

Minnesota Interconnection Progress

May 19, 2025 | i2X DER Interconnection Webinar

Speed Dating: Faster Connections Between Customer Resources and Utility Grids

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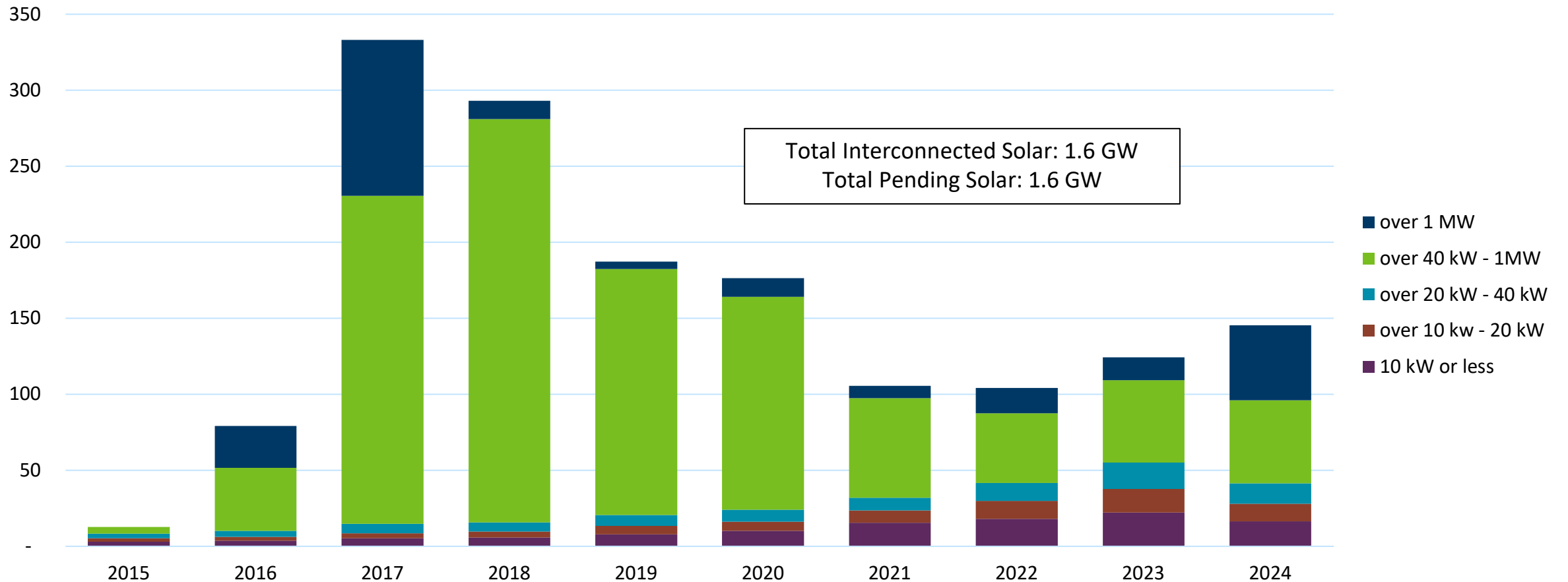
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The ideas expressed are the views of the presenters, and not the Minnesota Public Utilities Commission.

Minnesota Distributed Solar Snapshot

Minnesota Annual Distributed Solar Additions (MWac)



Interconnection Standards

- Historically, worked from interconnection standards set in 2004
- Very popular Community Solar Garden (CSG) legislation (2013) as well as small DER adoption prompted the need to modernize standards
- Distributed Generation Workgroup (DGWG) established in 2017 to create modern interconnection standards and processes
- Led to 2019/2020 Commission Orders approving the MN DIP and MN TIIR (MN DER Interconnection Process and Technical Interconnection and Interoperability Requirements)
- MN DIP broadly based on FERC SGIP (Small Generator Interconnection Procedures)
- DGWG ordered to continue refining interconnection process as need arises

MN DIP Initial Timeline

2017	PHASE I In-Person Topics	2018	PHASE II Web Meeting Topics
June 2	Pre-app report; Application requirements; Queue type & process; Material Modification Definition; Fast Track; Site Control	March 23	Scope/Overview; Inventory of Definitions to Discuss
July 28	Definitions; Transmission Provider's role; Engineering screens; Study process; process timelines/extensions; dispute resolution	April 13	Performance Categories; Response in Normal and Abnormal Conditions; MISO Bulk Power System
Sept 15	Insurance; Disconnect Switch; metering; Commissioning/inspection, testing, authorization; Design, procure, install, construct facilities/upgrades; advanced inverters	May 18	Reactive Power and Voltage/Power Control Performance; Protection Requirements
Nov 3	Interconnection Agreement; process for updating; Transition issues; any outstanding issues	June 8	Energy Storage; Non-export; Inadvertent export; Limited export
Dec 1	Webinar for feedback on some of the draft staff recommendations and descriptions of outstanding issues	Aug 24	Interoperability (Monitor and Control Criteria); Metering; Cyber security
		Sept 14	Test and Verification; Witness Test Protocol
		Sept 21	Full Day In Person to Revisit and Reconcile Edits
		Oct 3	References; Definitions; 1-line diagram requirements; Agreements

MN DIP Impact on Interconnection

Pre-Application Report

•Allows Interconnection Customer more detail about a specific location before submitting an application

Queue

Assigns capacity and organizes interconnection application requests for transparency and efficiency

Simplified Process

Expedites and streamlines interconnection process for smaller projects; incorporates Uniform Statewide Contract where appropriate

Fast Track Process

Expedited review option for projects under 500 kW and some projects under 5 MW

Updated Engineering Screens

Initial review screens for Simplified and Fast Track based on FERC SGIP updated with input from DGWG, NREL, & EPRI

MN DIP Impact on Interconnection

DER Modifications

- Clarifies what constitutes a major modification, identifies when new application is required (including for existing DER.)

Timelines

- Establishes timeframes for utility & customer. Option to withdraw an application for failure to meet deadline or request extension.

Electronic Submission

- Allows customer to submit applications & materials electronically. Enables electronic signatures and payment at utility discretion.

Application Agent

- Allows customer to identify someone to coordinate with the utility on details of the application/interconnection process.

Updates Fees & Study Deposits

- Establishes application fee caps based on DER capacity and type of review. Requires study deposits in advance.

Other improvements

- Recognize Distributed Energy Resources, including storage, which parallel with utility grid. Clarifies DER capacity is in AC not DC.
- 40 annual applications threshold for publishing queue.

Technical Interconnection and Interoperability Requirements (TIIR)

Interim Implementation

- Until IEEE 1547-2018 certified equipment is readily available, allows DER that meet IEEE 1547-2003. Utility and DER may agree to use UL 1741 SA settings.

IEEE 1547-2018

- Statewide TIIR addresses issues identified in IEEE 1547-2018: Performance categories, voltage and frequency ride-through, advanced inverter voltage regulation modes enabled/disabled, interoperability capabilities. TIIR addresses issues not in IEEE 1547-2018; such as, metering, protection requirements, signage/labeling.

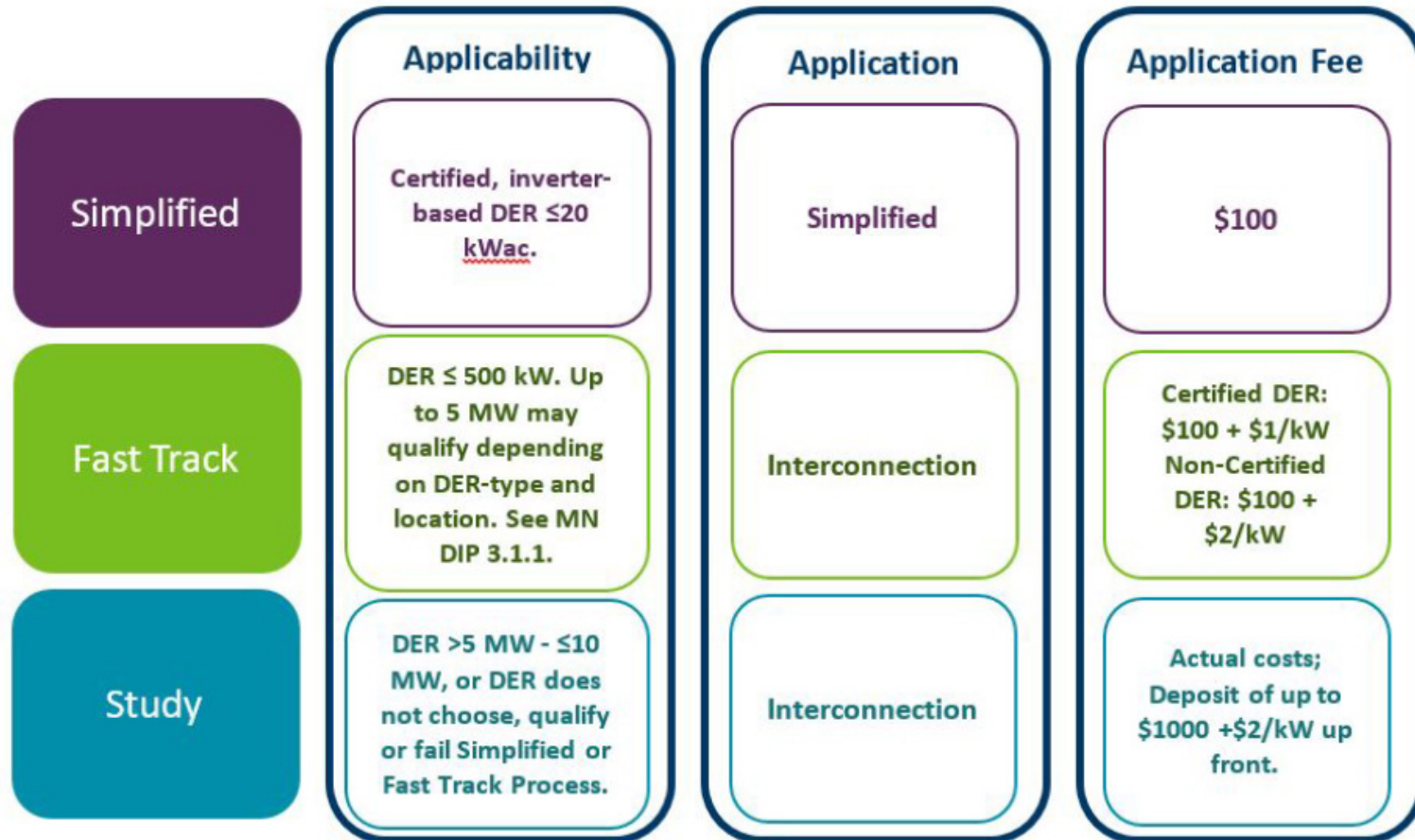
Utility Technical Specification Manuals

- Utilities' TSMs accessible to potential interconnection customers. Rate-regulated filed with Commission and published online.

Remaining Issues

- Energy storage control modes; Power control Systems (export); Volt-Var regulation; Volt-Watt regulation unintended curtailments; operating agreement details.

Overview of MNDIP – Process Tracks



Several Steps to take in each Track

Simplified Track (no facilities upgrades)

- 9-11 steps, each with maximum due dates
- ~83-93 maximum business days, 30-40 days are from customer-side of process

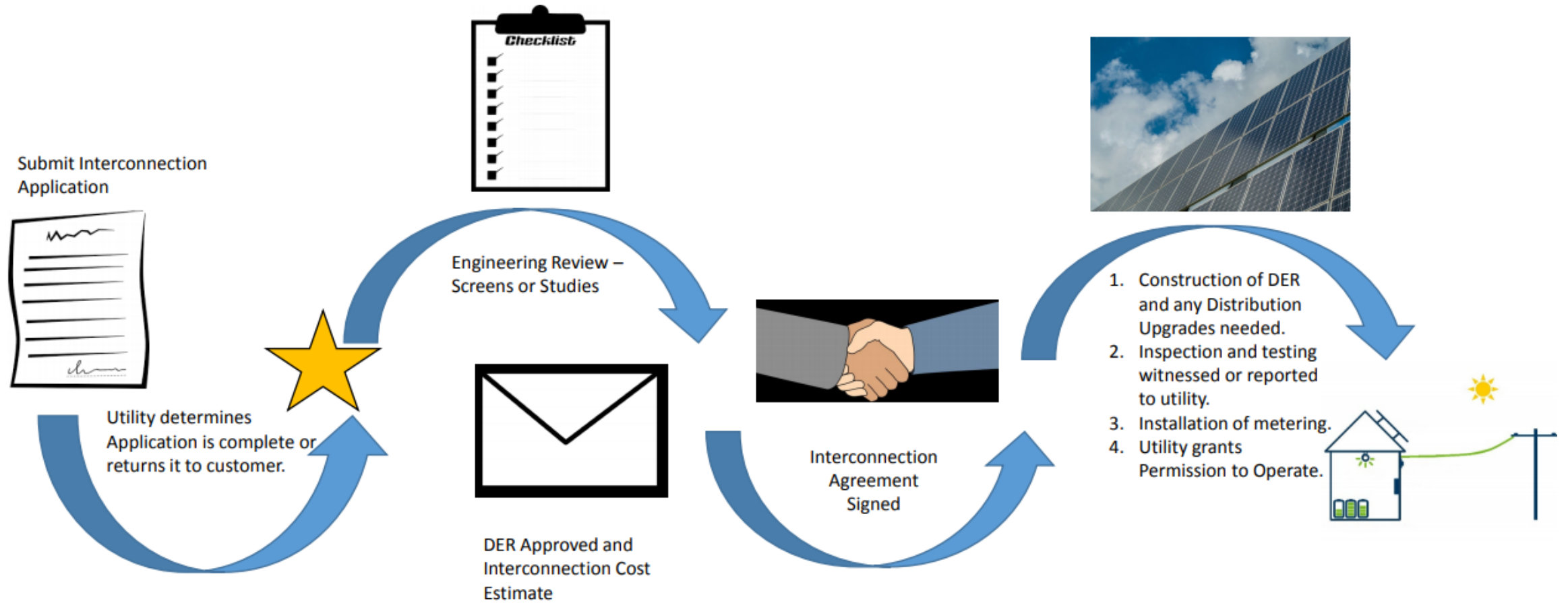
Fast Track* (no facilities upgrades/study need)

- ~11-15 steps
- ~98-153 business days
- Range includes supplemental review

Study Track*

- Several more steps
- Often, System Impact Study required
- Can add ~170 days to process if facilities and transmission study required also

MN DIP Process Overview



For a full flow chart of the Minnesota Distributed Energy Resource Interconnection Process (MN DIP), see Attachment 8 to the MN DIP.

- Try to get a comprehensive representation of the DG space
- Includes utilities, cooperatives, municipals, small and large DG industry, renewable and technical advocates (e.g. IREC)
- Emphasis on technical expertise – engineers the primary representative
- Has evolved overtime - as various developer groups leave, newer, more involved groups are brought in

DGWWG Purpose

- To respond to interconnection issues, opportunities, or changing landscape
- Specifically, to explore topics more thoroughly and more efficiently than a more rigid, formal process like Notice of Comment Periods
- Ultimately lead to DGWWG recommendations to Commission (for consensus items)
- For complex topics, goal is to find consensus where it exists and to clearly identify differences of opinions
 - Leads to a more informative and useful formal record development; makes decision making less complex

DGWG Norms and Process

- Norms and expectations
 - Strong emphasis on civility, honesty, clear communication
 - Parties come prepared and willing to participate
 - Discussions not a part of any formal record
- Creation of Subgroups
 - May create subgroups to tackle specific topics of interest; produce reports
 - Often, a "Technical Subgroup" is created for technical and complex items
 - Advanced inverters, unintentional islanding screens, etc.

DGWWG Outputs/Successes

- Creation of the MN DIP and TIIR
- Reports that led to Commission Orders to better the interconnection process:
 - Parallel Processing – small DER studied in parallel with larger DER
 - Semi-Parallel Processing – larger DER studied earlier when project ahead finishes SIS
 - Small DER Cost Sharing Fund – 40kW and under projects collectively pay for secondary upgrades as needed, up to \$15k
 - Cluster Studies – 3-8 larger DERs studied in a group and collectively pay for upgrades

DGWG Outputs/Successes

- Transition to IEEE 1547-2018 advanced inverters
 - DGWG discussed which specifications (e.g. volt-VAR, volt-watt) to use and when the inverters had adequate market proliferation before making the inverters a requirements
- New screens for Unintentional Islanding
- Ongoing:
 - How to process small scale storage and non-export systems
 - Flexible Interconnection
 - Affected System Studies (transmission studies of potential DER impacts)

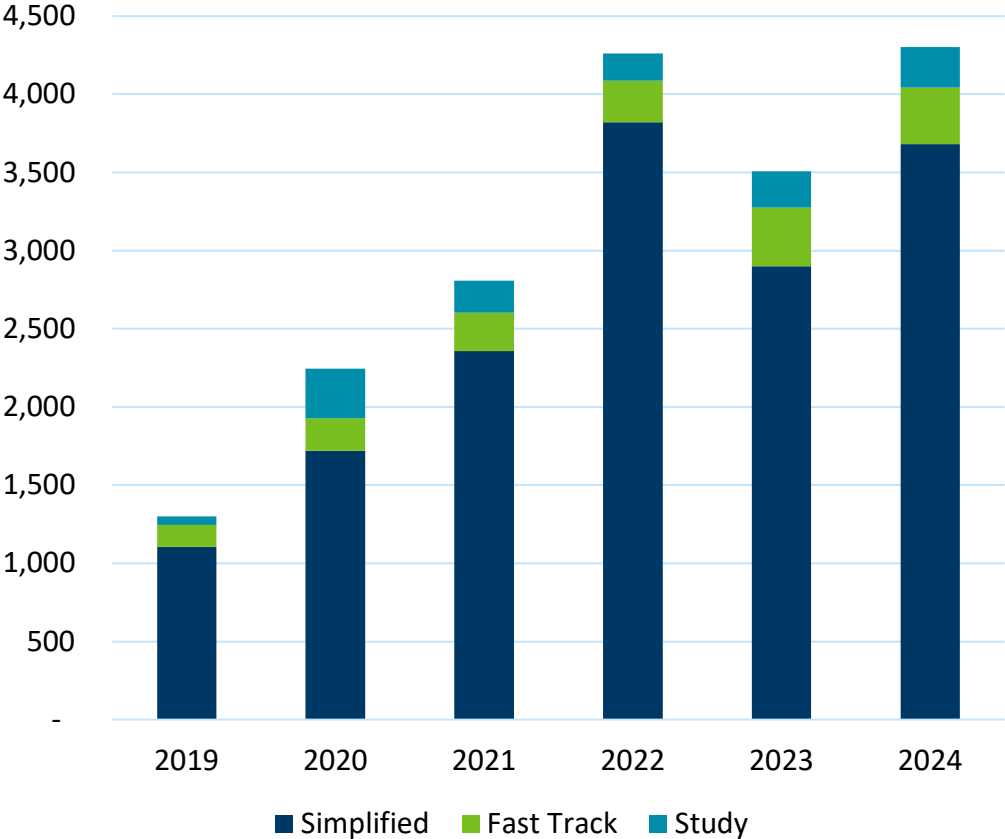
Interconnection Update Takeaways

- Identify a well-balanced workgroup or informal group of individuals from utilities, DER industry, and consumer advocates.
- Establish a clear process (scope and timeframe) that grounds recommendations in guiding principles and facts.
- Encourage shared learning and include Commission.
- Keep in mind future proofing versus driving specific outcomes.
- Engage outside expertise in a transparent way.
- Delineate what is interconnection/technical versus other policy considerations

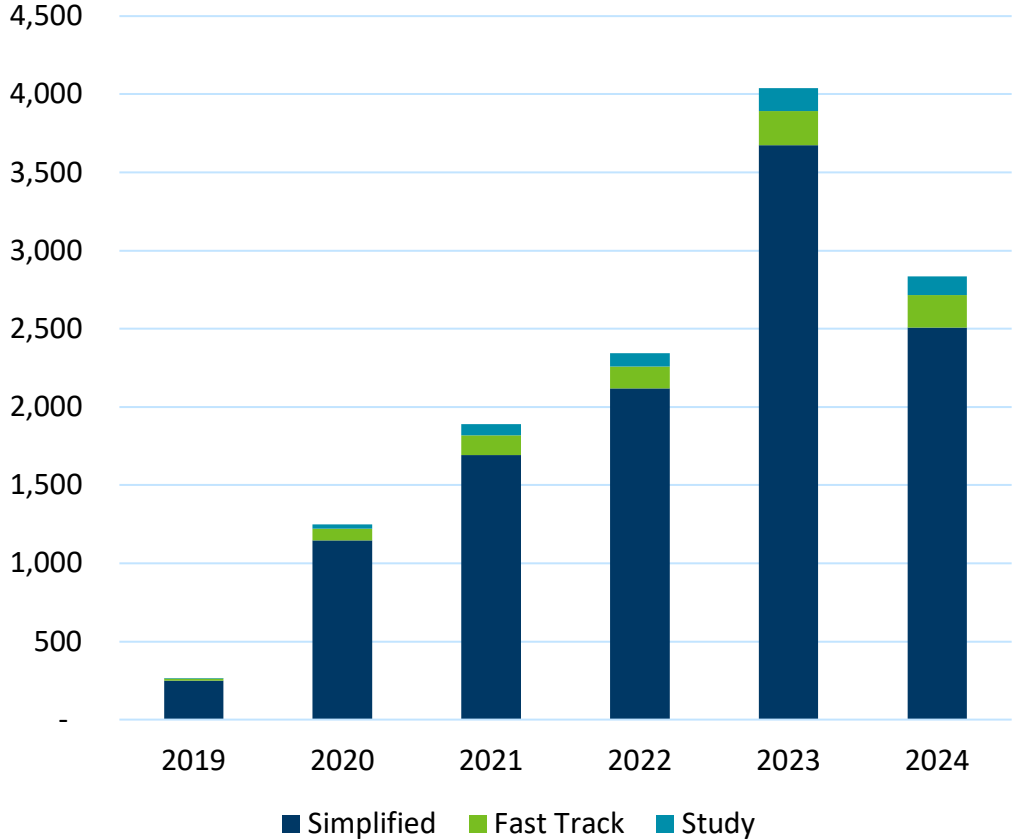
MN DIP data and results

Applications and Interconnections Under MNDIP

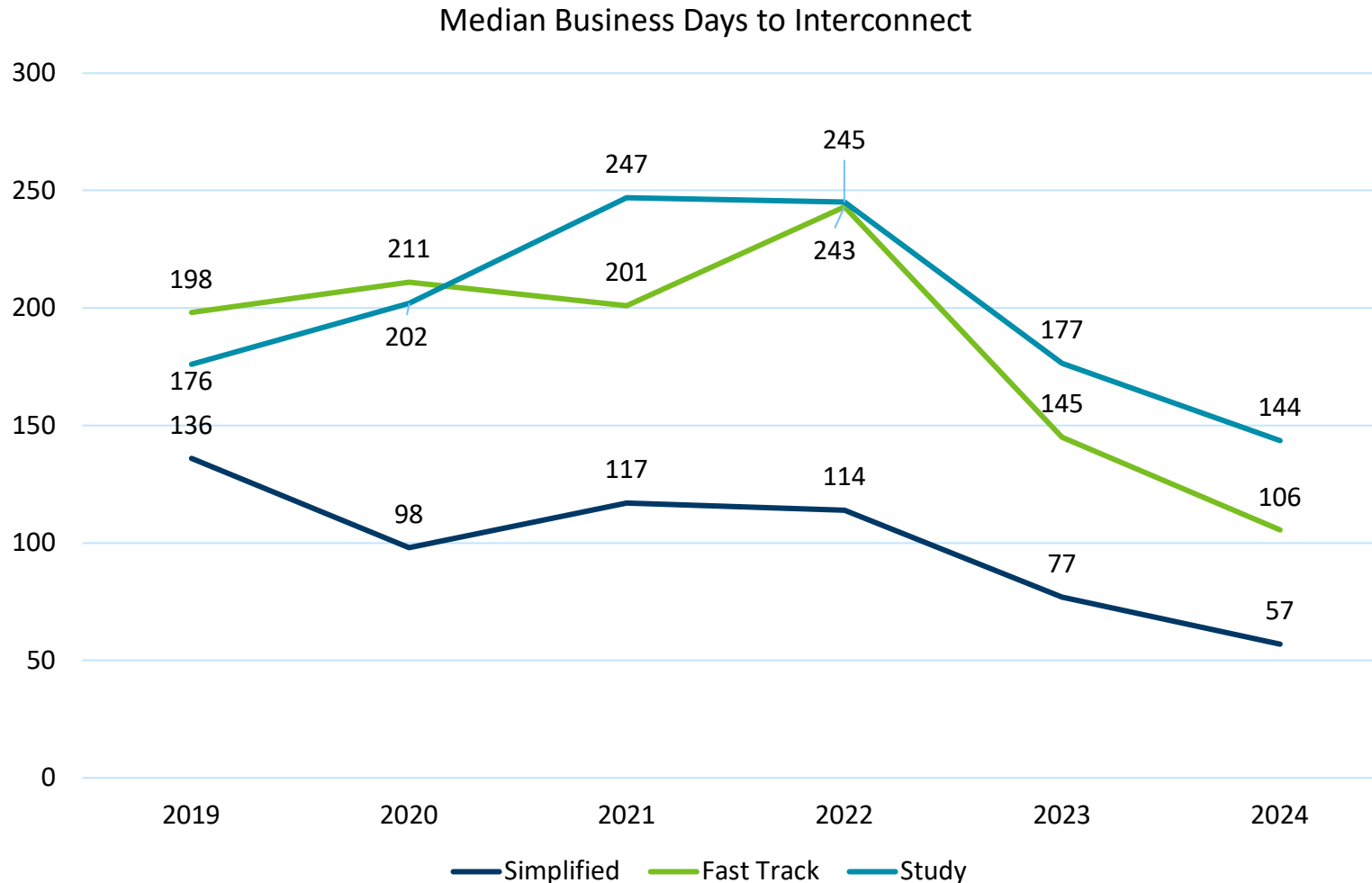
of Annual Applications Under MNDIP



of Annual Interconnections Under MN DIP

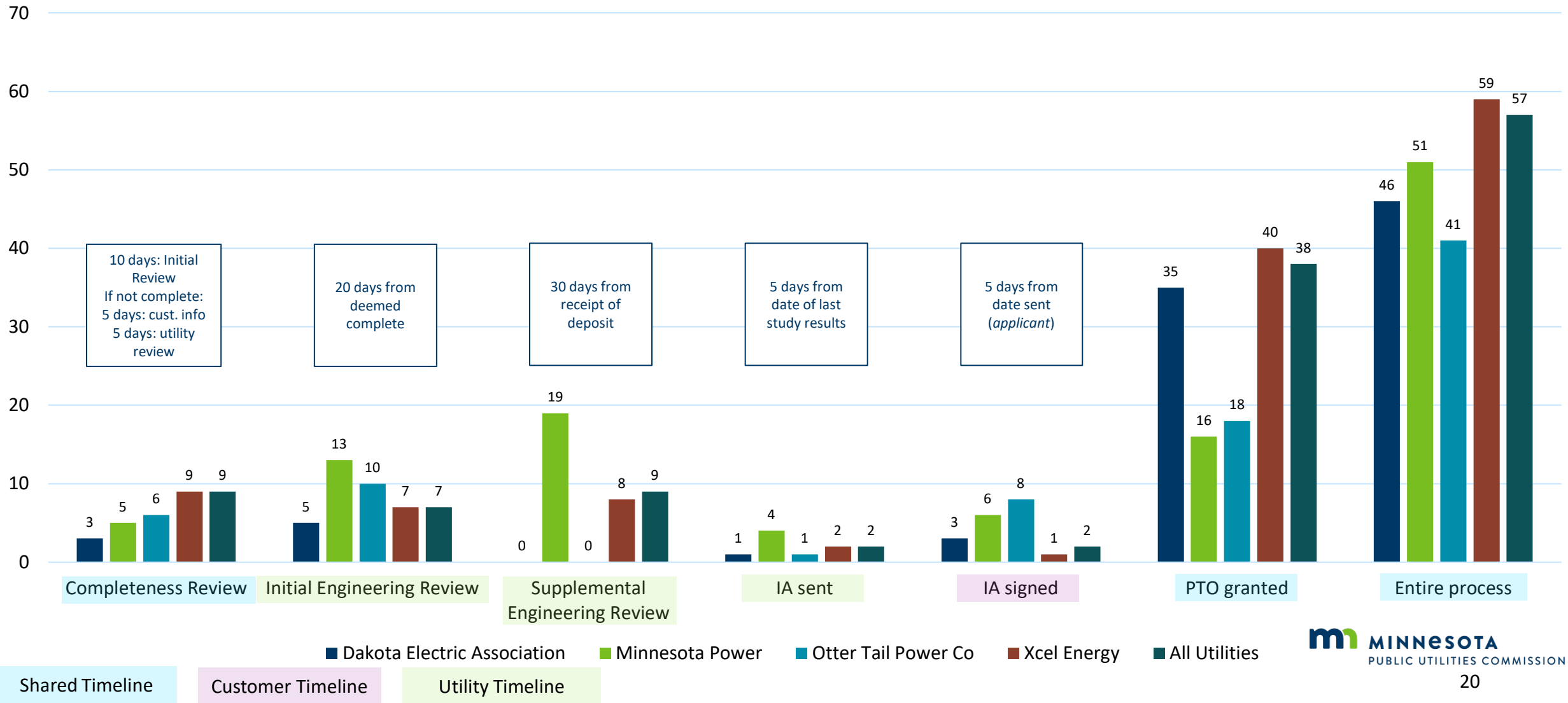


Days to Interconnect



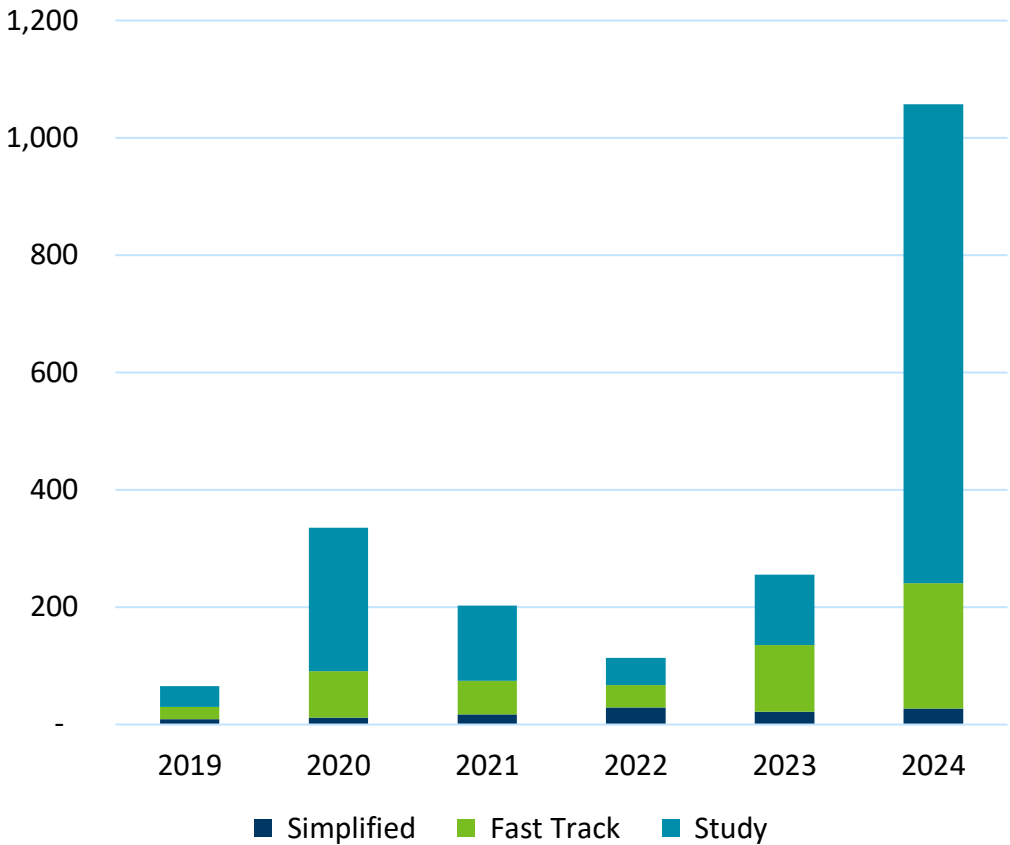
- Includes all utilities
- Time from “Deemed Complete” to “Permission to Operate”
- Includes construction time for facilities
- Faster times to interconnect across all processes:
 - 58% - Simplified
 - 47% - Fast Track
 - 18% - Study

Comparison of 2024 Simplified Process (Median Business Days)

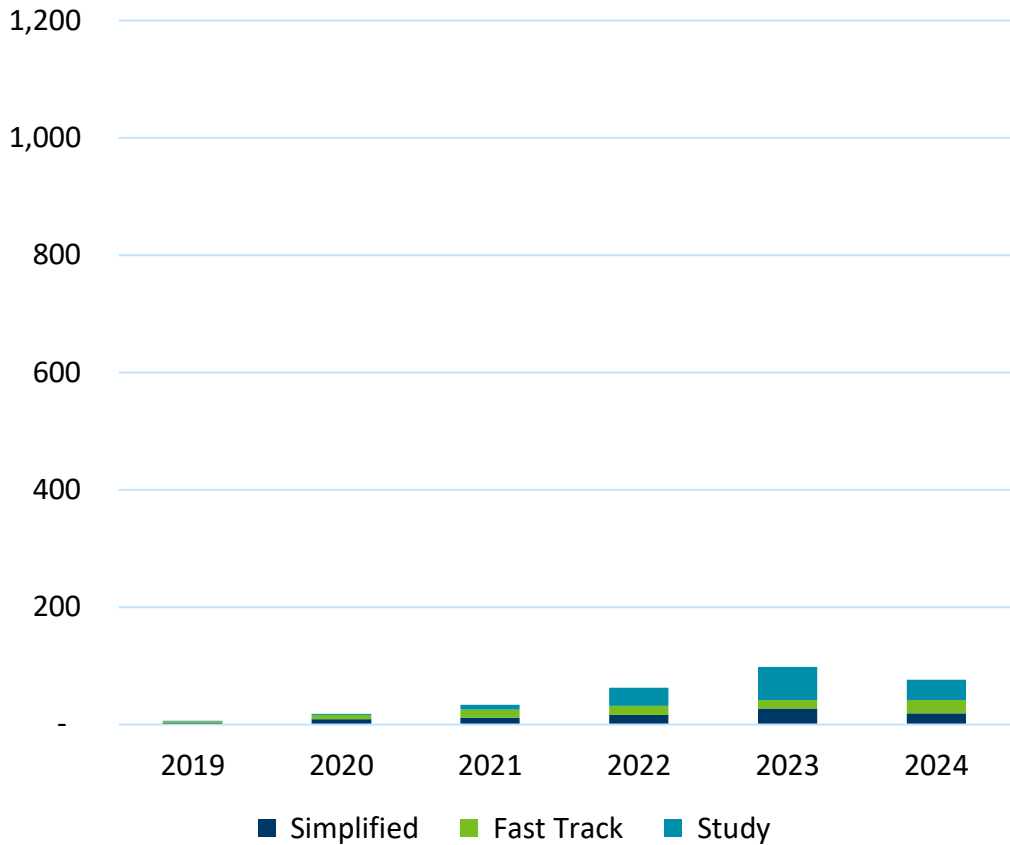


Applications and Interconnections Under MNDIP

MW of Annual Applications Under MNDIP

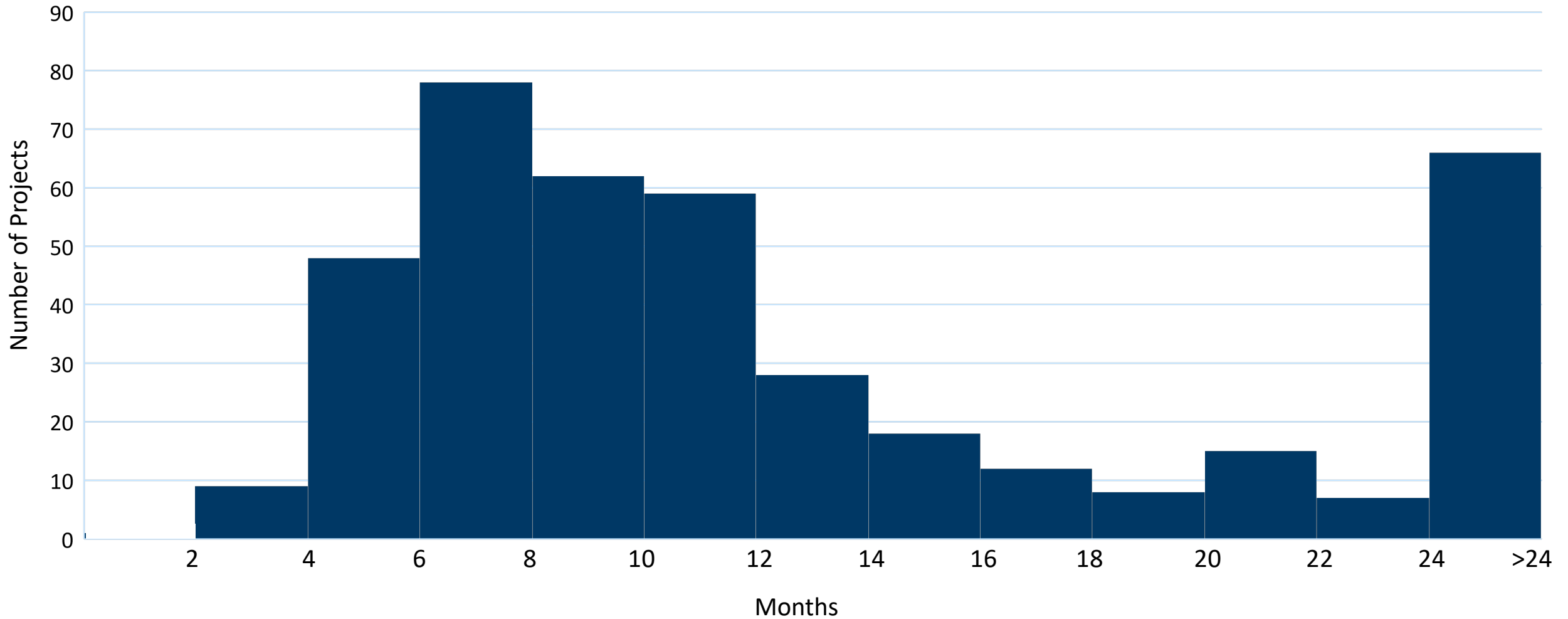


MW of Annual Interconnections Under MNDIP

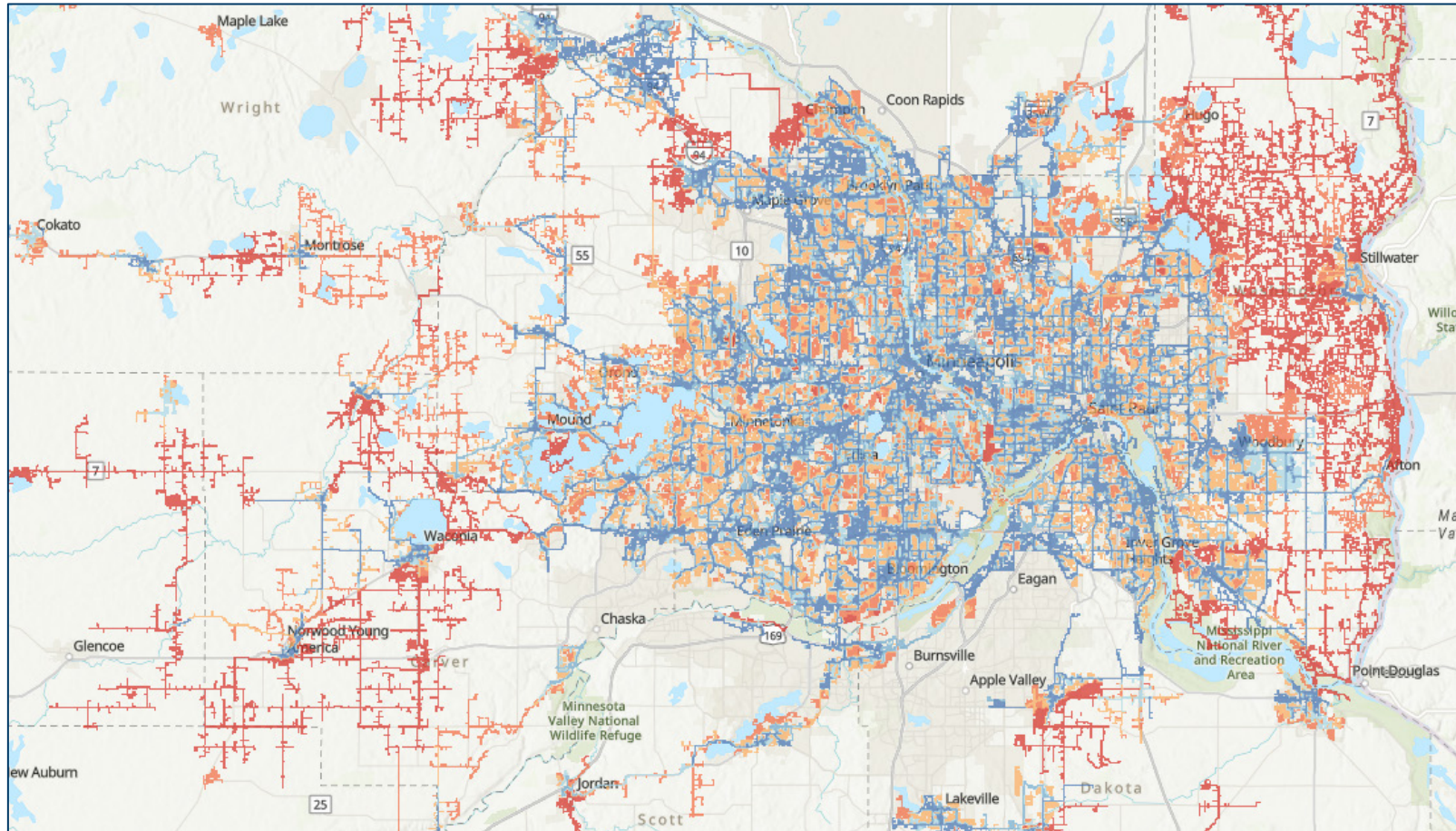


Distribution: Length of Time for Study Process

(Xcel Energy)

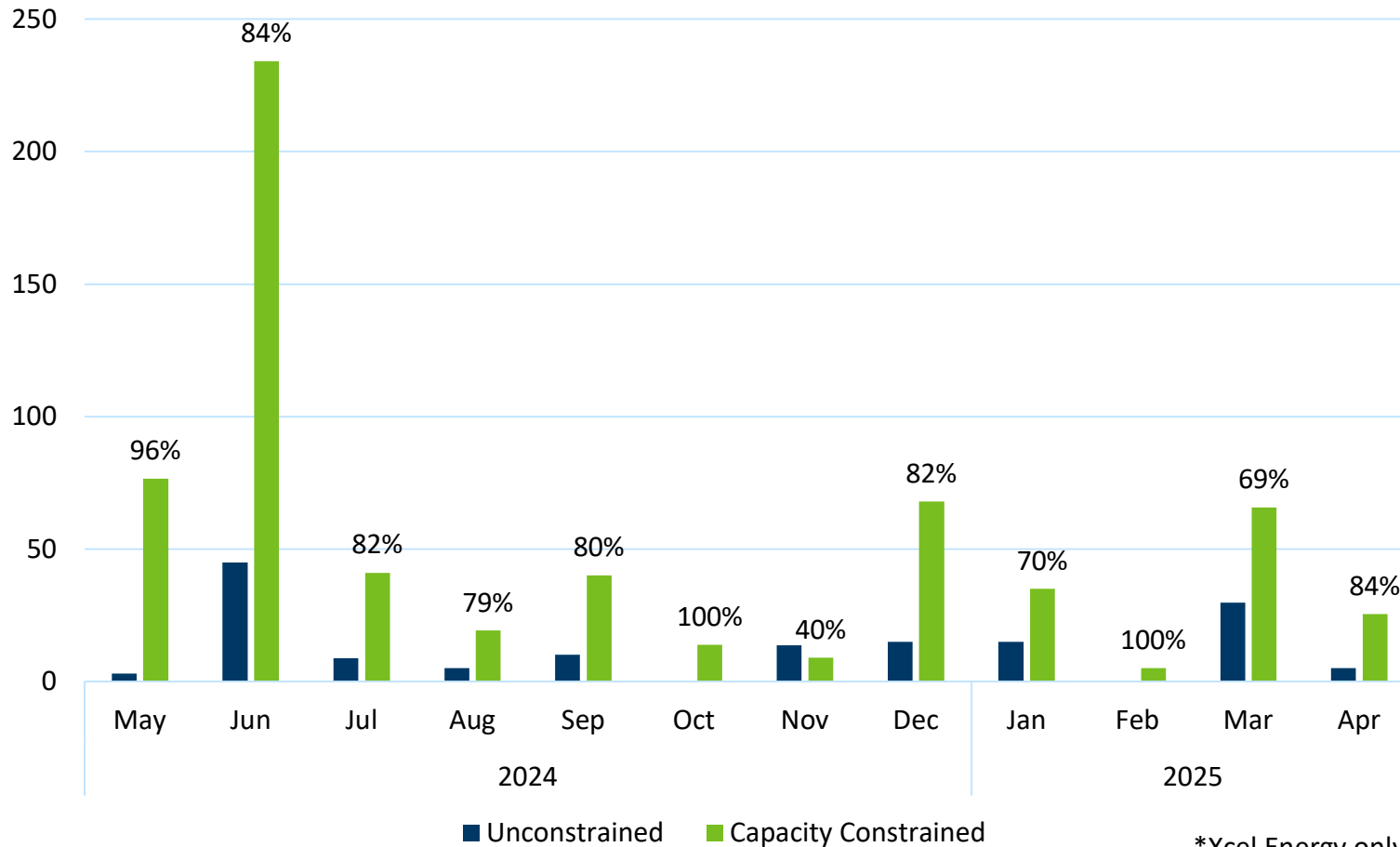


Distribution System Congestion



Applications in Constrained Areas – Study Process

MW of Applications in the Study Process*

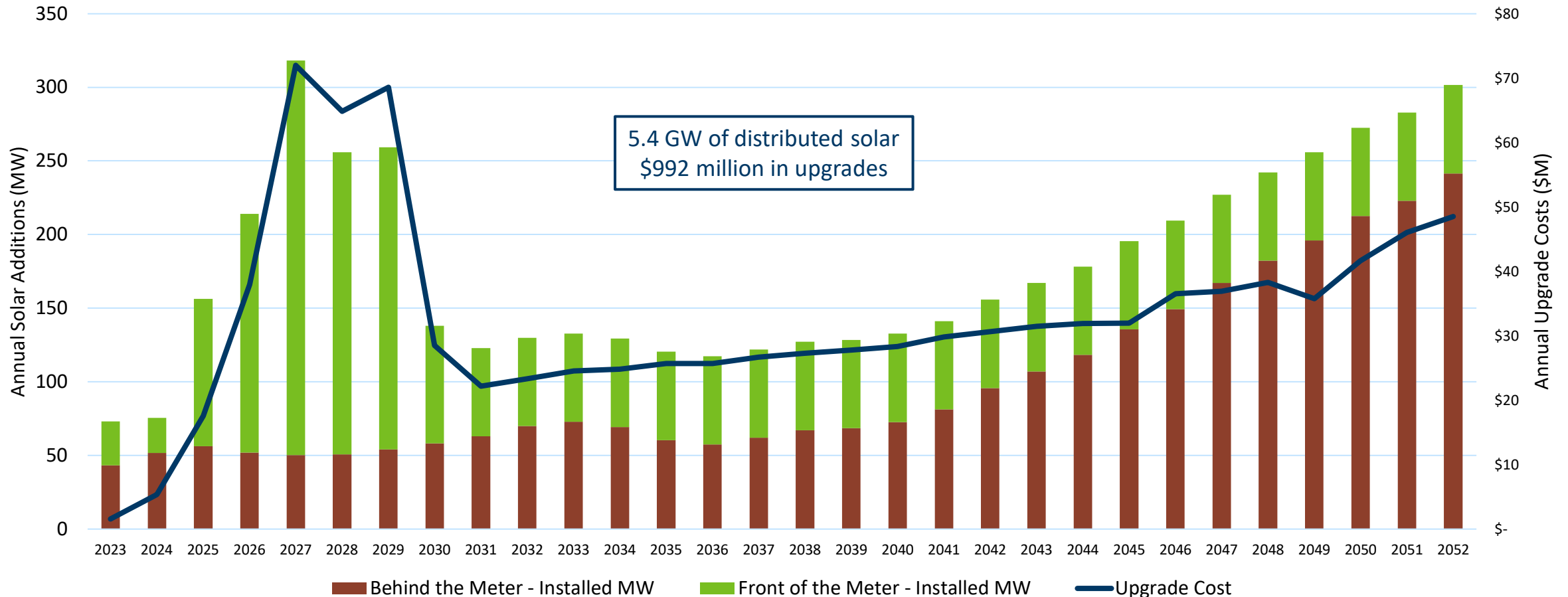


89% of the capacity of applications in the Study Process in constrained areas over the past year

*Xcel Energy only

Increasing DERs and electrification

Annual Forecasted Distributed Solar Additions and Estimated System Upgrade Costs for Xcel Energy



Integrated Distribution Planning Objectives

The Commission is facilitating comprehensive, coordinated, transparent, integrated distribution plans to:

1. Maintain and enhance the safety, security, reliability, and resilience of the electricity grid, at fair and reasonable costs, consistent with the state's energy policies;
2. Enable greater customer engagement, empowerment, and options for energy services;
3. Move toward the creation of efficient, cost-effective, accessible grid platforms for new products, new services, and opportunities for adoption of new distributed technologies,
4. Ensure optimized utilization of electricity grid assets and resources to minimize total system costs, and,
5. Provide the Commission with the information necessary to understand Xcel Energy's short-term and long-term distribution system plans, the costs and benefits of specific investments, and a comprehensive analysis of ratepayer cost and value.

Cost Allocation and Upgrades Framework

	Proactive Upgrades	Reactive Upgrades
Shared Cost Allocation	<ul style="list-style-type: none"> • Build distribution budgets around DER and electrification forecasts. • Assign incremental infrastructure costs via typical class cost allocation methods, e.g., in next rate case. • Benefits customers adopting DER and electrification by reducing or eliminating wait time and cost of interconnection. • Risks include deploying assets that are not used and useful if forecasts are not accurate, the potential for shifting costs of upgrades onto non-benefitting customers, and risk of inequitable investments. 	<ul style="list-style-type: none"> • Grid upgrades are made in response to individual customer requests. • Costs assigned via typical class cost allocation methods, e.g., in the next rate case. • Benefits customers adopting DER and electrification by eliminating the cost of interconnection; benefits ratepayers by ensuring upgrades are used and useful. • Risks include continued wait-times in the interconnection process, the potential for shifting costs of upgrades onto non-benefitting customers, and risk of inequitable investments.
Individually Allocated Costs	<ul style="list-style-type: none"> • Build distribution budgets around DER and electrification forecasts. • Individual customers, where appropriate, pay a fee to cover their share of the upgrade at time of interconnection. • Benefits customers adopting DER and electrification by reducing or eliminating wait times for interconnection; benefits ratepayers by reducing the costs of upgrades via reimbursement over time. • Risks include deploying assets that are not used and useful if forecasts are not accurate, and the potential for shifting costs of upgrades onto non-benefitting customers if forecasts or reimbursement fees are not accurate. 	<ul style="list-style-type: none"> • Grid upgrades are made in response to individual customer requests. • Individual customers, where appropriate, pay a fee to cover their share of the upgrade at time of interconnection. • For the most part the model in place today • Benefit is ensuring upgrades are used and useful. • Risks include wait time and interconnection costs for DER and electrification customers.

Proactive and Reactive Upgrade Frameworks

Reactive Distribution Upgrades

- Docket 24-288
- Legislatively initiated
- Customer driven upgrades
- Upgrades made *after* customers indicate interest

Proactive Distribution Upgrades

- Docket 24-318
- Commission initiated
- Forecast driven upgrades
- Upgrades made *before* specific customer indicate interest

Thank You!

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