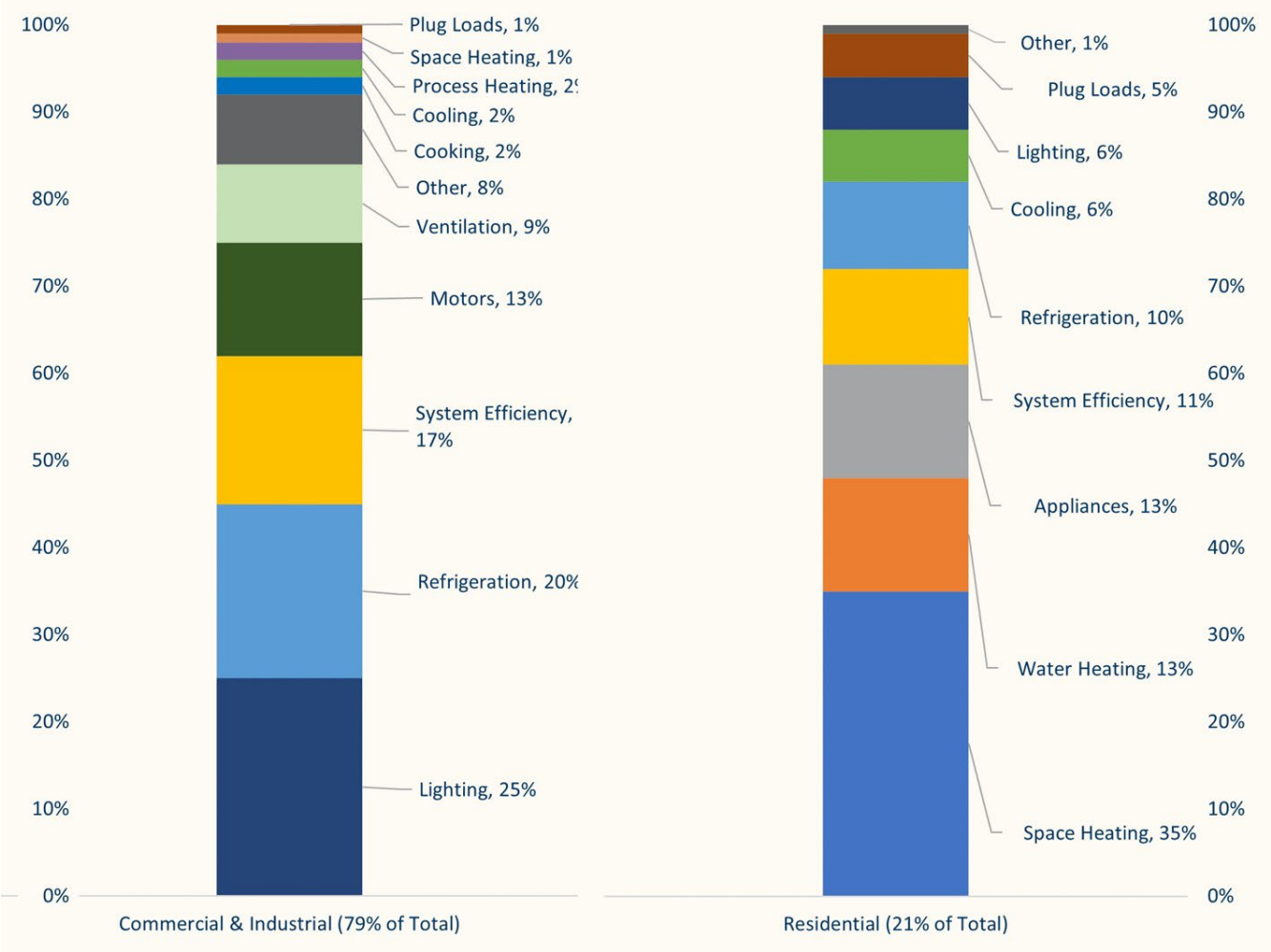

Figure 6-H: Electric Savings Program Potential by End Use (2029)

Figure 6-H shows the cumulative annual electric energy savings by end use in 2029 as a percentage of total savings for the residential and commercial & industrial sectors.

Savings figures are based on program potential estimated in the 2018 Minnesota Energy Efficiency Potential Study.

For natural gas, the study estimated economic potential to decrease forecasted gas sales by 33%, with program potential representing about one-third of that, or 11%, by 2029. Space heating is likely to dominate the end-use potential for the residential sector as well as the commercial and industrial sectors for natural gas utilities, with smart thermostats yielding the largest new source of potential savings.

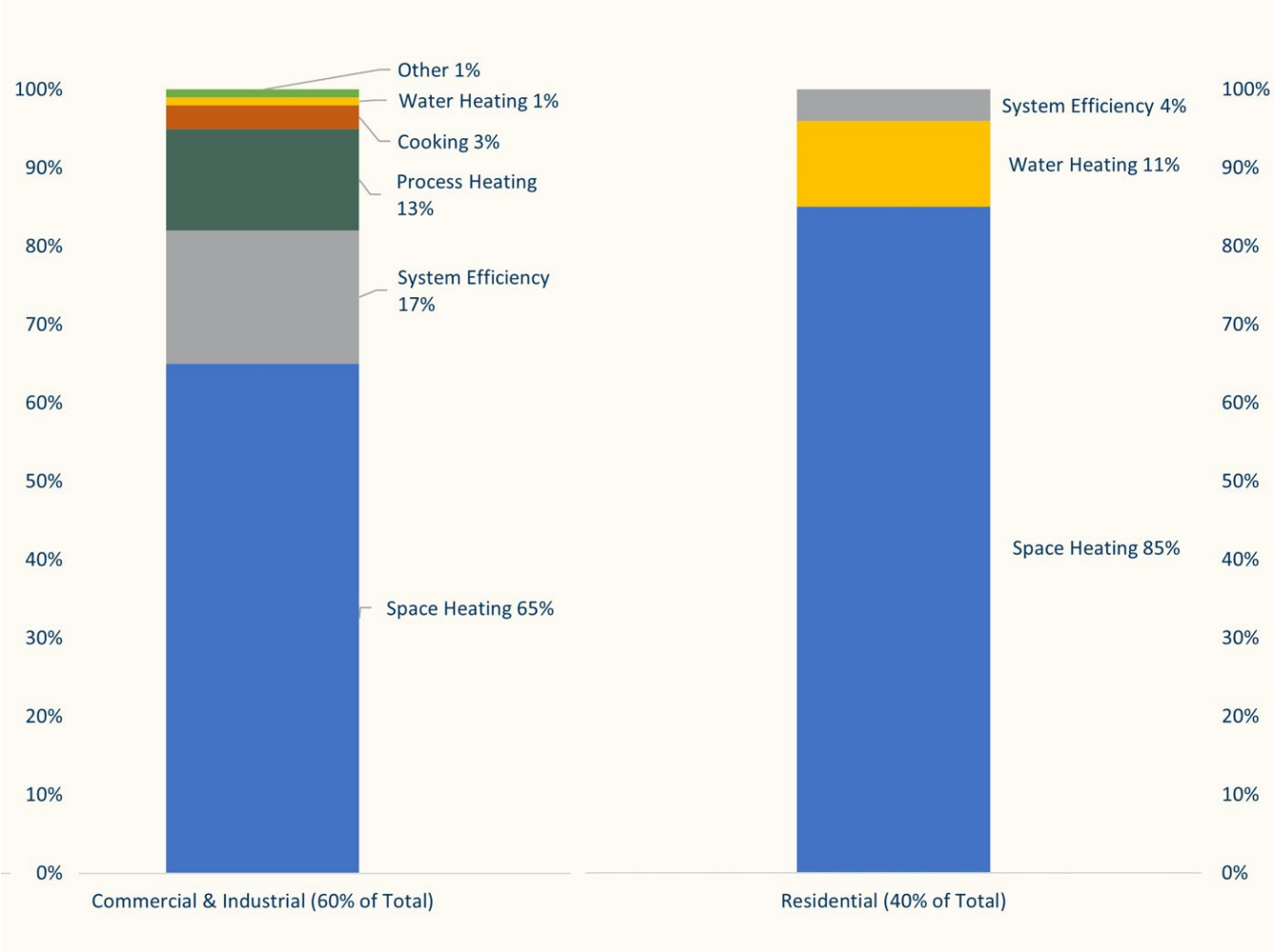

Figure 6-I: Natural Gas Savings Program Potential by End Use (2029)

Figure 6-I shows the cumulative annual natural gas energy savings by end use in 2029 as a percentage of total savings for the residential and commercial & industrial sectors.

Savings figures are based on program potential estimated in the 2018 Minnesota Energy Efficiency Potential Study.

The pandemic created increased uncertainty about future projections and expectations. In general, Americans' patterns of electricity and natural gas consumption across sectors changed. According to a report from the U.S. Energy Information Administration (EIA) from May 2020, weekday electricity demand in the Midwest fell between 9% and 13% in March and April due to shutdowns and changes to normal routines.[xv] The EIA report also mentioned that, nationwide, schools and business closures caused commercial and industrial electricity usage to decrease, while stay-at-home orders increased residential electricity usage. Preliminary data from summer 2020 indicates energy usage generally tracked changes in public health restrictions. As a result, the pandemic skewed energy usage metrics during most of 2020, complicating analysis of energy efficiency program results during this period. Any long-term effect the pandemic may have on energy consumption and efficiency programs remains unclear. Commerce will continue monitoring the situation and providing guidance.

Energy Affordability Efforts

To help reduce the energy burden for Minnesota's low- and moderate-income residents, Commerce manages the federally funded Energy Assistance Program (EAP) and Weatherization Assistance Program (WAP), as well as efforts to improve access to renewable energy and efficiency technologies for low-income households.

Reducing Energy Burden for Low-Income Minnesotans

In Minnesota, the average annual household energy cost, including heating and electricity, is two percent of the annual household income.[xvi] The annual household energy cost divided by the annual household income is also referred to as energy burden. Energy burden generally means the total energy burden for a household, combining the burden accruing from the electrical load and the burden accruing from heating sources, but not including the burden from transportation energy. According to the American Council for an Energy-Efficient Economy (ACEEE), energy burden above six percent is considered a high energy burden.[xvii] Minnesota's *Climate Action Framework*, released in 2022, includes a goal of reducing energy burden across the state so that by 2030 at least 80% of Minnesotans spend less than five percent of their household income on energy costs.[xviii]

The energy-related drivers of energy burden include "the physical condition of the home, a household's ability to invest in energy-efficient upgrades, and the availability of energy efficiency programs and incentives." But the primary driver of energy burden is household income. Nationwide, "low-income households experience high energy burdens almost three times more than the average household, and 13 times more than non-low-income counterparts."

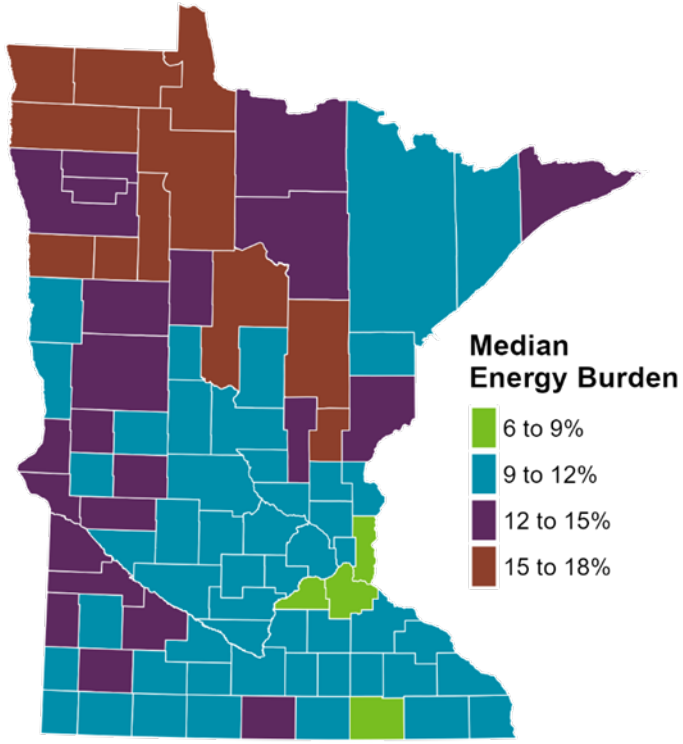

Figure 6-J: Energy Burdens for Low-Income Minnesota Households by County

Figure 6-J illustrates the median percent of income spent on energy by Minnesota households approved for Energy Assistance during the 2022–2023 heating season. Rural counties in the northern and western parts of the state have disproportionately high energy burdens.

Source: Minnesota Department of Commerce

Low-income households in Minnesota (in this case, income-eligible households under WAP, as defined in the *Income-Eligible Assistance* section earlier) have a median energy burden of 9%, while the median for Minnesota households over 200% of the federal poverty level is 2%.[xix] These percentages are similar to the national average

(8% and 2%, respectively). Households in Minnesota's rural northern and western counties have the highest energy burdens due to widespread reliance on delivered heating fuels such as propane and oil. During the 2022–2023 heating season, EAP-approved households in 11 such counties had median energy burdens exceeding 15%. Counties with broad access to connected utilities and lower poverty rates tend to have the lowest energy burdens.

EAP and WAP support home energy efficiency upgrades, lowering the energy burden of Minnesota households with income at or below 200% of the federal poverty level. EAP is paid annually, as needed, and focuses on immediate energy needs of income-eligible households, while WAP is a one-time but long-term home modification solution. Both programs target households with high energy burdens for service. The median household receiving EAP benefits in program year 2023 saw a 26% reduction in their energy burden.[xx]

Households receiving EAP benefits in program year 2023 saw a 26% reduction in their energy burdens, on average.

Households receiving weatherization assistance under the WAP see long-term energy cost reductions averaging 30% and large reductions in their energy burdens. However, neither of these programs can assist every income-eligible household in Minnesota. Approximately 20% to 30% of income-eligible Minnesotans apply for EAP assistance, and due to funding limitations, WAP has been able to weatherize only 9% of the eligible households in Minnesota over the last 15 years. As part of the *Climate Action Framework* released in 2022, Minnesota set a goal of weatherizing at least a quarter of dwellings where occupants earn 50% or less of the state median income by 2030.[xxi]

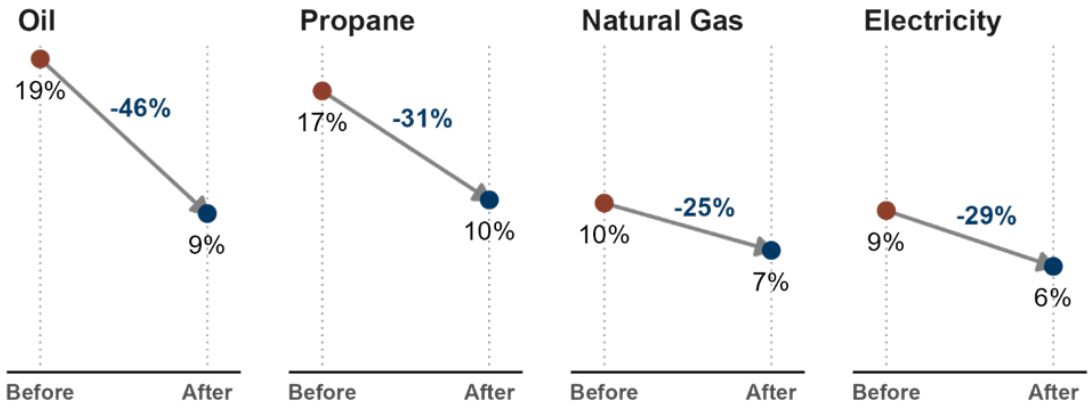

Figure 6-K: Change in Energy Burden for Households Receiving Energy Assistance by Heating Fuel Type (Program Year 2023)

Figure 6-K compares change in energy burden by heating fuel type for Minnesota households receiving Energy Assistance Program benefits during the 2023 program year. Homes heated by oil and propane had the highest energy burdens but also saw the largest energy burden reductions after receiving benefits.

Source: Minnesota Department of Commerce

For EAP program year 2023 (October 1, 2022, through September 30, 2023) the pre-benefit energy burden for Twin Cities metro income-eligible households receiving EAP benefits was 9.6% vs. 11.6% for income-eligible

households in greater Minnesota.[14] This is largely due to greater use of delivered fuels outside of the metro area; households heating with propane or oil typically have energy burdens exceeding 16%. Some demographic characteristics have notable correlations with energy burden: Native American households[15] receiving EAP benefits had a median energy burden of 16%, compared with 11% for non-native households; this is because Native American households are more likely to heat with delivered fuels and tend to have lower incomes than other households. (See Chapter 2, *Partnering with Tribal Nations*, for further information about efforts focused on improving energy costs, sustainability, and self-sufficiency for members of Tribal Nations that share Minnesota's geography.)

Low-Income Home Energy Assistance Program

The Low-Income Home Energy Assistance Program (LIHEAP or EAP) is a federally funded U.S. Department of Health and Human Services program authorized as part of the Omnibus Budget Reconciliation Act of 1981 (42 U.S.C. §§ 8621 through 8630) that aims to assist low-income households in meeting their immediate home energy needs. The program's direct benefits include making payments to energy vendors on behalf of eligible households to reduce their home energy burdens, providing payments that prevent or resolve the loss of heat due to utility disconnection or running out of fuel, and repairing or replacing malfunctioning or non-functioning heating systems.

By federal statute, state programs funded by LIHEAP are required to target households with seniors, disabled members, or children under age six; each year roughly 75% of eligible households include at least one member from one or more of these target groups. Two-thirds of annual funding for Minnesota's Energy Assistance Program is spent in Greater Minnesota, with the remaining one-third provided to households in the Twin Cities area. Commerce manages EAP through contracts with 28 service providers in service territories covering the entire state, including 21 Community Action Agencies, five Tribal Nations, one county, and one non-profit organization, as shown in the next figure.

Two-thirds of annual funding for Minnesota's Energy Assistance Program is spent in Greater Minnesota.

From 2014 through 2023, Minnesota EAP funding totaled an average of $138 million annually, including $167 million in emergency funding through the American Rescue Plan Act in 2021. During this time, Minnesota's EAP served an average of 130,000 households each year, providing direct benefits as well as services such as case management, referral, energy education, and advocacy with energy vendors.

The COVID-19 pandemic had a significant impact on Energy Assistance program operations during the 2020–2023 program years. After pandemic lockdowns and utility protections began to take effect in March of 2020, the number of households served by EAP hit their lowest point since 2005. Application numbers remained low during the 2020–2021 heating season; this was likely the result of both accessibility issues introduced by the

[14] One-third of the EAP benefits paid out in EAP Program Year 2023 went to recipients in the Twin Cities area.
[15] Applications from Native American households make up five percent of EAP applications annually.

pandemic as well as reduced demand for benefits due to utility shutoff moratoriums and availability of other emergency programs.

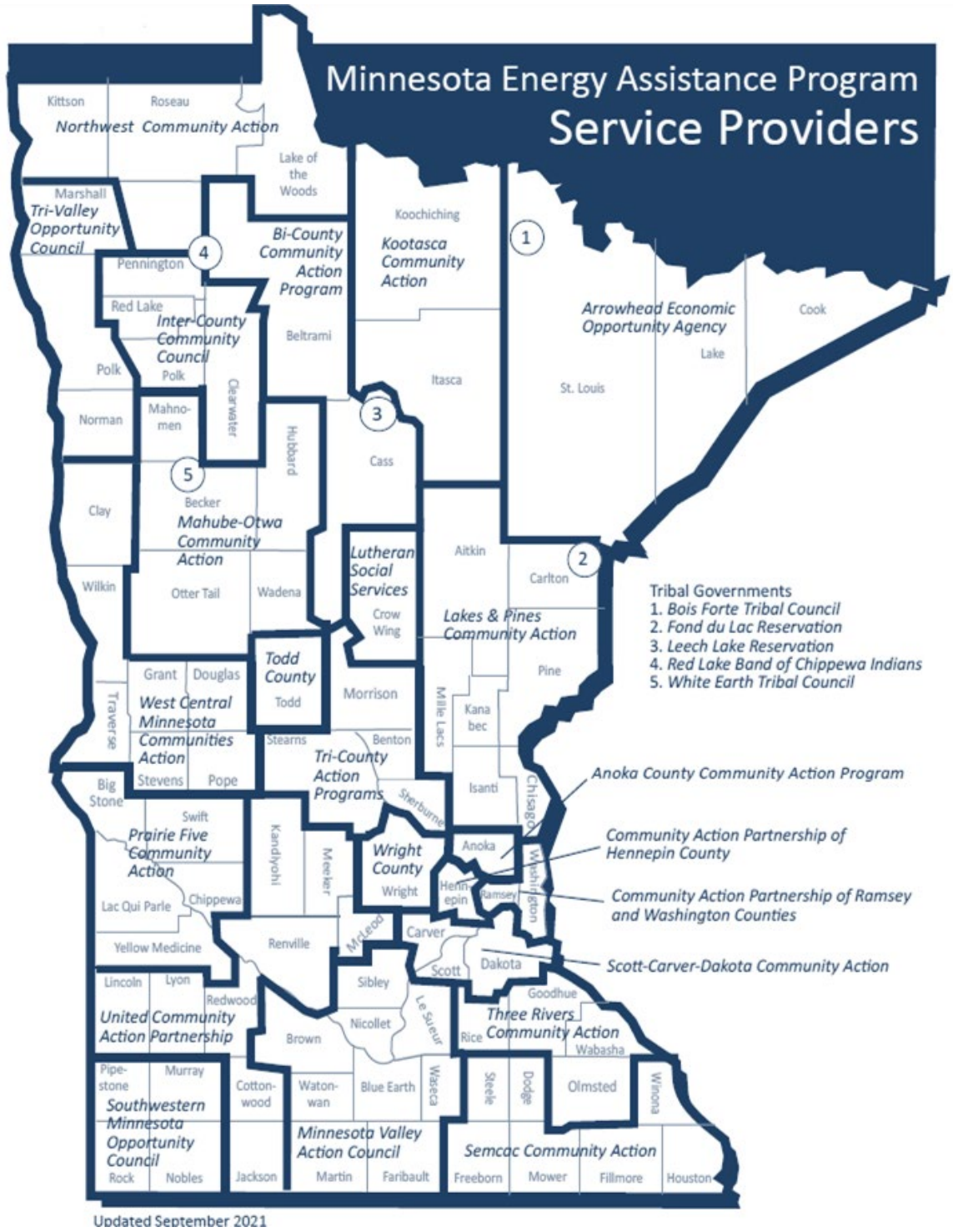

Figure 6-L: Minnesota Energy Assistance Program service providers and territories (2021)

Source: Minnesota Department of Commerce

Minnesota was awarded $167 million in Energy Assistance funds through the American Rescue Plan Act (ARPA) in March of 2021, and these funds were made available to households during the 2021–2022 heating season. With this historic level of funding, EAP was able to reduce energy burdens below five percent for roughly 80% of households; this was achieved by doubling the average benefit (from $500 to over $1,000) and adjusting benefit calculations to account for a household's total energy cost instead of just their heating expenses. EAP crisis benefits were also capped at $3,000 instead of the typical $600. These unusually high benefits were featured prominently in an extensive outreach campaign designed to bring new households to the program; despite these efforts, EAP was only able to serve 127,605 households, a 10% increase over the previous year. Remaining ARPA funds were used to eliminate $22 million in utility arrearages for EAP-approved households; despite awarding large benefits, over 40,000 households still had past due balances averaging roughly $400 which the program was able to pay.

EAP launched an online application midway through the 2022–2023 heating season, and over 20,000 households applied online between February and June of 2023. These early adopters tended to have higher incomes and younger household members than the average EAP applicant; despite a relatively high rate of incomplete applications submitted online, this new application format led to an additional 10,000 households served by the program.

Low-Income Weatherization Assistance Program

The Low-Income Weatherization Assistance Program (WAP) is a federally funded U.S. Department of Energy (DOE) program to create weatherization jobs and improve the energy efficiency of homes occupied by income-eligible residents. Enabling legislation was enacted in 1976 under Title IX of the Energy Conservation Act[xxii] and is aligned with Minnesota statutes.[xxiii] In addition to DOE, WAP receives an annual transfer of EAP (via the U.S. Department of Health and Human Services) funding to further increase the number of households served, as well as a small fund targeted to increase the number of propane heated households. The Infrastructure Investment and Jobs Act (IIJA, aka Bipartisan Infrastructure Law), signed into law in November 2021 provides an additional $76 million for WAP through at least 2027.[xxiv]

WAP energy measures improve the household's indoor environment and result in long-term reductions in energy use and annual household energy cost, allowing those funds to be re-directed to other key living expenses. The weatherization program aims to improve occupants' health, safety, comfort, and mental and physical well-being, allowing a better quality of life for those served.

At completion, all weatherization work requires inspection and sign-off by a certified quality-control inspector.

WAP in-home weatherization work begins with an advanced energy audit and building systems diagnosis, followed by energy measures such as insulation, ventilation, air sealing, and mechanical systems repair or replacement. Prior to beginning work, measures are required to meet a minimum savings-to-investment ratio (SIR);[16] the value of the energy savings from each measure and the project overall is required to be greater than

[16] The minimum SIR required for work to proceed is 1.0.

the cost of the work. The program is subject to federal and state regulations, and requires fully licensed, bonded, and certified personnel who adhere to nationally defined standard work specifications to maintain high-quality work while ensuring the health and safety of household occupants. At completion, all work requires inspection and sign-off by a certified quality-control inspector.

WAP serves an estimated 3,000 Minnesotans annually. Homes with children, elderly, or disabled occupants, or those with a high energy burden or high energy use, receive priority service. Similar to EAP, two-thirds of households served are in greater Minnesota, with one-third located in metro areas. Weatherization assistance is available to homeowners and renters, single-family site-built, and manufactured homes, as well as multi-family buildings.

Commerce contracts with 22 regional service providers across Minnesota to deliver weatherization services. Service providers are primarily community action partner agencies, with three Tribal Nations, one county development agency, and one non-profit organization also delivering services. In total, the service provider

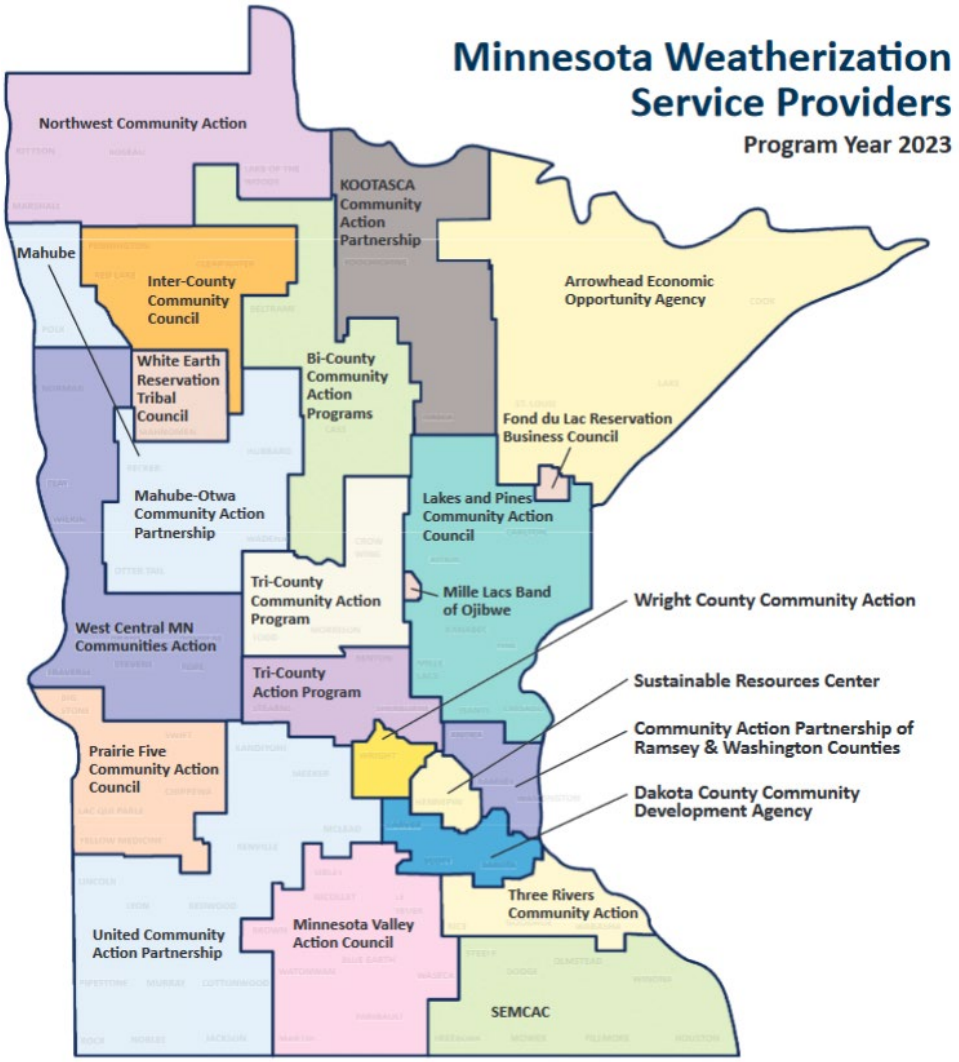

Figure 6-M: Minnesota Weatherization Service Providers (2023)

Figure 6-M illustrates the Minnesota regions served by 22 service providers that Commerce contracts to deliver weatherization services. The service provider network employs more than 180 people and more than 350 independent contractors to weatherize the households of WAP clients.

Source: Minnesota Department of Commerce

network employs more than 180 people and more than 350 independent contractors to weatherize the households of WAP clients.

Between July 2022 and June 2023, a total of 1,365 homes received whole-dwelling weatherization at an average household unit cost of $7,953. An additional 2,373 homes were served with “stand-alone” work on mechanical systems, with an average unit cost of $4,683.

Between 2021–2022, the Weatherization Assistance Program Working Group convened to explore ways to leverage existing and identify new funding sources to increase the number of income-eligible Minnesota households served or the scope of services provided by WAP. This informal working group, including legislators, low-income advocates, utilities, service providers, and other partners, met seven times and subgroups formed to look at barriers related to funding and deferrals, barriers to equitable implementation, and workforce issues.[xxv]

The Weatherization Assistance Program Working Group concluded its work by generating a report highlighting recommendations for implementation of the program entitled: *Working Group Recommendations on the Minnesota Weatherization Assistance Program.*

Recommendations to the state legislature included:

- Supplement federal funding with state funds to stabilize the program.
- Allow state funds to be used to address structural issues in homes and mitigate deferrals.
- Allocate funding for targeted outreach to communities with disproportionately high poverty and low participation rates relative to energy burden.[xxvi]

To further support this work, Commerce commissioned research by the University of Minnesota, Humphrey School of Public Affairs, Center for Science, Technology, and Environmental Policy who worked with APRISE Incorporated to conduct a landscape analysis focused on opportunities and challenges within the process of implementing WAP in Minnesota. The report resulted in 10 recommendations with themes of allowing funding flexibility (across program years and allowed services), collaboration (with multifamily weatherization entities, partner agencies, and other states), and establishing strategic goals and performance metrics to allow for better prioritizing objectives.[xxvii]

Weatherization Deferrals

Between July 2021 and June 2022 43% of the households receiving a WAP energy audit were deferred from receiving weatherization work. Households are deferred from receiving work for two reasons: either the forecasted energy savings associated with the needed weatherization work does not deliver a SIR (of 1.0 for DOE funding or 0.75 for EAP funding) or factors in the home make immediate weatherization work impossible—e.g., unsafe conditions, presence of vermiculite insulation (which usually contains hazardous asbestos), deferred maintenance, structural issues, moisture and mold, etc.

At households with potentially dangerous conditions or other factors preventing immediate work, such conditions must be resolved before WAP funds can be used for weatherization measures. Although federal program funds can be used for some non-energy measures necessary to improve a residence’s health and

safety, the amount is limited. Issues such as deferred maintenance ("deferrals"), extensive repairs, and presumed asbestos-containing insulation generally are outside WAP's scope. In the recent past, both DOE and the State of Minnesota have dedicated funds to addressing some of these issues so more homes now have access to full weatherization.

In 2023, the legislature appropriated $45 million in pre-weatherization and workforce training funding to address deferrals and make more homes ready for weatherization services. In 2024 Commerce hired additional weatherization staff to implement a campaign to increase awareness of careers in the weatherization field, engage with diverse communities of workers, and explore approaches to increase availability of required trainings. Initial mitigation deferral funds will be released to the WAP Service Provider network starting in 2024. The program guidelines have been revised to address a wide range of potential deferral issues and to align with resources available from other sources (federal, utility, etc.).

Healthy AIR (Asbestos Insulation Removal) Program

Since program year 2017, Commerce has utilized $900,000 in allocated state funding to remove asbestos-laden insulation under the Healthy AIR Program, which safely and completely removes all particles of insulation from a home. This program has cleared 136 houses of vermiculite insulation, at an average cost of $8,429, allowing comprehensive weatherization measures to follow.

Solar Options for Income-Eligible Households

Low-income Minnesotans rely on a variety of heating sources, including wood, propane, fuel oil, electricity, and natural gas. Renewable heating technologies such as solar and geothermal systems generally have historically been too costly for low-income residents to afford. However, as the installation cost of solar systems has continued to decrease, solar has become more economically viable for programs to support installation on income-eligible houses.

In late 2019, Minnesota WAP introduced a pilot program to increase income-eligible households' access to renewables by supporting the installation of solar photovoltaic (PV) systems on 15 WAP homes. U.S. DOE policies allow WAP funding to be spent on a portion of PV system installation costs. Minnesota's solar WAP pilot program leverages funding from Xcel Energy's income-eligible Solar*Rewards rebate program to augment allowable WAP funds. Initial findings from the pilot showed that a 3.6 kW-system size can offset an average reduction of 49.4% of a household's electrical usage, reducing the annual electrical cost by $558 and reducing income-eligible Minnesotans' high energy burdens. In addition, using U.S. Environmental Protection Agency's health benefits-per-kWh value for solar energy,[xxviii] the value of the associated health benefits for a solar array installed under the WAP solar pilot totals from $134 to $303 a year. Program year 2021 allowed the incorporation of funding from LIHEAP partners, which allowed for solar PV installations outside of Xcel Energy's service area. This resulted in the addition of four more participating Service Providers. The allowable system size was also increased from 3.6 kW to 5.0 kW, reducing recipients' electrical use to over 60%. Currently, the MN WAP has initiated 49 solar PV projects and completed 28 installations.

Strategies for Increasing Access to Solar for LMI Households

From 2020–2024, Commerce focused numerous efforts on reducing barriers to solar for low-income Minnesotans targeting funding for income-eligible solar projects, collaborating with national organizations to expand access to community solar gardens, developing a solar+weatherization effort, exploring alternative financing mechanisms, and expanding outreach and data gathering.

A few highlights from this period include:

Develop a Model Income-Eligible Solar Program: Xcel Energy, in partnership with Commerce and multiple stakeholders developed an income-eligible Solar*Rewards program to better assist eligible low-income customers in accessing solar.

Expand Access to Community Solar Gardens: Commerce was selected by the National Association of State Energy Officials (NASEO) and the National Energy Assistance Directors' Association in late 2020 as a state partner in the Inclusive Shared Solar Initiative. The Initiative, a partnership between NASEO, the National Energy Assistance Directors' Association, and the NY State Energy Research and Development Authority, is designed to support development of innovative models which reduce hurdles and increase accessibility for income-eligible participants.

As part of this work, Commerce is collaborating on a community solar pilot project with Detroit Lakes Public Utilities and MAHUBE-OTWA Community Action Partnership. The pilot is exploring how to best integrate the state's Energy Assistance Program process with a utility's billing and solar credit processes. This will help maximize the value of both community solar subscriptions and energy assistance for income-eligible households, particularly for those who live in manufactured homes with electric heating.

Manufactured Homes

Between July 2021 and June 2022, 13% of the WAP household units weatherized were manufactured homes.

In 2024, Commerce will initiate a Community Site Pilot Project funded by DOE which will allow for community-focused weatherization. Specifically, Commerce will provide weatherization to 10 manufactured home parks serving 80 households. This geographic focus will allow for economies of scale as well as word of mouth. The economies of scale will allow for maximum service to each household as driving down costs improves the SIR to allow an expanded list of measures. And word of mouth is the most effective recruitment strategy for engaging homeowners in WAP.

Renters

Weatherization assistance is available through WAP to both homeowners and renters alike. Annually, 7% of the homes weatherized under Minnesota's program are rentals, while overall, rental households make up approximately 28% of the households statewide.[xxix] Successful weatherization projects for rental units require joint alignment and cooperation among landlords and tenants, and often the parties have different motivations regarding weatherization assistance. Additionally, complex program requirements apply to weatherizing large multi-family buildings, which comprise most urban rental housing.

Minnesota WAP seeks to increase the number of rental units weatherized. The lower-than-desired rental participation rate is an energy-equity issue because members of under-resourced communities are more likely to be apartment renters than single-family homeowners. For example, according to the Minnesota Housing Partnership, years of discrimination in housing policies, real estate, and lending practices have resulted in Minnesotans who identify as African American being less than one-third as likely to own a home as those who identify as white.[xxx]

Discussions are currently underway on how to utilize increased funding available to WAP through IIJA to address this disparity and serve more renters and multi-family units with weatherization. As noted previously, the WAP Working Group convened legislators, advocates, and others in 2021 and 2022 to discuss equitable service to eligible households, including service to renters and to multi-family residences. The resulting *Working Group Recommendations on the Minnesota Weatherization Assistance Program* included the following recommendations:

- Provide opportunities to fund multi-family buildings where upgrade timelines exceed the federal one-year funding cycle.
- Provide gap funding to help owners of income-eligible subsidized or naturally occurring affordable multi-family housing bridge the owner financial contribution required to participate in WAP.[xxxi]

WAP continues to consider additional ways to address renters' and multi-family weatherization. Initial approaches under consideration of implementation include offering additional supports to service providers for renter outreach, additional technical assistance on multi-family weatherization (via a contracted provider), and specialized funding allocations to support multi-family weatherization. In addition, WAP anticipates further consideration of approaches that allow weatherization timelines to cross over program years.

Workforce opportunities

Minnesota WAP service providers face a continual challenge to maintain a workforce of experienced weatherization and mechanical contractors, electricians, energy auditors, and quality-control inspectors. While WAP has earned and maintained a reputation for doing high-quality work, complying with quality-control standards and federal and state program requirements results in additional burdens for independent contractors working with WAP households vs. other housing clients.

WAP has access to many high-quality and committed contractors, auditors, and quality-control inspectors, but an expanded workforce is needed in each discipline. These trades all have good job growth potential as WAP expands to reach additional homes. In much of greater Minnesota, for example, the number of electricians overall is low, which means few electricians participate in WAP. This is especially problematic as further expansion of low-income solar is considered; more electricians will be needed in Greater Minnesota with experience and knowledge on wiring new PV installations to help households throughout the state gain access to renewable energy opportunities.

The myriad of other energy conservation and efficiency programs funded through IIJA will only increase the need for qualified workers in the field.

Utilizing resources available through state appropriations and WAP IIJA funding, Commerce is working on strategies and approaches to mitigate some of the challenges in hiring and retaining staff and contractors. Approaches include streamlining the onboarding processes, increasing awareness of opportunities for careers in weatherization and energy conservation, and more efficiently connecting contractors with weatherization opportunities.

New federal and state funding for home energy efficiency

The 2021 IIJA included a five-year increase in weatherization assistance funding of over $75 million for the State of Minnesota. This section 40501 funding will allow WAP to approximately double the number of Minnesota houses weatherized by the program during that period. Refer to Chapter 1 for more details about programmatic funded included in the IIJA.

The 2022 Inflation Reduction Act (IRA) contains two grant programs aimed at reducing home energy use and greenhouse gas emissions from residences. These two provisions are:

- Section 50121: Home energy performance-based, whole house rebates (Home efficiency rebates or HOMES).
- Section 50122: High-efficiency electric home rebate program (Home electrification and appliance rebates or HEAR).

Together, the provisions are called the IRA Home Energy Rebates. These programs will help Minnesota households save money on energy bills, upgrade to clean energy equipment, improve energy efficiency, and reduce indoor and outdoor air pollution. At the federal level DOE administers these programs and has awarded Minnesota almost $150 million for the IRA Home Energy Rebate programs. Commerce will administer both programs for Minnesota.

In September 2023, DOE awarded Commerce initial administrative funds to plan the programs. In August 2023, Commerce established a new unit within the Energy Division, the Programs for Innovation and Equity (PIE) unit, to manage the programs, and as of spring 2024 Commerce is actively hiring and onboarding staff within the unit.

Home Efficiency Rebates (HOMES) Program

The HOMES program will provide homeowners with rebates to cover energy efficiency home improvements (insulation, upgrading appliances, and HVAC, etc.) that are predicted to save at least 20% of the home's energy use. This rebate requires an energy assessment and bases the rebate on the total energy savings expected from the project. Higher rebate amounts will be available for low-and-moderate income households. The IRA appropriated over $74 million to Minnesota to implement the HOMES program.

Home Electrification and Appliance Rebate (HEAR) Program

The HEAR program is a point-of-sale rebate program for heat pumps and other electric appliances. The rebates are limited to eligible low-income households. The IRA appropriated over $74 million to Minnesota for implementation of the HEAR program.

In 2023 and 2024 Commerce began its strategic program design, collecting stakeholder lists and soliciting bids for a contractor to support Commerce through program design and initial implementation. Commerce is also participating in a DOE-supported cohort of states to accelerate their HEAR funding application. Commerce plans to launch the program in late 2024.

Additionally, in 2023, the Minnesota Legislature approved over $20 million for related home energy rebate programs designed to supplement the federal rebate programs, to launch in 2024:

State Electrical Panel Upgrade Grant

The Minnesota residential electrical panel upgrade grant program (Minn. Stat. § 216C.45) will provide financial assistance to owners of single-family residences and multifamily buildings to upgrade residential electric panels, up to $3,000 per household and varying amounts for multifamily depending on the number of units. This program is available only to low- and middle-income households. Visit the state electrical panel upgrade grant webpage for more details.

State Heat Pump Rebate

The Minnesota residential heat pump rebate program (Minn. Stat. § 216.46) will provide financial assistance, up to $4,000 per household, to eligible applicants that purchase and install a heat pump for space heating and cooling in their Minnesota residence. This program was designed to supplement the federal HOMES/HEAR rebates, by providing additional funds to cover the cost of cold climate air source heat pumps, which tend to be more expensive but better suited to Minnesota's climate. Commerce hired a person to administer the program in November 2023.

Strengthen Minnesota Homes

A new pre-disaster mitigation program will provide financial assistance to Minnesotan homeowners to help upgrade their roofs to make them more resistant to high wind, hail, and other extreme weather events. The program, named "Strengthen Minnesota Homes," aims to keep Minnesotans safer and healthier in their homes and is an action Minnesotans can take to further individual climate resiliency. Minn. Stat. § 65A.299 creates the framework for the program and establishes criteria for contractors and other professionals to perform work on homes once the grant program becomes operational. Minn. Stat. § 65A.298 requires insurance companies to offer a premium discount to Minnesotans who upgrade their existing roof, or build a new roof, to a standard established by the Insurance Institute for Building Home and Safety, the FORTIFIED standard. Approved products are becoming available, at which time Minnesotans with a FORTIFIED roof on their home will be eligible for a discount on their insurance premium.

References – Chapter 6

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Chapter 7: Energy Reduction Efforts in Buildings, Water, and Transportation Sectors

Minnesota's policies and programs work together to support cost-effective energy conservation and efficiency in various sectors, including new and existing buildings, public water supplies, and transportation. As detailed in Chapter 5, Minnesota utilities have made progress in transitioning to renewable energy sources, and overall emissions related to electricity generation have been falling. Emissions from commercial and residential buildings and the transportation sectors, however, have been more variable over the years and have yet to show a sustained decline.

Building Energy Use

Minnesota's policies and programs work together to support cost-effective energy conservation and efficiency in both new and existing buildings. Building energy efficiency is especially critical in cold-climate states. Minnesota has some of the coldest winter weather in the nation, coupled with hot, humid summers. Operating and maintaining buildings involves the consumption of large amounts of energy. In 2021, buildings in Minnesota consumed 42.1% of the total energy consumed in the state, 19.2% of which was from commercial buildings, including large multifamily buildings.[i]

Minnesota is the only midwestern state that consistently ranks in the top 10 states nationwide in the American Council for an Energy-Efficient Economy (ACEEE) State Energy Efficiency Scorecard.[ii] Despite this progress, some emissions and energy use from buildings are increasing. The Minnesota Pollution Control Agency (MPCA)'s greenhouse gas (GHG) inventory shows that, between 2005 and 2020, GHG emissions increased by 14% from residential buildings. However, emissions have lately decreased from commercial buildings in part from using less oil and natural gas.[iii]

Building codes, policies, and programs related to new construction, renovations, and upgrades all represent tools that the State of Minnesota and local jurisdictional agencies use to improve the performance of Minnesota's various types of buildings.

Policies for New Construction

Building Energy Codes

Minnesota has had a state building code, including a building energy code, for more than 50 years. Minnesota law requires the state building code to conform as much as possible to model building codes that are generally accepted and in use throughout the U.S. Minnesota law states that the commissioner of the Minnesota Department of Labor and Industry (DLI) shall by rule and in consultation with the Construction Codes Advisory Council establish a code of building standards, of which energy efficiency standards are addressed in chapters

1323 and 1322. Even though the State Building Code is established by rule using model codes, the legislature can still enact specific requirements to regulate the construction of buildings.[iv]

The commercial building energy code in Minnesota is now based on standards established by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).[v] The current code, ASHRAE 90.1-2019, became effective on January 5, 2024.

A 2023 update to Minn. Stat. § 326B.106 requires DLI to advance the commercial energy code more quickly than in the past. Updates will now be every three years instead of every six years, aligning with the schedule for ASHRAE revisions. The law mandates that the commercial energy code in effect in 2036 and thereafter must achieve an 80% reduction in annual net energy consumption or greater, using ASHRAE 90.1-2004 as a baseline. This will require DLI, with stakeholders, to develop stronger amendments that go beyond the ASHRAE standards. The U.S. Department of Energy (DOE) estimates that ASHRAE 90.1-2022 would result in a 9.8% national average site energy savings. To meet the legislative objectives, future codes will need to achieve a 68% reduction in energy use from the current energy code, which is based on ASHRAE 90.1-2019. The proposed strategy is to pursue a more aggressive improvement during the 2026 and 2029 code cycles with smaller goals for the 2031 and 2034 code cycles.

To support Minnesota's commercial energy code improvements, DOE awarded over $5 million under the Inflation Reduction Act (IRA) 50131 (Resilient and Efficient Codes Implementation) to a partnership led by Center for Energy and the Environment and supported by Commerce, DLI, and the Center for Sustainable Building Research at the University of Minnesota. This effort will provide technical resources to support advancing the commercial code and conducting code compliance activities through outreach, trainings, and tool development in jurisdictions throughout the state.

Minnesota's current residential energy code is based on the International Energy Conservation Code (IECC), developed by the International Codes Council through a consensus process.

The current residential energy code, 2012 IECC with amendments, became effective Feb. 14, 2015. A Technical Advisory Group began meeting in August 2023 to begin the process to adopt a new residential code based on the 2021 IECC. As of March 2024, the Technical Advisory Group meetings are paused while DLI evaluates changes in the 2024 international residential code (Ch. 11, Energy Efficiency) compared to the 2021 IECC.

As a result of adopting the 2012 IECC residential and 2019 commercial codes, energy cost savings for Minnesota are estimated to be approximately $1.82 billion annually by 2030.[vi]

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A 2024 update to Minn. Stat. § 326B.106 requires DLI to advance the residential energy code more quickly than in the past. Updates will now be every three years instead of an indeterminant length of time, aligning with the schedule for IECC revisions. The law mandates that the residential energy code in effect in 2038 and thereafter must achieve an 70% reduction in annual net energy consumption or greater, using IECC-2006 as a baseline. This will require DLI, with stakeholders, to develop stronger amendments that go beyond the IECC standards.

Although development occurs at national and state levels, Minnesota's building energy codes are enforced locally by those counties and cities that have passed local ordinances. Throughout Minnesota, 507 municipalities enforce the State Building Code. This includes 432 out of 852 cities, 59 of 1,790 townships, and 16 of 87 counties.[vii]

The relationship between building codes and energy use intensity in buildings has been well documented.[viii,ix] Although variation exists in the energy use intensity for different types of buildings (e.g., industrial production, hospital, office, residential), the research suggests that the average energy use intensity trends steadily downwards as new model building energy codes are developed and implemented.

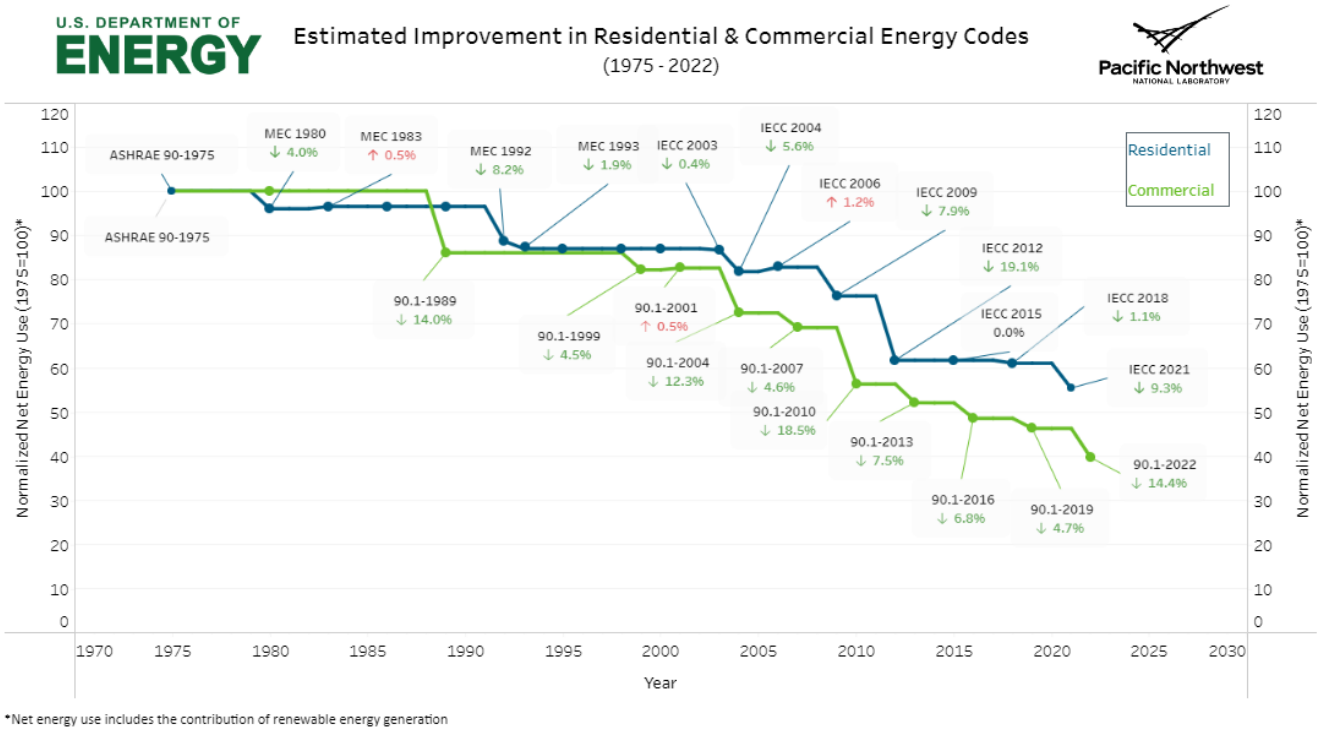

Figure 7-A: Improvement in Residential and Non-Residential Model Energy Codes (1975–2022)

Figure 7-A tracks the improvement in building energy use established by model energy codes from national and international standards organizations for residential and non-residential buildings from 1975 through 2022 Normalized building energy use standards improved by about 50% over that 43-year period.

Source: Pacific Northwest National Laboratory

Sustainable Buildings 2030 Performance Standards

Minnesota Statutes §16B.325, enacted in 2001, required the Departments of Administration and Commerce to develop sustainable building design guidelines that would become mandatory for all new buildings receiving funding from state bond proceeds after January 1, 2004. The guidelines were required to focus on strategies that ensured all new state buildings exceeded the existing energy code by 30%, employed life-cycle cost methods, and implemented measures to reduce waste and material costs as well as to increase daylighting, improve indoor air quality and human productivity, and use of renewable energy sources.

In 2008, the legislature enacted a mandate for the state to establish an energy performance standard to achieve reductions in energy consumption by least 90% in 2025 and 100% by 2030 for buildings that used the sustainable building design guidelines. The standard must be cost-effective based upon established practices used in evaluating utility energy-savings measures under the Energy Conservation and Optimization (ECO) Program. Accordingly, in 2009 the guidelines expanded to include the Sustainable Building 2030 (SB 2030) energy performance standards—cost-effective, energy-efficiency sustainable building performance standards. Starting in 2010, buildings that received bond funds were designed to be 60% more energy efficient than the baseline, and 70% more efficient in 2015. Case studies are developed on buildings going through the process to assist architects and building owners, with ongoing training of architects, engineers, and builders.[x]

SB 2030 is administered by the Center for Sustainable Building Research at the University of Minnesota with annual funding provided through a utility rate assessment and managed by Commerce. All new and substantially renovated buildings funded in whole or part by Minnesota bonds must comply with the SB 2030 standards. Further, after design, building owners are required to track and report the buildings' energy use in Buildings, Benchmarks, and Beyond (B3) Benchmarking for 10 years, and if the building is not performing to the standard, it must apply the B3 energy efficient operations manual to achieve compliance.

While the Sustainable Building 2030 standards are voluntary for all other buildings, they have served as a model for reducing both energy use and carbon emissions. The model can be cost-effective and beneficial for building owners, citizens, and utilities throughout Minnesota. SB 2030 reflects the goals of the national Architecture 2030 program, though it is tailored to Minnesota buildings. Architecture 2030 established a goal to achieve net-zero energy use in buildings by 2030 and outlined specific incremental performance targets in order to meet this goal. The SB 2030 program required that all state bond-financed projects that began schematic design in 2020 through 2025 must meet the SB 2030 80% reduction standard, to reduce net use of energy (total consumption minus renewable energy generated onsite) by 80% compared to a 2003 building.

Accomplishments of the SB 2030 initiative through 2022 include:

- 244 buildings designed to the SB 2030 Energy Standard are predicted to save approximately 919 million kilo British thermal units (kBtus)/year.
- To date, 91% of all building projects enrolled in the SB 2030 program have documented designs that met or exceeded the SB 2030 Energy Standard.
- Buildings designed to the SB 2030 Energy Standard are predicted to save approximately $16.7 million per year assuming an average cost of $18.18 per million Btu (mmBtu).
- Buildings designed to the SB 2030 Energy Standard anticipate a reduction in carbon emissions of 100,000 tons of carbon dioxide equivalent (CO_2e) annually.
- Projects have reported anticipated energy consumption of 26% less than their 2030 Energy Standard.
- 178 completed SB 2030 projects are estimated to have saved 4,594 million kBtus, a reduction of 604,000 tons of CO2e and a savings of $83.5 million to-date.[xi]

In 2024, increased funding for the SB2030 Program was included HF4323 (Cash Only Capital Investment Bill). The bill passed the Minnesota House of Representatives but did not pass the Senate on the last day of the 2024 legislative session.

Policies for Existing Buildings

Building code affects new construction, but a high-performing building not only needs to be designed energy efficiently, but also operated efficiently. Further, building design doesn't always address plug-load energy consumption from appliances and other plug-in devices, which can account for approximately one-third to one-half or more of the energy used in Minnesota residential and commercial buildings.[xii,xiii]

Commercial & Multifamily Building Energy Benchmarking

The 2023 Minnesota Legislature enacted a policy requiring large commercial and multi-family buildings in the Twin Cities metro and larger cities in Greater Minnesota to share their building energy use with the state. The program will be implemented in stages. In 2025, the first year, buildings larger than 100,000 square feet will report electricity, natural gas, and district heat energy use. The following year, buildings 50,000 square feet and larger will report their energy use data. Commerce will collect the data and share trends with the public on its website. Commerce will also notify building owners of their building performance—how their building energy use relates to other buildings of similar size. The use of these data will allow Commerce to understand how Minnesota buildings are using energy, to connect low-performing buildings with incentives and other programs to improve building efficiency and to create new programs to better target building performance challenges.

Appliance & Equipment Standards

Federal Appliance and Equipment Standards dictate appliance efficiency. In 1975, the Energy Policy and Conservation Act was enacted among other things to develop, revise, and implement minimum energy efficiency standards. The DOE reviews standards and test procedures for more than 60 products that encompass 90% of home energy use and 60% of commercial building energy use.[xiv] Some states have adopted additional appliance and equipment standards, but Minnesota is not among them. Any new appliance and equipment standards that states might consider must accommodate federal authority to set standards for the country.[xv] Standards that have been recently revised include, among others, residential gas furnaces, cooking products, refrigerators, clothes washers and dryers, and hot water heaters. On the commercial side, variable refrigerant flow multi-split air conditioners and variable refrigerant flow multi-split system heat pumps standards are updated. In aggregate, DOE estimates that the improved standards will save nearly $2 trillion dollars per year by 2030, along with saving millions of tons of carbon emissions annually.[xvi]

Financial Programs/Incentives

The federal and state government, along with non-profit organizations focused on energy issues, offer a variety of financial programs and other incentives that include criteria for efficiency and renewable energy use in residential and commercial buildings. Examples include:

- Federal tax credits for energy efficient home retrofits, including electrical panel upgrades and heat pumps;

- Minnesota's enabling legislation for Property Assessed Clean Energy (PACE) programs, which many Minnesota counties have joined;[17] and
- Minnesota Housing's Qualified Allocation Plan, which distributes low-income housing tax credits.

Other policies that affect buildings' GHG emissions include the Energy Conservation and Optimization Program and Weatherization Assistance Program as well as ordinances and programs implemented by local units of government in Minnesota. See Chapter 6 for more information about these and related policies and programs.

Local Governments

Participation in IECC 2021 Development

In 2020, the IECC completed the process of establishing the 2021 IECC model building code. The IECC is updated every three years and is the most commonly adopted energy code by states and local governments.[xvii] Cities from across the country participated in the process by reviewing and casting votes on whether to approve the new codes. The 2021 IECC update garnered great interest among municipalities, who turned out several times as many votes as previous voting cycles.[xviii] 2021 IECC established standards yielding the second biggest efficiency gain in the last decade for the IECC.[xix]

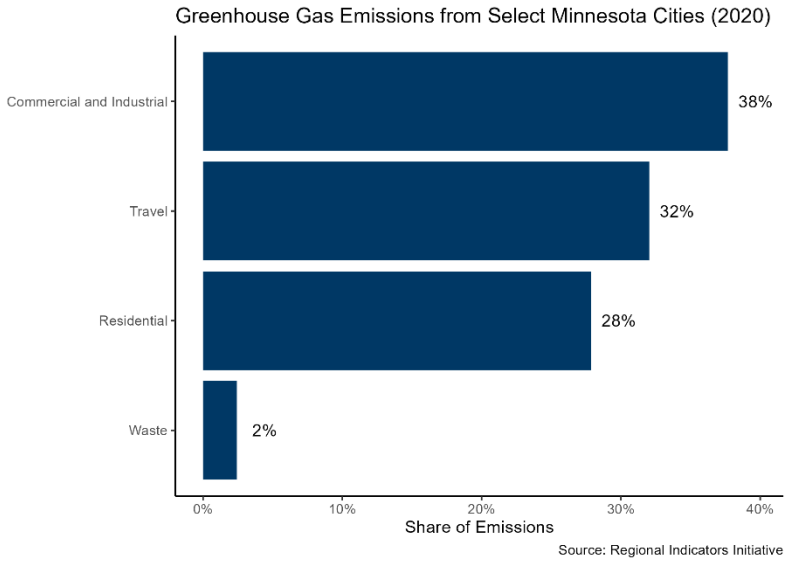

Figure 7-B: GHG Emissions in Minnesota Cities (2020)

Figure 7-B compares the percentages of GHGs from various sources in 20 Minnesota cities. Commercial and industrial buildings represent the largest source of GHGs, producing 38% of the total, with vehicles producing 32%, residential buildings 28%, and the remaining 2% emitted by waste products.

Source: Regional Indicators Initiative, 2022

Local Existing Building Policies

Local governments throughout Minnesota have enacted ordinances and implemented programs to increase existing building energy efficiency and renewable energy generation to meet city-wide energy or GHG reduction goals. Examples of such local programs and policies affecting existing buildings include:

- **Benchmarking Ordinances:** The Hennepin County Efficient Buildings Collaborative works with the county, cities, and building owners to perform energy benchmarking. The county program helps cities to adopt an energy benchmarking ordinance and develop and implement related programs and provides building owners assistance on how to benchmark their buildings. Participating cities include Rochester,

[17] See Chapter 2 for further information about PACE programs in Minnesota.

St. Louis Park, Bloomington, Edina, and St. Paul.[xx] These cities plan to transition their programs to the statewide benchmarking program over the next few years. Minneapolis also has a long-standing energy benchmarking program, and they plan to continue to operate their own program separate from the statewide benchmarking program.

- **Financial Programs:** The City of Minneapolis's Green Cost Share Program offers matching funds for commercial, industrial, multifamily, and single-family properties undertaking energy efficiency, solar, or innovative pollution reduction projects.[xxi]

- **Truth in Sale of Housing & Energy Disclosure:** The Minneapolis City Council in February 2019 enacted an ordinance to provide homeowners and prospective buyers with the general energy performance information of a home.[xxii]

See Chapter 2 for more information about community-led efforts to support energy efficiency and emissions reductions.

Building End Uses

Exploring how buildings use energy provides some insight into the overall energy trends seen at the state level. For residential buildings, the National Renewable Energy Lab (NREL) provides a set of estimates of the energy consumption of the residential building stock in each state through its ResStock analysis tool. While individual building use varies, the ResStock estimates provide a helpful look at how residential buildings as a whole in Minnesota use energy. Perhaps unsurprisingly, heating makes up roughly 72% of estimated residential energy use, with roughly 52% of total estimated energy use coming from heating with natural gas alone.[xxiii]

Aside from heating, NREL estimates that five additional end uses make up roughly 22% of residential energy use. Water heating makes up close to 11% of residential energy use (much of which is currently powered by

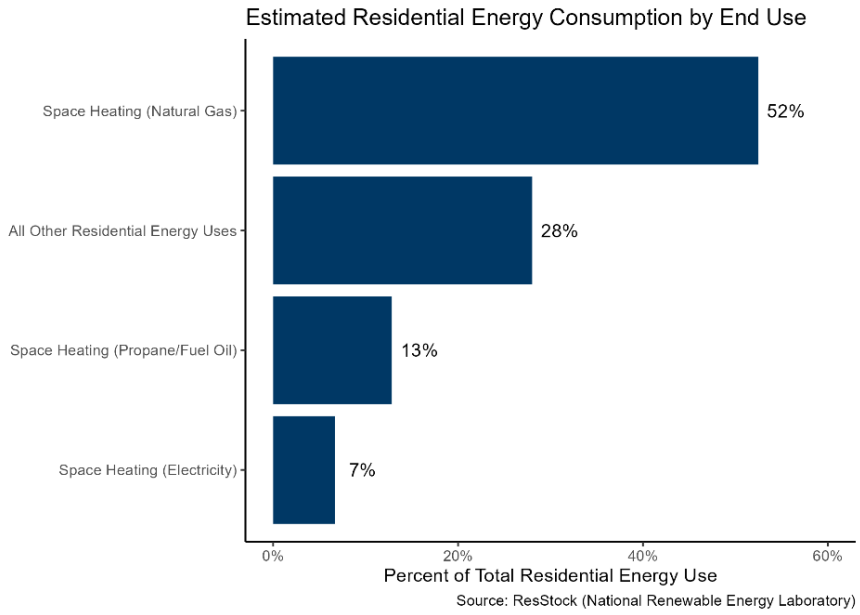

Figure 7-C: Estimated Residential Energy Consumption by End Use

Figure 7-C shows estimates of the share of energy use in Minnesota's residential buildings. Space heating, and particularly space heating with natural gas, makes up the bulk of residential energy use in the state.

Source: ResStock (U.S. DOE National Renewable Energy Laboratory)

natural gas), with plug loads, interior lighting, cooling, and refrigeration making up the other 11%.

Commercial buildings also devote much of their energy use to space heating (an estimated 45% of total commercial building energy use according to NREL's ComStock Analysis Tool), but there is more variety in commercial energy use. An estimated 19% of energy use in commercial buildings goes to equipment (this presumably differs depending on the enterprise), with an additional 27% of commercial energy use being devoted in near-equal parts to interior lighting, cooling, and running fans.[xxiv]

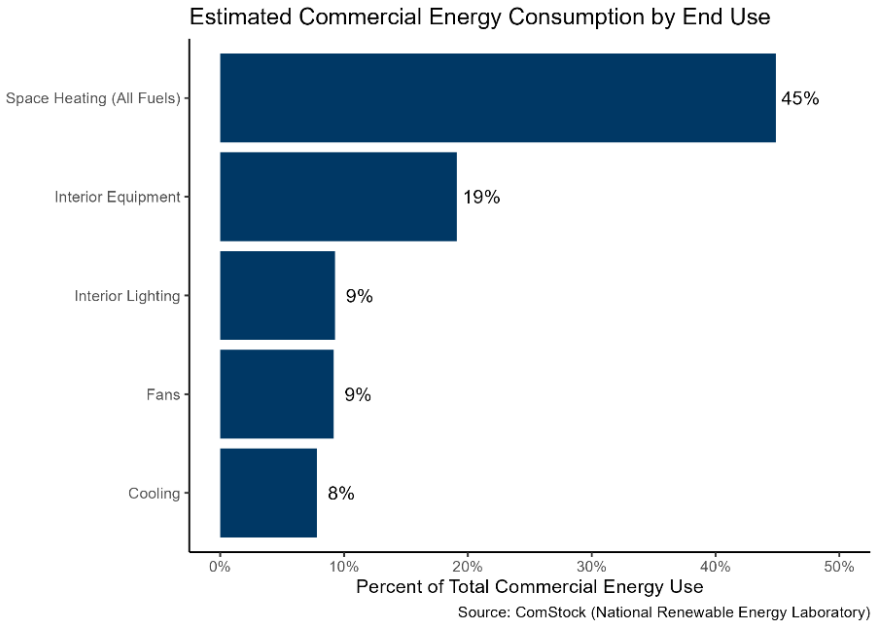

Figure 7-D: Estimated Commercial Energy Consumption by End Use

Figure 7-D estimates of the share of energy use in Minnesota's commercial buildings. Space heating is still the largest end use, but equipment, lighting, cooling, and fans all use large amounts of energy.

Source: ComStock (U.S. DOE National Renewable Energy Laboratory)

Recommendations for Commercial Building Energy Use

Building Performance Standards

In 2023, DOE awarded Commerce, DLI, and Center for Energy and the Environment a grant to explore creating a statewide building performance standard. A Building Performance Standard is a policy that aims to reduce energy use in buildings by setting performance targets, typically focusing on energy intensity and/or GHG emission reductions. Through the Resilient and Efficient Codes Implementation funding, the partnership received $5.3 million to conduct stakeholder outreach on a potential building performance standard, provide technical resources to support stretch code adoption efforts and conduct code compliance activities through outreach, trainings, and tool development in jurisdictions throughout the state.

The 2024 legislature considered a bill to adopt a statewide building performance standard, which would expand upon the new commercial and multifamily building benchmarking statute. Commerce and Center for Energy and the Environment submitted another proposal to DOE in April 2024 to create a technical resources hub for building owners and to conduct further stakeholder outreach to inform potential legislation.

Public Water System Energy Use

Opportunities for financing water infrastructure

Nationally, water and wastewater utilities typically use 35% of municipal energy budgets. Electricity costs make up a large portion of wastewater treatment plant (WWTP) operating budgets, typically 25 to 40%.[xxv] There are over 700 municipally-owned wastewater treatment facilities across Minnesota that need on-going operation and maintenance (O&M) in addition to investments in capital infrastructures to build and upgrade facilities to meet permit requirements and to minimize energy usage. The vast majority of these investments are funded by municipalities, but there are also state and federal financial assistance low-interest loans and grant programs, as described below.

Clean Water Revolving Fund

In Minnesota, many municipal wastewater and water treatment plants seek funding from Minnesota's Clean Water Revolving Fund (CWRF). The fund is managed by the Minnesota Public Facilities Authority (PFA), a multi-agency authority governed by a board consisting of commissioners representing the Minnesota Departments of Employment and Economic Development, Management and Budget, MPCA, Health, Agriculture, and Transportation.

The CWRF includes the Green Project Reserve that (GPR) may forgive up to 25% of loan principal up to $1 million if the project uses green infrastructure, water or energy efficiency or other environmental innovations.

PFA and MPCA staff jointly administer the wastewater and stormwater aspects of the CWRF, which provides below-market-rate loans and principal forgiveness to finance projects.[xxvi] The PFA is responsible for the financial elements of the program and the MPCA is responsible for its environmental and technical components.[xxvii] The PFA and the Minnesota Department of Health (MDH) administer the water treatment components of Minnesota's revolving fund, known as the Drinking Water Revolving Fund, which provides below-market-rate loans to upgrade and construct public drinking water systems.[xxviii] The CWRF includes the Green Project Reserve that (GPR) may forgive up to 25% of loan principal up to $1 million if the project uses green infrastructure, water or energy efficiency, or other environmental innovations.[xxix] All projects that receive CWRF funding must complete a comprehensive present-worth analysis of monetary and non-monetary elements, including but not limited to asset management, energy conservation, renewable energy, and water conservation. The MPCA developed processes for ensuring project cost-effectiveness and provides references and resource lists to support project planning and implementation.

Water Energy Nexus Retreat Action Plan

In August 2018, the National Governors Association Center for Best Practices hosted a Water Energy Nexus Retreat for the State of Minnesota. Local and national experts gave presentations and discussed water utility energy efficiency opportunities as well as constraints. Participants included state agencies, the University of Minnesota, cities or regional wastewater treatment plant organizations, and state water utility associations. The

retreat produced an action plan for four key strategy areas: policy, finance, technical assistance, and workforce development.

Sustainable Buildings 2030 WWTP Review

The University of Minnesota's Center for Sustainable Building Research, Commerce, and MPCA developed the B3 SB 2030 WWTP Review, an energy review process and set of minimum energy conservation measures that could be considered for applicable WWTP designs using tools established under Minn. Stat. § 216B.241. The review outlined a five-part compliance process, including:

- data entry into B3 Benchmarking and an energy audit of existing facility,
- documentation of energy conservation measures that were considered for inclusion in the project even if they are not implemented,
- anticipated performance metrics under several load conditions,
- evaluation of opportunities for renewable energy generation onsite, and
- evaluation of water savings potential.[xxx]

Through this process project engineers are expected to develop technical memoranda to document their energy efficiency and renewable energy reviews, and then submit that information to MPCA. In this way, MPCA can track the information to understand what energy efficiency and renewable energy decision-making is occurring during new construction of wastewater treatment plants as well as during major renovations.

Wastewater Treatment Plant Cohort Training Implementation Plan

Minnesota's public wastewater treatment plants, including small and mid-sized energy intense WWTPs, present opportunities for cost-effective energy efficiency and renewable energy projects. The Minnesota Technical Assistance Program (MnTAP) at the University of Minnesota helps businesses in the state prevent pollution, use resources efficiently and reduce energy use while reducing costs. MnTAP in 2018 completed a project supported by Commerce and MPCA to perform energy assessments at 11 mid-sized wastewater treatment facilities and recommended operational strategies. As a result of the study, WWTP facilities have implemented or plan to implement recommendations that will save more than four million kilowatt-hours (kWh) per year, out of the 5.5 million kWh of potential annual energy savings identified in the report.[xxxi]

Activities and Policies since 2020

Wastewater Treatment Plant Cohort Training Program

Building on the successful identification and implementation of operational energy efficiency improvements at mid-sized municipal WWTPs through MnTAP's previous work, a CIP CARD grant funded an energy market characterization and developed a cohort training program for WWTP operators to learn about and assess energy use at their facility and implement improvements.

The market characterization estimated the electricity consumption, the primary energy source for Minnesota wastewater treatment plants, of the 210 largest and most energy intensive WWTPs in the state. The characterization also looked at which facilities had staff or other resources to work on reducing energy use and

which did not. A cohort training program was developed for energy intensive WWTPs that lack staff resources for energy-reduction efforts. This training builds on the collaborative nature of the state's WWTP sector to help to create a culture of energy efficiency at these facilities.[xxxii]

Since 2019, MnTAP has trained over 40 wastewater professionals representing over 30 wastewater treatment facilities in the WWTP Cohort Energy Efficiency Training Program. To date, MnTAP's energy efficiency training program has resulted in the reduction of over 3.4 million kWh of energy use annually by Minnesota WWTPs through no and low-cost operational adjustments.

To date, MnTAP's energy efficiency training program has resulted in the reduction of over 3.4 million kWh of energy use annually by Minnesota WWTPs.

Large Wastewater Treatment Plants

The Sustainable Water Infrastructure of the Future Accelerator from DOE's Better Buildings initiative provided state, regional and local agencies with information and networking over three years to explore best-practice approaches in data management, technologies, and financing for WWTP energy efficiency and renewable energy. In Minnesota, the City of St. Cloud, Western Lake Superior Sanitary District, and Metropolitan ("Met") Council Environmental Services participated.[xxxiii] As of 2021, the Western Lake Superior Sanitary District reported a 24% reduction in purchased electricity compared to that baseline year of 2015.[xxxiv] In addition, the Western Lake Superior Sanitary District will complete a project in Fall 2024 to install three 850 kW biogas generators.[xxxv] The biogas project is anticipated to allow the facility to generate electricity to meet 35 to 50% of the facility's energy requirements.[xxxvi]

Met Council's Environmental Services division seeks to establish energy-improvement goals for its nine wastewater treatment plants as part of its 2022 Climate Action Work Plan.[xxxvii] Met Council has been coordinating with state agencies to meet the state energy and GHG reduction goals outlined in Executive Order (EO) 19-27: a 30% reduction of GHG emissions by 2025 relative to a 2005 calculated baseline and a 30% reduction in consumption of energy per square foot by 2027 relative to a 2017 adjusted baseline.[xxxviii]

Small Water and Wastewater Treatment Plants

The Minnesota Rural Water Association has continued providing technical assistance, training, and development support for rural water system owners. The association's energy efficiency technical advisor provides training and technical assistance to small municipal and non-municipal systems, rural water districts, and wastewater districts with populations under 10,000 to identify energy efficiency opportunities.[xxxix] This program has reduced energy use by a total of 6.7 million kWh in both water and wastewater systems since 2020.

Emerging Trends

Wastewater Treatment

As of 2024, there are more than 700 public wastewater treatment plants serving the majority of the state's population.[xl] Of these plants, 50% are pond systems. In general, pond systems, particularly non-aerated ones, are less energy intensive than mechanical systems.[xli] Secondary aeration systems for activated sludge treatment

are likely the largest source of energy use in a plant, representing 40 to 60% of total plant electricity.[xlii] The 210 largest and most energy intensive municipal wastewater treatment plants in Minnesota consume an estimated 388 million kWhs annually and are primarily powered by electricity. The six largest WWTPs in the state consume an estimated 64% of that electricity.[xliii]

Minnesota's wastewater treatment plants are aging. WWTPs in the state range from under 10 years old to more than 40 years old, but the majority are at least 20 years old.[xliv] This is demonstrated by an increase in CWRF requests and projects in the fundable range. Increasing use and awareness of the GPR through the SB 2030 process may be an opportunity for future energy work in the wastewater sector. Establishing SB 2030 guidance to promote right-sizing equipment and controls for both peak future wastewater loading and today's average wastewater loading could result in more new retrofits being eligible for the GPR while also saving on energy long term.

Based on recent needs surveys conducted by the U.S. Environmental Protection Agency (EPA), MDH, and MPCA, over the next 20 years Minnesota cities will need to invest an estimated $7 billion to support water treatment facilities and an estimated $6.5 billion to support wastewater treatment.[xlv] Given these numbers, it's clear that there will continue to be many projects with substantial costs each year that will affect their energy profile in the future. Having a healthy clean water revolving fund in place ensures that municipalities will be able to financially accommodate changes in effluent limits and the need to implement new technologies to reduce pollutants and decrease energy use into the future.

Based on recent needs surveys conducted by MDH, MPCA, and the U.S. EPA, over the next 20 years Minnesota cities will need to invest over $13 billion to support water and wastewater treatment facilities.

Facilities are becoming more receptive to technical assistance outreach and considering energy efficiency projects to include in their facility development plans in an effort to control costs while meeting new requirements.

Decisions made now will have impacts on energy consumption over the coming decades.

Transportation

In the context of the state's *Energy Policy and Conservation* quadrennial report, transportation stands as a critical component of Minnesota's infrastructure and economic vitality. However, the reliance on traditional fossil fuels like gasoline, diesel, and propane has raised concerns regarding environmental sustainability and energy security.

In the last few years, Minnesota has been in the process of adopting cleaner transportation technologies. Notably, electric vehicles (EVs) are increasingly becoming a more prevalent aspect of the state's transportation landscape. This section delves into Minnesota's transition towards cleaner transportation solutions with a particular focus on the rise of electric vehicles and examining their impact, challenges, and the state's strategies to promote their adoption and integration into the transportation system.

Light-Duty Vehicles

According to the DOE's history of electric vehicles, electric cars were some of the first personal vehicles developed in the late 19th and early 20th centuries. In fact, electric vehicles were so popular that in 1900, they made up about a third of all cars on the road.[xlvi] As cars powered by gasoline became cheaper, electric vehicles faded from use until the beginning of the 21st century, when a renewed interest in reducing transportation emissions restarted the electric vehicle market.

In Minnesota, electric vehicles have been registered with model years as far back as 1997, according to the Minnesota Public Utility Commission's data.[xlvii] As of January 13, 2024, more than 50,000 EVs were registered in Minnesota.[xlviii] Increasing adoption of EVs have been bolstered by state and local policies and programs, including the statewide adoption of Clean Cars MN standards, state and federal investments in charging infrastructure, state incentives such as the EV rebates and EV auto sealer grants passed by the Minnesota Legislature in 2023, and the regional public-private partnership offering electric vehicle carsharing in the Twin Cities.

As of January 13, 2024, more than 50,000 EVs were registered in Minnesota.

Clean Cars Minnesota

Clean Cars Minnesota is the name given to vehicle emissions standards adopted in Minnesota in 2021. The federal Clean Air Act allows states to either follow the default federal vehicle emissions standards or adopt the more stringent standards developed by California. Accordingly, in 2021 Minnesota went through rulemaking procedures to adopt the more stringent California standards. Clean Cars MN includes two standards:

1. The low-emission vehicles standard requires vehicle manufacturers to deliver cleaner liquid-fuel vehicles to Minnesota.
2. The zero-emissions vehicle standard requires manufacturers to increasingly deliver EVs to Minnesota.

A voluntary early action credit system encouraged early delivery of EVs to Minnesota for model years 2022–2024. The regulatory mechanism begins in model year 2025, which began in January 2024. The zero-emissions vehicle rule uses a credit-based system to require vehicle manufacturers to deliver EVs as part of an increasing

percentage of their overall deliveries for sale within the state. California recently adopted new clean cars standards which begin in model year 2026 and run through model year 2035. Minnesota has not affirmatively adopted these new standards, so the state will revert to federal standards beginning in model year 2026. The adoption of Clean Cars MN supported increased EV availability in Minnesota both in number and variety, as well as raising the profile of Minnesota as a leader of EV policy and investment in the Midwest.

State Electric Vehicle Incentives

In the 2023 legislative session, as part of the Climate and Energy Omnibus, the Minnesota Legislature passed a consumer EV rebate program. The program, launched on February 7, 2024, provides rebates to Minnesota residents who have purchased or leased, for 24 months or longer, an eligible EV. Qualifying vehicles may be new or used, with new vehicles being eligible for a higher rebate amount than used vehicles. The rebate statute included a manufacturer's suggested retail price (MSRP) cap for eligible new vehicles, as well as a purchase price cap for eligible used vehicles. To qualify, vehicles must be either electric or plug-in hybrid, purchased or leased on or after May 25, 2023, and titled in Minnesota. Over $14M was allocated for the program and applications are still ongoing as of May 2024. As of May 31, 2024, over $5M in rebates has been distributed to recipients, and over $8M in funds is reserved but not yet disbursed to recipients. As of May 31, 2024, less than $500,000 in rebates is still available to be applied for.

In 2023 the legislature also passed a grant program to assist automobile dealers under franchise from an EV manufacturer with the costs of training employees and outfitting the dealership for EV sales. Eligible costs for reimbursement include training and certification of employees and purchase and installation of equipment to service and repair EVs. As of January 31, 2024, the dollar amount in grant applications far exceeded the 2023 allocation by the legislature for this program; therefore, the grant application portal was closed.[xlix]

Electric Vehicle Carsharing

In 2021 Twin Cities-based nonprofit carsharing organization HOURCAR partnered with the City of St. Paul and the City of Minneapolis to provide Evie, the largest fleet of all-electric carsharing vehicles in the U.S. As discussed further in the following section about EV charging infrastructure, this program was developed as part of the EV Spot Network, which is placing Level 2 and DC fast charging locations across St. Paul and Minneapolis. Studies have shown that carshare programs reduce the energy usage of the transportation sector by reducing vehicle miles traveled.[l] Electric carshare programs also help shift the fuel used by transportation away from gas and diesel, toward electricity. According to HOURCAR's 2023 Annual Report, Evie is powered by 100% renewable energy, and in the first year of service 2,637 Evie users drove over 675,000 miles, which the organization estimates represents a two thousand ton reduction in GHG emissions.[li] The program's partnership between public and private entities has allowed lower cost rates for low-income Minnesotans, allowing people to use EVs that could have otherwise been unable to afford it.

Medium- and Heavy-Duty Vehicles

Before 2020, the adoption of electric medium- and heavy-duty electric vehicles in the state of Minnesota was gaining momentum, although at a slower pace compared to light-duty vehicles, such as passenger cars and small

trucks. Efforts to promote the deployment of medium- and heavy-duty EVs across the U.S. were gaining traction. For example, the Volkswagen settlement Fund allocates funding to support the deployment of cleaner medium- and heavy-duty vehicles and equipment.

As a part of Minnesota's plan to mitigate the environmental impacts of fossil fuels, various local governments, businesses, and organizations are exploring the feasibility of integrating medium- and heavy-duty EVs into their fleets to reduce emissions and operating costs. Challenges, such as higher upfront costs, limited charging infrastructure, and concerns about range in Minnesota's notably cold winter climate, hinder the widespread adoption of medium- and heavy-duty EVs. Despite these challenges stakeholders continue to advocate for policies and incentives to accelerate the transition to clear transportation technologies, including medium- and heavy-duty EVs in the state.

A noteworthy example is the Duluth Transit Authority, which has been actively exploring and implementing electric bus technology as part of its efforts to reduce GHG emissions and improve air quality in the region. Since 2018 the Duluth Transit Authority, with funding from the Federal Transit Administration's Low or No Emissions Grant Program, started operating a fleet of seven battery-electric buses and charging infrastructure.[lii]

The electric buses in Duluth are equipped with advanced battery technology and can travel extensive distances on a single charge. These buses not only reduce emissions but also offer quieter and smoother rides for passengers. The deployment of electric buses in Duluth aligns with the city's broader goals of promoting environmental sustainability and reducing its carbon footprint. It also serves as a model for other cities, transit agencies in Minnesota and across the U.S., showcasing the feasibility and benefits of electrifying public transportation.

Other upcoming projects such as Rochester's Link aims to use 60-foot electric buses to form a rapid transit system connecting the Mayo Clinic, the University of Minnesota Rochester, and transit-oriented developments in the area.[liii]

The Minnesota Department of Transportation (MnDOT)'s Office of Transit and Active Transportation is currently collaborating with six rural transit agencies to electrify their existing transit fleets. The funds for these projects were awarded through the 2021 MnDOT Clean Transportation Pilot Program and 2022 Low or No Emissions Discretionary Grant Program from the federal government, aiming to provide funding for alternative fueling for transit systems. MnDOT is assisting these sites to procure electric Class 400 cutaway buses and install charging equipment and infrastructure and providing workforce training when needed.

Six rural Minnesota cities are working with MnDOT to electrify their existing transit fleets in 2024 and 2025.

At the end of the 2024 calendar year two Minnesota cities, Morris and Virginia, will receive their buses and infrastructure, making them the first rural sites in MN to have electric public transit. The other four participating cities—Le Sueur, New Ulm, Fairmont, and Owatonna—will receive their buses and charging infrastructure in 2025. MnDOT will be working diligently to ensure success at these six sites, as their example could serve as a catalyst for other rural transit agencies to invest in EVs for their future bus fleets.

Electrifying Minnesota's School Buses

School buses are a valuable candidate for electrification because of the health benefits associated with replacing aging and more-polluting buses, particularly for children. As of 2022, there are over 2,000 school buses in the state,[liv] so electrifying all of them requires a variety of funding sources and programs. Luckily there are a number of programs available in Minnesota that allow a school or district to access cleaner school buses, including EPA's Clean School Buses Rebate and Grant programs, the MPCA's Volkswagen settlement funds, and the upcoming Commerce Electric School Bus Grant program.

The EPA's Clean School Bus (CSB) program began in 2022 with over $5 billion in funding across five years "to replace existing school buses with zero-emission and low-emission models."[lv] The EPA CSB program provides rebates on EVs, operates a grant competition, and develops technical assistance and educational resources.[lvi] Only two public school districts in Minnesota have received rebates from the CSB program in 2022. Official announcement for the awardees of the 2023 rebate program were not yet available in April 2024.

Since 2019 the MPCA has been spending Minnesota's share of the Volkswagen settlement funds ($50 million). The goal of the Volkswagen settlement is to reduce emissions of nitrogen oxides across the state. As of late 2023, there have been two phases of funding distribution, and phase three will begin in spring of 2024. Part of the funding has been used for grants to replace high polluting vehicles with cleaner versions, such as electric school buses and heavy-duty EVs. Since the first phase of funding there have been 16 electric school buses awarded and a third phase of $2.1 million for electric school buses will be forthcoming. Funding for 23 electric heavy-duty vehicles has been awarded so far, with $2.8 million more available in phase three.

Another program created by the Minnesota Legislature in 2023 also provides grants to assist with the adoption of electric school buses in Minnesota's school districts. Though the program is not yet launched, grants awarded by the program are anticipated to be used to purchase electric school buses or convert fossil-fuel-powered buses to be powered by electricity, as well as deploying charging infrastructure to power those buses.

The MPCA also distributes grant funding through the Diesel Emissions Reduction Act (DERA) program to fund off-road clean diesel projects in Minnesota. The DERA program reduces diesel emissions from older diesel engines to improve air quality and public health. The grants are funded by the EPA National Clean Diesel Campaign for clean diesel activities in Minnesota and by the Volkswagen settlement. Since 2019 there have been six rounds of DERA funding with more to come.

Charging Infrastructure

According to the DOE, public chargers started being installed in Minnesota in 2011.[lvii] As of March 2024, there are 1,973 public ports for electric vehicle charging in Minnesota.[lviii] These ports span the three levels of charging: Level 1, Level 2, and Direct Current Fast Charging (DCFC). The U.S. Department of Transportation provides an overview of the differences between these levels of charging.[lix]

Level 2 chargers are the most prominent kind of public charging in Minnesota, accounting for about 75% of all public charging ports in the state, because they provide faster charging than Level 1 but don't cost nearly as

	Level 1	Level 2	DC Fast Charging
Connector Type	J1772 connector 	J1772 connector  J3400 connector 	CCS connector  CHAdeMO connector  J3400 connector 
Typical Power Output	1 kW	7 kW - 19 kW	50 - 350 kW
Estimated Light-Duty PHEV Charge Time from Empty[18]	5 - 6 hours	1 - 2 hours	N/A
Estimated Light-Duty BEV Charge Time from Empty[19]	40 - 50 hours	4 - 10 hours	20 minutes - 1 hour[203]
Estimated Electric Range per Hour of Charging	2 - 5 miles	10 - 20 miles	180 - 240 miles
Typical Locations	Home	Home, Workplace, and Public	Public

Figure 7-E: Overview of EV chargers: power output, plug type, and charge time for light-duty vehicles

Source: Adapted from the Alternative Fuels Data Center [lx]

[18] Assuming an 8-kWh battery; most plug-in hybrids do not work with fast chargers.
[19] Assuming a 60-kWh battery.
[20] To 80% charge.

much to build as DCFC. DCFC, can easily cost upward of $100,000 per port to install, due to the infrastructure needs associated with the high-power output needed to charge so fast.[lxi] By contrast, a single port of a Level 2 charger is usually around $4-6,000, not including installation costs.

As of March 2024, there are 1,973 public EV charging ports in Minnesota, of which about 75% are Level 2 chargers.

Minnesota has increased the amount of infrastructure available to EV users in the last three to four years. Some of these programs include the Twin Cities' EV Spot Network, using Volkswagen settlement funds for grants to support the development of charging stations, and state planning for the National Electric Vehicle Infrastructure Formula Program.

A 2023 update to Minn. Stat. § 326B.106 requires DLI to include electric vehicle charging facilities in the state building code for all commercial buildings that have associated parking and for all residential buildings containing four or more dwelling units and have associated parking. These charging facilities will allow Minnesotans to charge their electric passenger vehicles at home and at work. The rules are currently under consideration by technical advisory groups and will be incorporated into the Minnesota Building Code in 2026. Similar language was introduced in the 2024 legislative session but was not incorporated into statute. However, code change proposals through rulemaking are in process within technical advisory groups to facilitate the installation of electric vehicle charging equipment into all residential buildings.

EV Spot Network

In 2021, the cities of St. Paul and Minneapolis partnered with the American Lung Association, East Metro Strong, HOURCAR, and Xcel Energy to develop the EV Spot Network, a "series of 70 renewably-powered curbside EV Spot Charging locations within Saint Paul and Minneapolis that offer public access to the new all-electric Evie carshare service and the EV spot electric charging stations."[lxii] Each of the 70 spot charging locations will have two dedicated parking and charging spaces for Evie Carshare (discussed in greater detail in the light-duty vehicles section above), and two charging spaces for personally owned vehicles of residents. The majority of these charging locations are equipped with Level 2 chargers, while a select few sites have DCFC. Construction on these chargers continues into 2024, when the final nine locations will be constructed.[lxiii] This program demonstrates an innovative approach to simultaneously providing charging and electric vehicle access to residents of the Twin Cities Metro area in a way that could become a national model.

Grant Support

As described previously, since 2019 the MPCA has been utilizing part of Minnesota's share of the Volkswagen settlement funds ($50 million) to build out charging infrastructure. So far there have been two phases of funding distribution, with phase three set to begin in spring of 2024. The first two phases of funding included several grant rounds, totaling about $5 million, to install EV chargers including DC fast chargers and Level 2 chargers. An additional $2.1 million will become available in phase three.

National Electric Vehicle Infrastructure (NEVI)

The National Electric Vehicle Infrastructure (NEVI) Formula program provides funds to states to build a convenient, affordable, reliable, and equitable fast charging network for EVs across the U.S. Over five years

(federal fiscal years 2022 through 2026), Minnesota anticipates receiving and investing about $68 million from the NEVI Formula program. MnDOT is responsible for administering the NEVI Formula program funds in Minnesota. The funds must first be used to build out a state's Alternative Fuel Corridors (AFCs) with fast charging stations, as described in Federal Highway Administration's Final National Electric Vehicle Infrastructure Standards and Requirements. In Minnesota, the AFCs for EV Charging are Interstate 94 (I-94) and Interstate 35 (I-35).

Key requirements of the AFCs include that stations:

- Are located no more than 50 miles apart along the AFC
- Are located less than one mile driving distance from the AFC Exit
- Have a minimum of four 150 kW charging ports able to operate simultaneously
- Are open to the public 24 hours a day, seven days a week with no entry fee to access the chargers

Third party entities will construct, own, operate, and maintain the stations for five years, and they will not be in the MnDOT right-of-way. MnDOT issued a Request for Proposals for the first round of stations (up to 18 locations) in December 2023 and is reviewing and scoring applications in early 2024. Conditional awards are expected to be announced in 2024. This network of stations will help Minnesotans and travelers from other parts of the country confidently travel using EVs, and it is anticipated to help increase the rate of EV adoption.

Looking forward

As EVs become more plentiful in the future, they will require more electricity from the grid to keep active, which could have implications for grid reliability and peak load times. California has a statute requiring the California Energy Commission to publish a biennial report on the charging needs associated with meeting the state's goal of five million EVs on the road by 2030.[lxiv] In that report staff project the amount of electricity needed to support those vehicles and when that electricity would be pulled from the grid to the vehicle under a variety of policy scenarios. A similar report could help the State of Minnesota assess what grid reliability implications there are to consider for the widespread adoption of electric vehicles. Understanding the impact of different policy scenarios on vehicle charging peak load would be especially valuable as the state moves toward more time sensitive electricity resources through the 100% clean electricity by 2040 goal.

Potential policy scenarios are especially important when considering how to build out charging infrastructure, especially DCFC, which has increased vehicle charging speed by requiring more power. NREL has been working on technology to increase the power of DCFC to as high as 350 kW, enabling rapid vehicle charging speeds for light-, medium-, and heavy-duty electric vehicles.[lxv] These chargers require specialized electric infrastructure to support that amount of power and can have large impacts on the grid—connecting just one DCFC charger can have the equivalent impact of adding 3,200 U.S. homes to the grid.[lxvi] While most EVs on the road can only accept up to 150 kW at a time, developments in both vehicle and charging infrastructure technology mean that these higher-powered extreme fast chargers could become an important part of the charging network in the future.[lxvii]

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Appendix 1

Verbal questions received during the June 12, 2024, public meeting:

Question	Response
When Commerce talks about water conservation within the report, is it mostly about saving the energy used for water treatment and pumping, or is trying to conserve scarce water resources also discussed? There are many states that are focused on lack of water—or simply not having it; does the report talk about those climate constraints? Asked about current view and future view.	The public water energy use section of the 2024 report (in Chapter 7) focuses on energy savings from drinking and wastewater treatment. Commerce appreciates that conserving water also limits the energy needed to treat it, so the Energy Conservation and Optimization (ECO) program works with utilities to encourage ratepayer water conservation. This is discussed briefly in Chapter 6 of the 2024 report. Commerce will continue working with partners to find ways to support energy conservation through water conservation.
Is Commerce considering the energy use of data mining, data centers, and AI?	The 2024 report does not include these energy consumers, but they came up in discussion while drafting the report and Commerce anticipates they may feature in the 2028 report.
How much does Commerce work with and guide local jurisdictions/municipalities with energy codes and ordinances? Municipalities often require energy assessments, but the commenter would prefer to see a focus on implementation and action rather than doing studies and assessments (would also like to see consistent measures across the state versus monitoring and measures set by each locality).	Statewide energy codes are managed by the Minnesota Department of Labor and Industry and apply to new construction and qualifying renovations. In Minnesota local jurisdictions are prohibited from enacting their own building codes; rather, they can set goals, define zoning, provide incentives, and are often delegated authority for building inspections. Working toward increased code compliance is one option for locals to have greater impact. Additionally, some federal funding will go toward code compliance and training for inspectors and plan reviewers. For existing buildings, the new statewide benchmarking law requires more commercial and multifamily buildings to monitor energy data and potentially make energy efficiency improvements—see Chapter 7 for more details. Commerce recommends the commenter work with their legislators if they would like to see Minnesota go beyond benchmarking to a building performance standard (energy targets) for existing buildings.

When will the Quad report be published?	As close to 7/1/2024 as possible.
Will public feedback and comments be published?	At the time of the meeting Commerce wasn't sure how comments would be shared. When interest was expressed in seeing them, this Appendix was added.

Written comments on the draft report emailed on 6/12/2024:

Comment	Action
On page 3, "Anne Sell" should go after "Michael Schmitz"	Revised.
Please consider adding a table of contents to help readers navigate the chapters / sections.	Added.
The caption for Figure 5-QQ should be corrected as follows: "Figure 5-QQ shows forecasted ~~electricity~~ gas use for all customers in Minnesota through ~~2037~~ 2027."	Revised.
On the 6th page of Chapter 6, the first paragraph is missing a couple important details: • WAP eligibility is based on the greater of 200% of the federal poverty income guidelines or eligibility for EAP, which is currently restricted to households below 50% of state median income. The underlined/red portions of the previous sentence are missing from the report.	Revised.
On the 6th page of Chapter 6, the first paragraph is missing a couple important details: • In addition to utilities often using the EAP/WAP income guidelines for ECO low-income programs, the COMM also now allows utilities to use geographic eligibility methods. For an overview of geographic eligibility methods, please see p. 8, Geographic Proxy Methods, in the following COMM guidance document: https://mn.gov/commerce-stat/pdfs/low-income-in-mf-bldgs-15Mar2022.pdf	Added.
On the 17th page of Chapter 6, the penultimate paragraph misstates the American Rescue Plan Act of 2021 as the American Rescue Plan Act of 2012.	Revised.
Could you please revise the last paragraph on the 21st page of Chapter 6? We recognize that this section is on WAP and CAP agencies, but without mentioning the role of utilities working with WAP/CAP in the metro area, then at minimum this part seems misleading to a reader, "The prevalence of natural gas heating in urban areas contributed to the high deferral rate, as declining natural gas prices have made it more difficult for weatherization investments to meet the required SIR." This might be true to some extent given how the CAP agency accounts for their deferral statistics, but most projects/measures failing the SIR in CenterPoint Energy's metro	Removed the sentence in question.

territory (it is likely similar for Xcel Energy) are covered by our energy efficiency programs, which are not subject to cost-effectiveness requirement. In fact, one of several reasons this partnership exists is to combine funding sources to complete as many energy efficiency measures as possible in a home with WAP and utility program funds. To the extent that these projects might be considered a “deferral,” the weatherization work is likely being completed. Until recently, deferrals related to the non-energy barriers were a real reason energy efficiency measures were not completed in a home. It could also be noted in this section that in addition to the legislative appropriation, utilities can also now cover these costs through their energy efficiency programs as well.	