

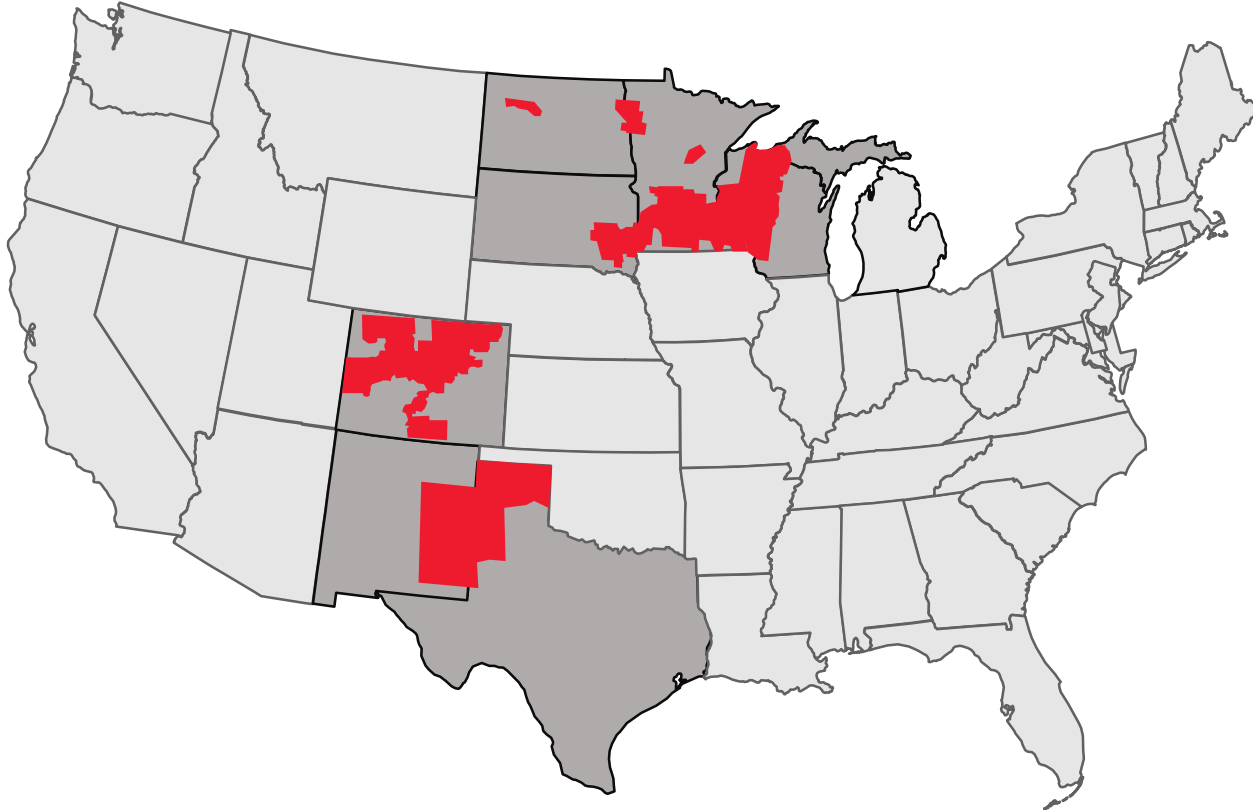


INTEGRATED DISTRIBUTION PLANNING AT NORTHERN STATES POWER COMPANY – MINNESOTA

Jody Londo | Regulatory Policy Manager

May 13, 2022

Xcel Energy



Serving eight states

3.7 million electricity customers

2.1 million natural gas customers

Nationally recognized leader:

Wind energy

Energy efficiency

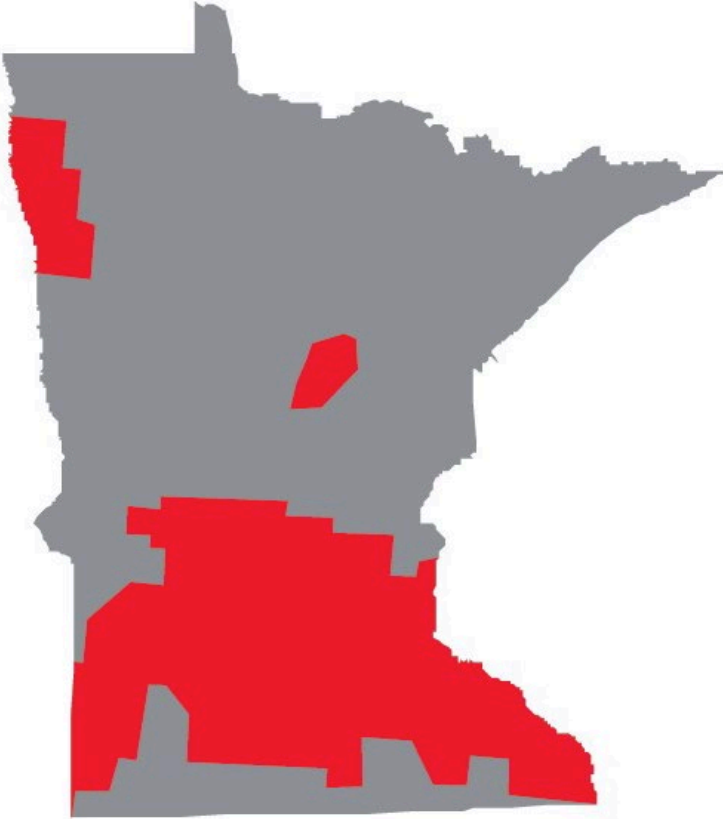
Carbon emissions reductions

Innovative technology

Storm restoration

2020 Data

Powering Minnesota



**1.3 million
Electric
Customers**



**472,000
Natural Gas
Customers**



**99.9%
Electric
Reliability**

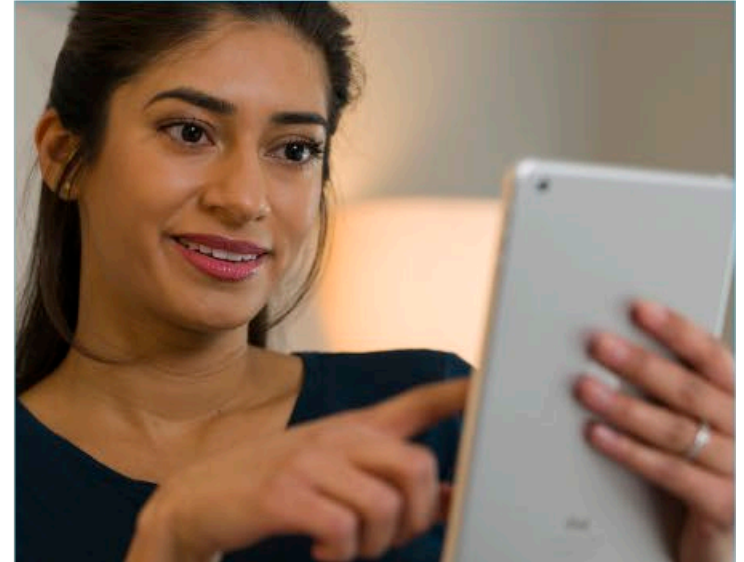
Xcel Energy Priorities



**Lead the Clean
Energy Transition**



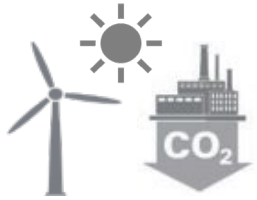
**Enhance the
Customer Experience**



Keep Bills Low

Xcel Energy's Comprehensive Clean Energy Strategy

Clean energy across all the ways we power people's lives



100% Carbon-Free Electricity



Net-Zero Natural Gas



1.5 Million EVs



Our Energy Goals



Safe



Clean



Reliable



Affordable

DISTRIBUTION PLANNING FRAMEWORK

Integrated Distribution Planning in Minnesota

- **The Minnesota Public Utilities Commission established integrated distribution planning (IDP) reporting requirements as an outcome of its Grid Modernization proceeding**
- **Xcel Energy was the first utility to submit an IDP (in 2018)**
- **Full IDP requirement is biennial, with a smaller report due annually**
- **Enabling statute also allows utilities operating under a multi-year rate plan to seek “certification” of eligible grid modernization investments**
 - **If certified by the Commission, utilities can seek cost recovery through a rate Rider.**

Minnesota IDP Objectives

- **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,**
- **Enable greater customer engagement, empowerment, and options for energy services,**
- **Move toward the creation of efficient, cost-effective, accessible grid platforms for new projects, new services, and opportunities for adoption of new distributed technologies, and**
- **Provide the Commission with the information necessary to understand Xcel Energy's short- and long-term distribution system plans, the costs and benefits of specific investments, and a comprehensive analysis of customer cost and value.**

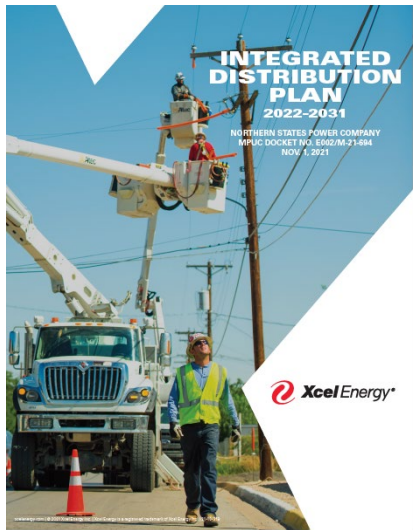
XCEL ENERGY 2021 MINNESOTA IDP



Snapshot – 2021 NSPM Integrated Distribution System Plan

The Company's Integrated Distribution Plan provides insight and data on how the Company plans its system, reflected through several key documents and methodologies:

IDP PLAN



~40 PAGES

APPENDICES AND ATTACHMENTS

Docket No. EW02/M-21-694
2021 Integrated Distribution Plan
Table of Contents

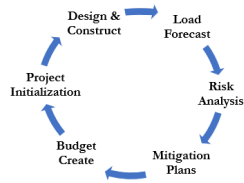
TABLE OF CONTENTS	
APPENDICES LIST	
Number	Name
A1	System Planning
A2	Standards, Asset Health, and Reliability Management
A3	Distribution Operations
A4	Distribution System Statistics
B1	Grid Modernization
B2	Customer Strategy and Roadmap
B3	Operational and Planning Data Management, Data Security, and Data Access Plans and Policies
D4	Existing and Potential New Grid Modernization Pilots
C	Grid Modernization Action Plans
D	Distribution Financial Framework and Information
E1	Hosting Capacity, System Interconnection, and Advanced Inverters/ IEEE 1547
E2	Distributed Energy Forecast Methodology and Forecasts
F	Non-Wire Alternatives Analysis
G	Distributed Intelligence Certification Request
H	Resilient Minneapolis Project Certification Request
I	Stakeholder Engagement

ATTACHMENTS LIST	
Number	Name
A	IDP Non-Public Designations
B	Compliance Matrix
C	Conditions of IDP Consent to Commission's IDP Planning Objectives
D	Distribution Risk Scoring Methodology
E	Risk Scored Project Details
F	Planning Assumptions, Assumptions
G	Distribution Function NPV
H	Capital Project List by IDP Category
I	Capital Profile Trend
J	O&M Profile Trend
K	PE MN Goals for Generation Distribution and EV
L	Non-Wire Alternatives Analysis
M	Resilient Energy Partners – Firm Capability Statement
Workpapers	Essential CBA Model – Distributed Intelligence
Workpapers	Essential CBA Model – Resilient Minneapolis Project

16 APPENDICES
17 ATTACHMENTS
~550 PAGES

ANNUAL SYSTEM PLANNING APPROACH

Figure 1: Annual Distribution Planning Process

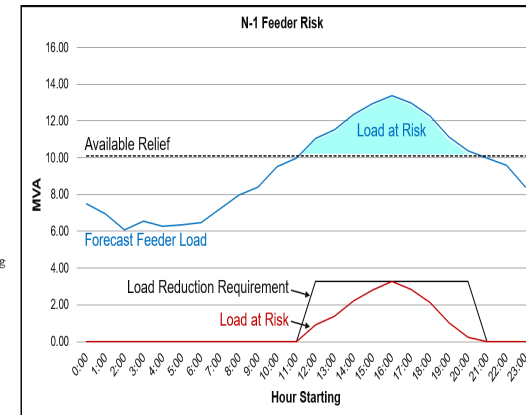


As part of our annual distribution planning process, we thoroughly review existing and historical conditions, including:

- Feeder and substation reliability performance,
- Any condition assessments of equipment,
- Current load versus previous forecasts,
- Quantity and types of DER,
- Total system load forecasts, and
- Previous planning studies.

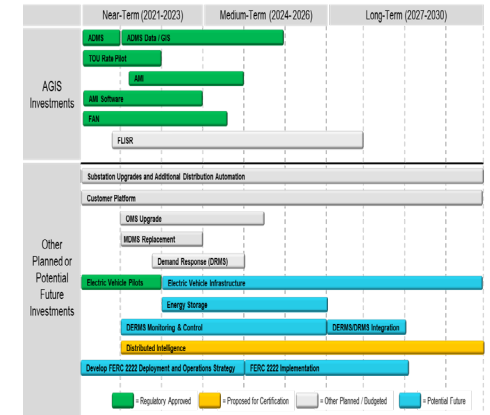
~1,600 FEEDERS AND SUBSTATIONS ASSESSED

NEW NWA METHODOLOGY PROPOSED



ADDITION OF STACKED VALUES PLUS MORE FOCUSED COST-EFFECTIVENESS TEST

GRID MODERNIZATION – NOW TO 2030



FOUNDATIONAL PROJECTS UNDERWAY WITH MORE PROPOSED

Within these documents, we provided information responsive to over 75 requirements.

The Minnesota Distribution System and Plan

BY THE NUMBERS

\$537M AVERAGE ANNUAL DISTRIBUTION BUDGET OVER 5 YEARS

12,000 MILES UNDERGROUND CABLE

150+ GRID NEEDS IDENTIFIED OVER 5 YEARS

142 FROM **7,760** PROJECTS WITH **42** MW FROM **1,325** APPLICATIONS IN QUEUE

14 CANDIDATE NON-WIRES PROJECTS ANALYZED FOR 2021

811 MW COMMUNITY SOLAR GARDENS

13.4M KVA DISTRIBUTION SUBSTATION CAPACITY

FROM **407** PLUS **555** MW (**565** APPLICATIONS) IN QUEUE

15,000 MILES OVERHEAD CONDUCTOR

740 MW OF DEMAND RESPONSE FROM **460,000** CUSTOMERS

Drivers – Distribution Business Evolution



Increasing expectations of the distribution system

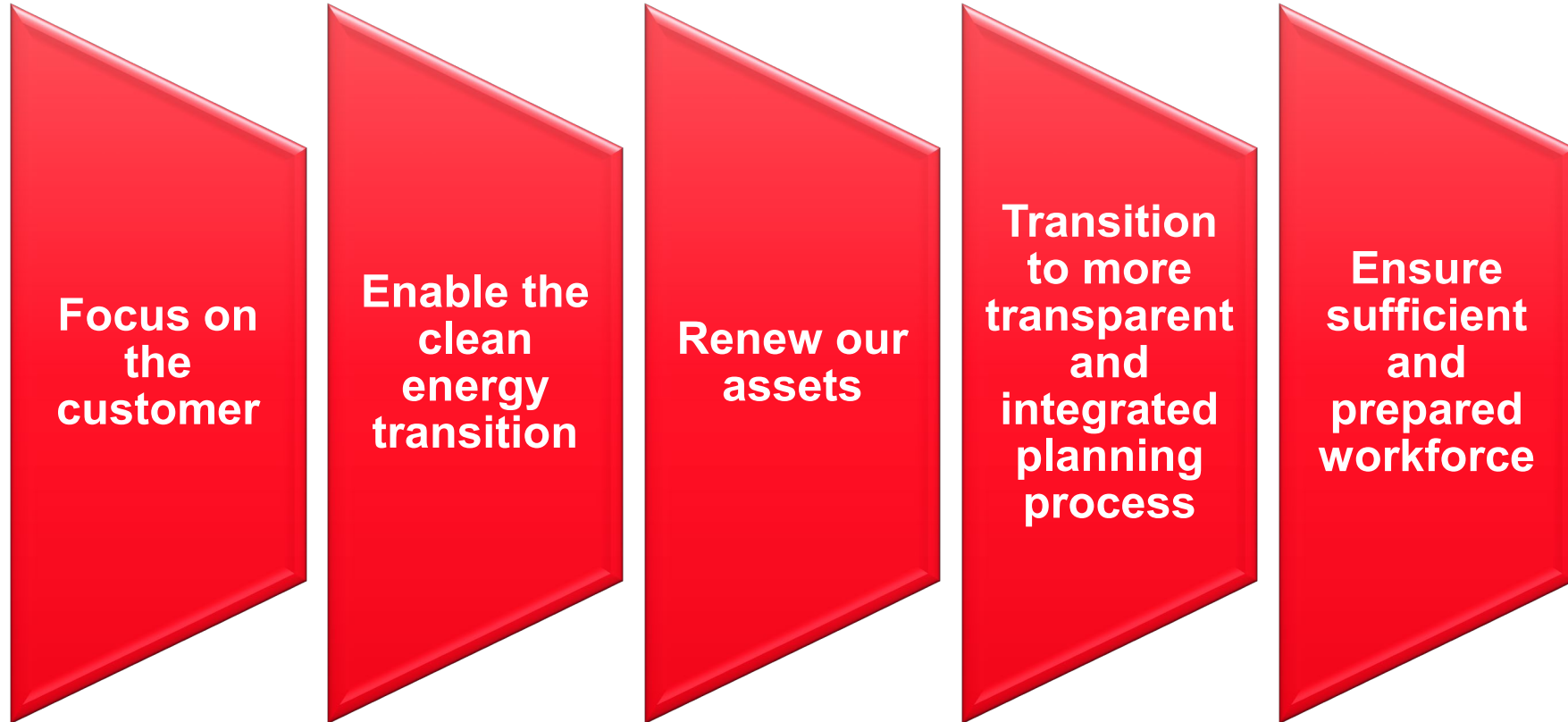
Greater customer expectations of performance and accessibility

Greater desire to understand and participate in system planning

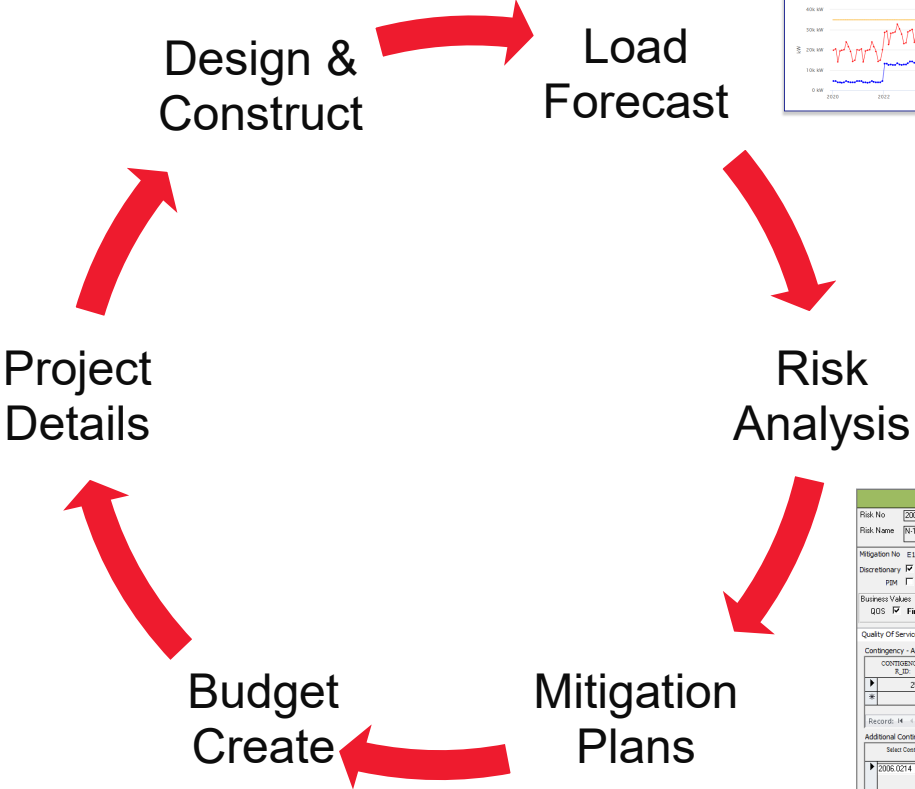
Broad interest in decarbonizing the economy

Emerging technologies

Distribution Strategic Priorities



Fundamental Distribution Planning – Annual Process



Create/Edit Mitigation - Capital

Risk No: 2005.0551 Risk Year: 2009 Utility: Electric Location: 156 WYline Dear Job Type: []
 Risk Name: N-1 Baytown BYT TR1 21.4 MVA at risk. Appropriation: N/A Program: N/A

Mitigation No: E156.002804 Title: Add 2nd bank at Baytown to eliminate N-1 risk Mitigation ID: 15338
 Discretionary: Mitigation Year: 2015 Ongoing Project: Mitigation Status: Workbook Approved Sponsor: Tricot, Meghan
 Business Values: QOS: Financial: Safety: Environment: Legal: Current Status: Workbook Approved Sponsor Phone #: []
 Need Status: [] Project ID: WBS 5 View Add Risk Total Score: 0.73 Risk Score Input Date: 3/19/2015

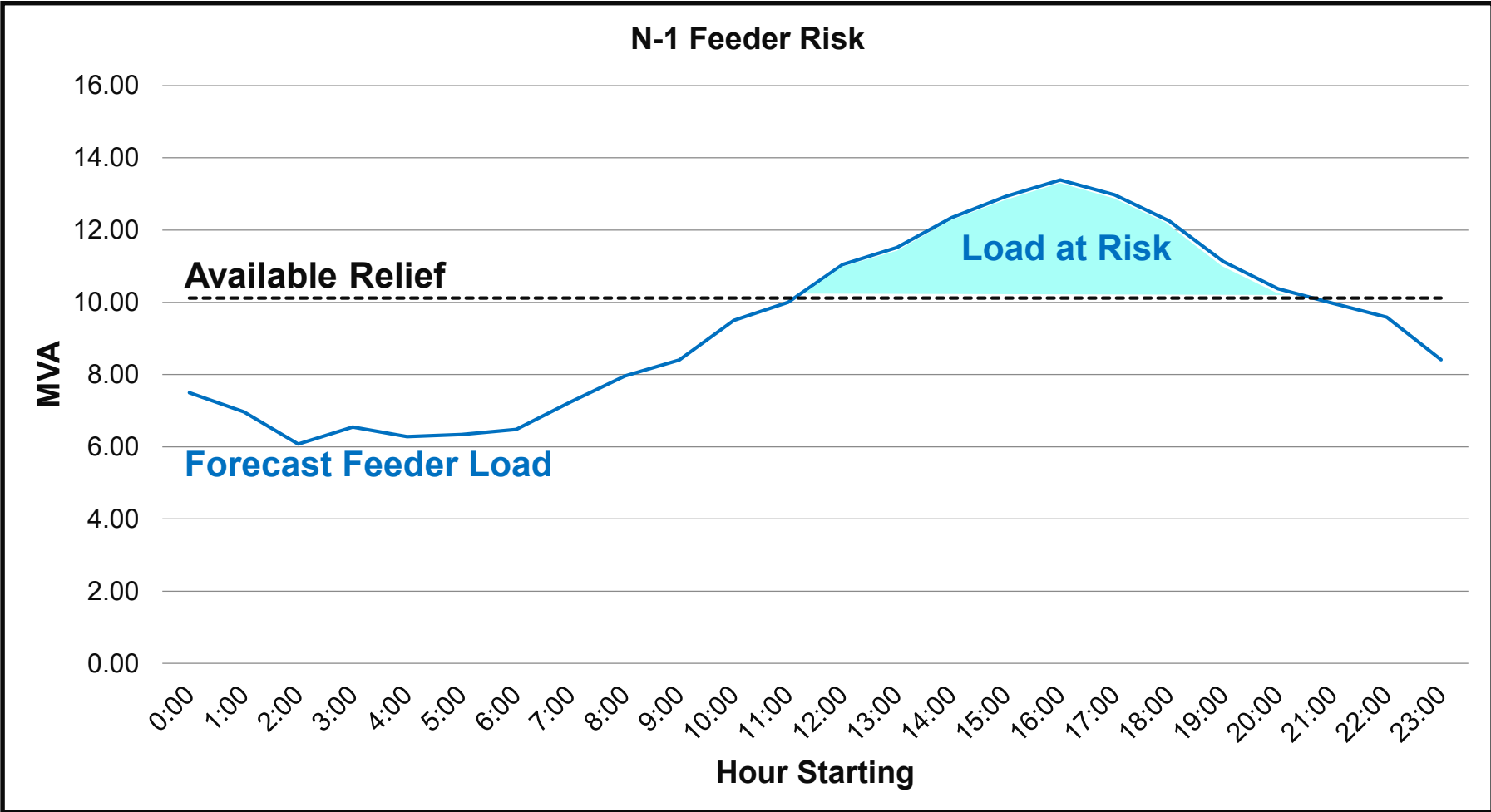
Contingency - Assigned By Risk

Contingency No	Peak Load	Availability	Customers	Peak Day	Time To	Annual Bk	Age Of Equip	Lik Of Equip	Trans	Transformer	Failure Rate Of
%	MVA	MVA	Peak Day	Hours	Hours/Year	At Risk	At Risk	At Risk	OP Status	ETC Code	Equip At Risk
2546	21.358	0	120	24	24	6760	26	40	OK Switching	[]	[]

Additional Contingencies - From Linked Risks

Select Contingency	Peak Load	Availability	Customers	Peak Day	Time To	Annual Bk	Age Of Equip	Lik Of Equip	Trans	Transformer	Failure Rate Of	Cost Of Failure
%	MVA	MVA	Peak Day	Hours	Hours/Year	At Risk	At Risk	At Risk	OP Status	ETC Code	Equip At Risk	Peak Day
2006.0214	11.058	6.929	64	13	13	641	49	49	[]	[]	2143	0
Risk: 2006.0214 [N-1 Oak-Pak OPK073.4.1 MVA at risk]												
2006.0196	12.731	2.249	120	24	12	6760	49	49	[]	[]	1081	0
Risk: 2006.0196 [N-1 Baytown BYT 10.5 MVA at risk]												

Illustrative Example – System Planning Risk Analysis

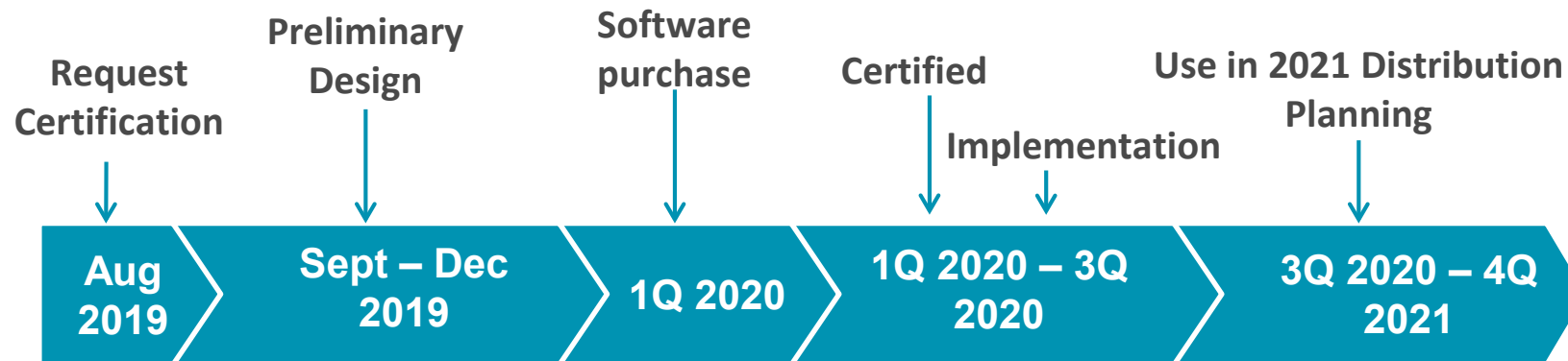


Distribution System Planning Tools

Tool	Planning Process Component						Hosting Capacity
	Forecast	Risk Analysis	Mitigation Plans	Budget Create	Initiate Construction - EDP Memo	Long-Range Plans	
Synergi Electric			X			X	X
LoadSEER	X	X				X	
MS Excel		X		X		X	
CYMCAP		X					
GIS			X			X	X
SCADA	X						
WorkBook		X	X	X	X		
PI Datalink	X						
DRIVE							X

Advanced Planning Tool – *History and Overview*

- Implemented LoadSEER, developed by Integral Analytics
- Certification grid modernization investment – 2020

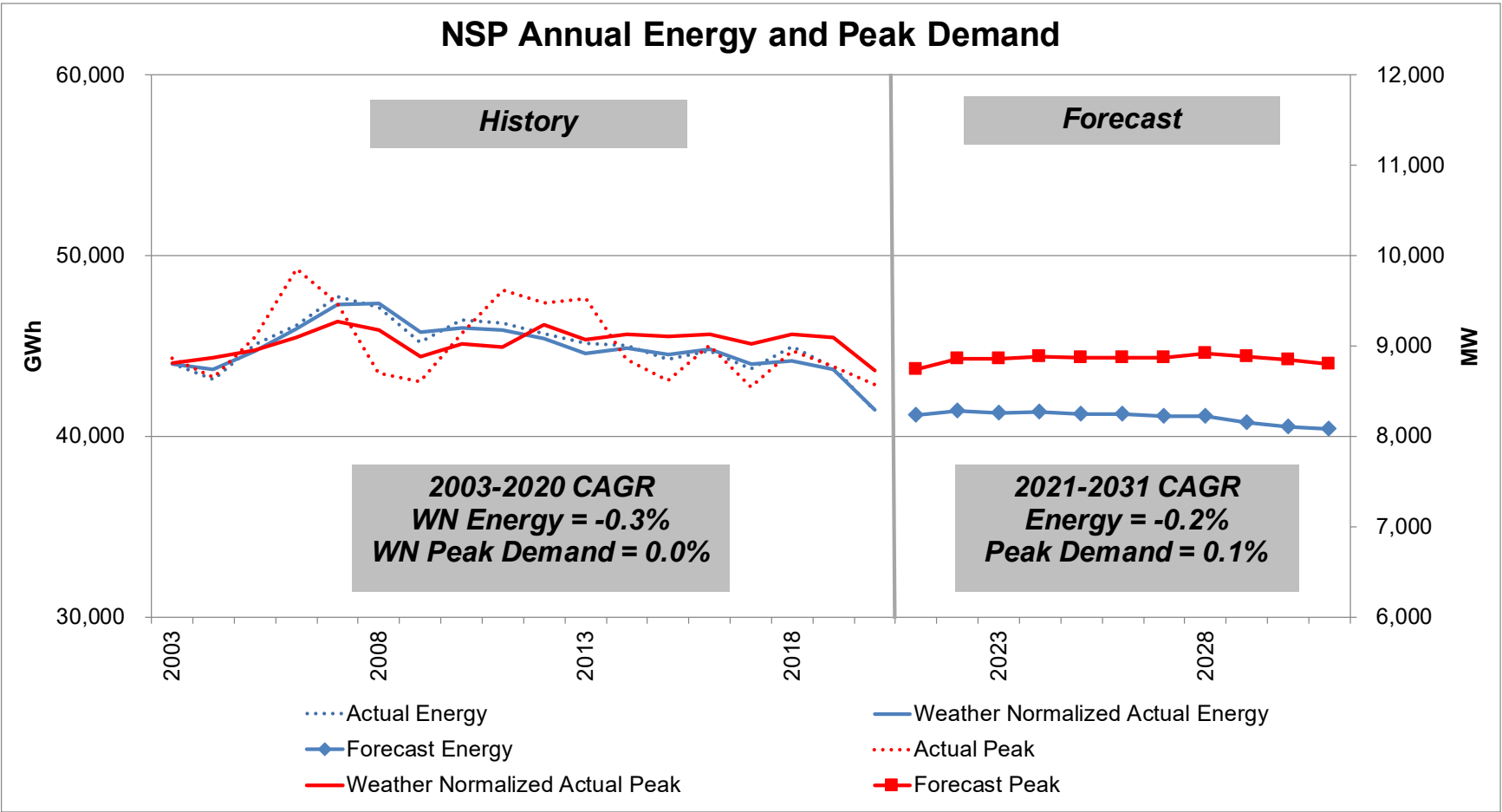


- Needed to aid in developing more granular load forecasts and distribution plans that allow for enhanced analysis
 - Increasing DER adoption and electrification requires more granular understanding of grid conditions
 - Need for system to be more dynamic, so must plan for more than just meeting peak loads
 - Scenario development and analysis
 - Able to integrate data source inputs and with other Company planning efforts

KEY INPUTS – LOAD AND DISTRIBUTED ENERGY RESOURCE FORECASTING

Distributed generation, battery storage, electric vehicles, demand response, energy efficiency

Corporate Load Forecast – *Fall 2020*



DER – Minnesota IDP

For purposes of the IDP, DER is defined as:

Supply and demand side resources that can be used throughout an electric distribution system to meet energy and reliability needs of customers; can be installed on either the customer or utility side of the electric meter.

IDP Requirements – DER Forecasting

- **Develop base-case, medium and high case DER scenarios**
Reasonable mix of DER adoption, aggregated or bundled services
Assume geographic dispersion across the Xcel distribution system
- **Provide methodologies and details**
- **Describe how IDP is aligned with Integrated Resource Plan inputs**
- **Describe processes and tools, system impacts and benefits, type of system upgrades**
- **Solicit input from stakeholders on DER forecasts**

Forecasting EV and PV – Models

Technology Curves / S shaped market adoption curves



Economic Models — EV & PV adoption payback year

Energy Prices



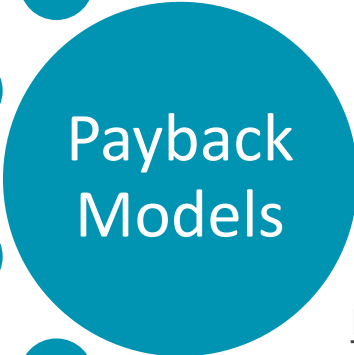
System Cost



Learning Curve



Public Policies



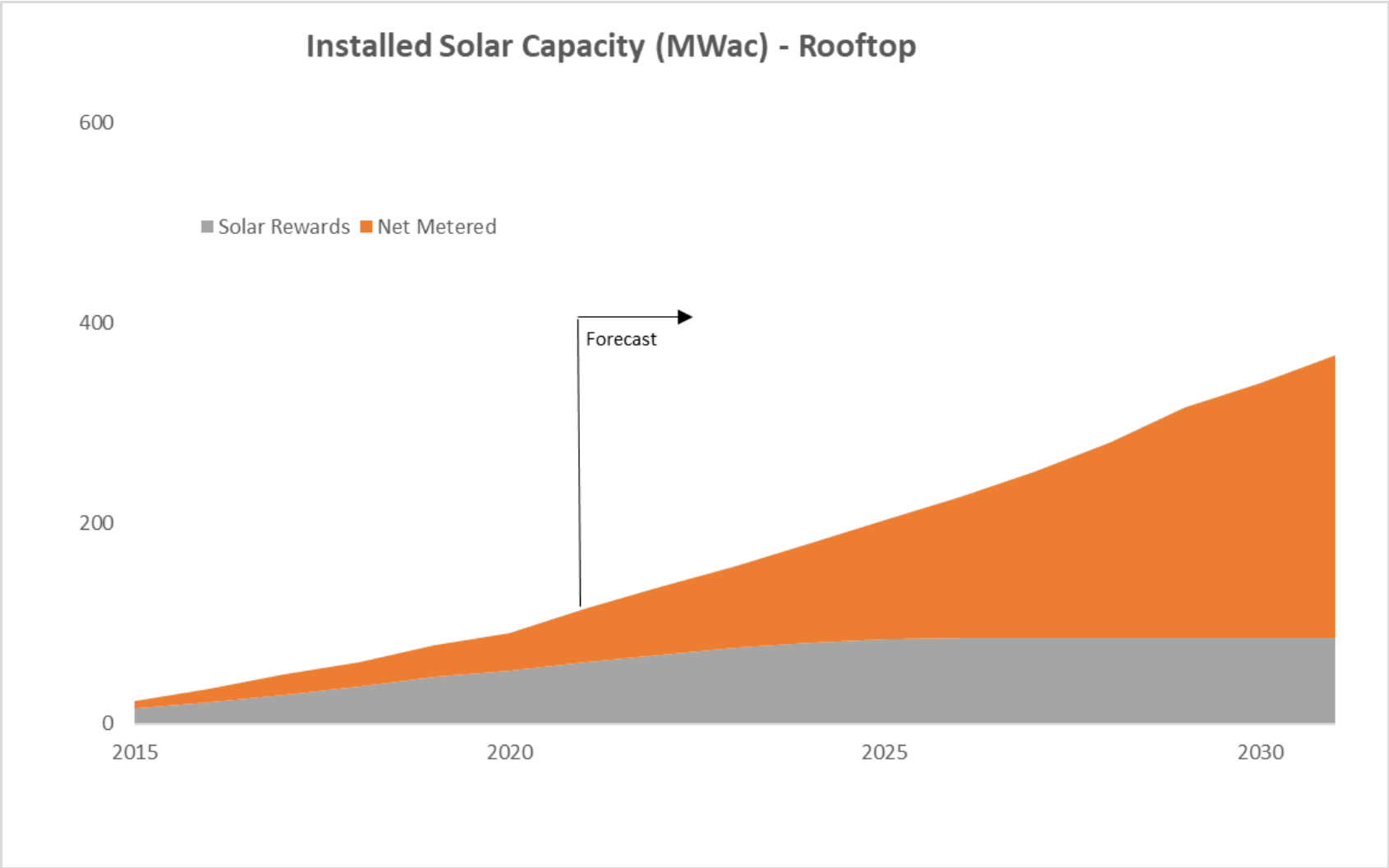
Key Drivers – EV:

- Annual Fuel Savings
- Battery Prices
- Incentives / Policy

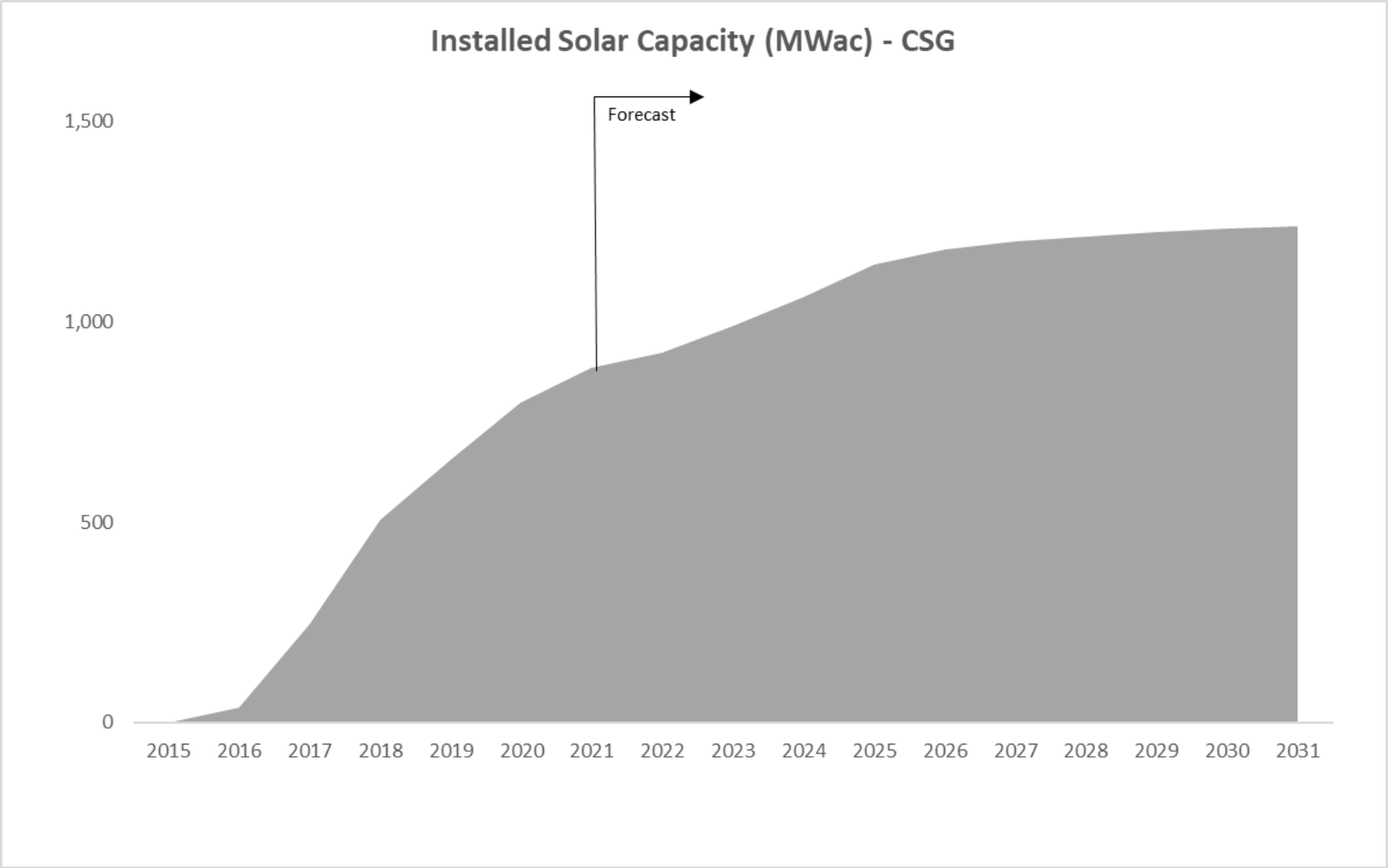
Key Drivers – PV:

- Installed Costs
- Electricity Prices
- Incentives / Policy

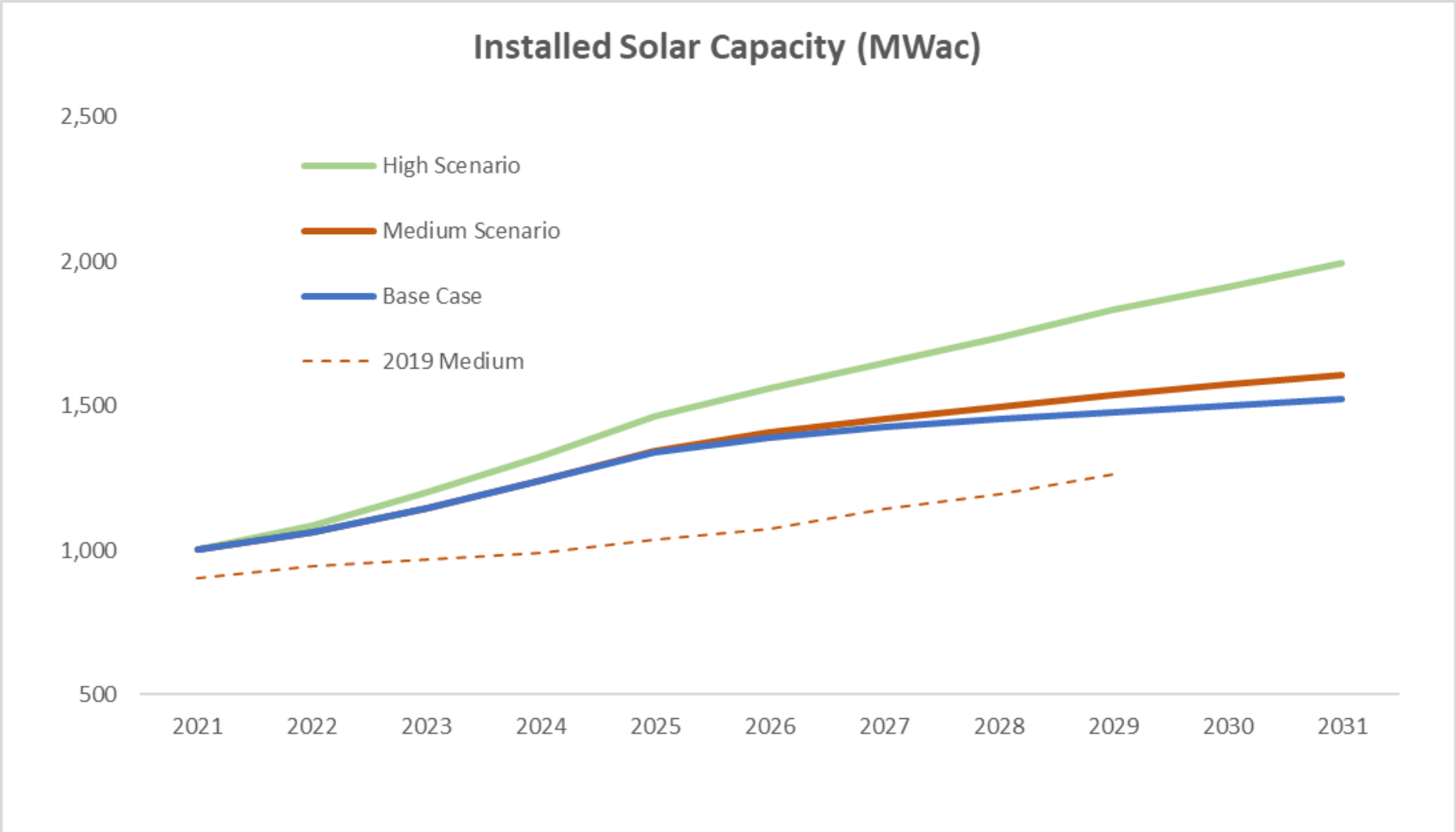
DER Forecasting – *Rooftop Solar*



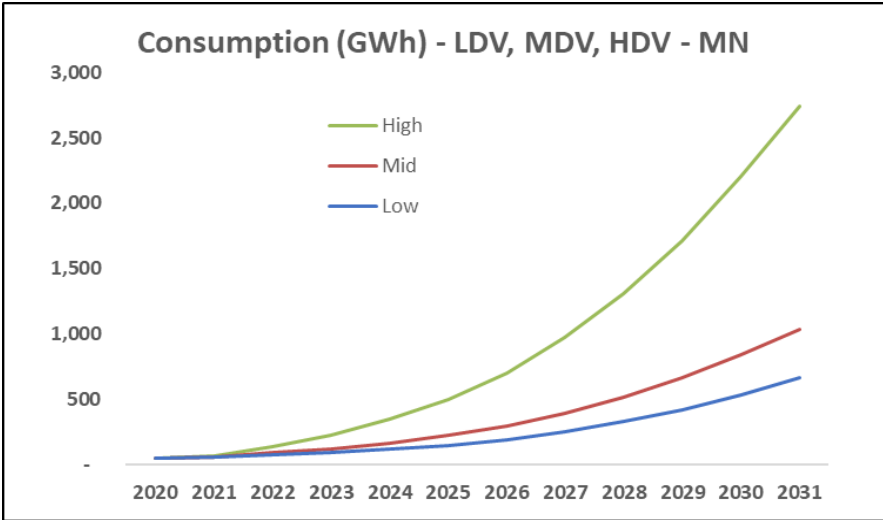
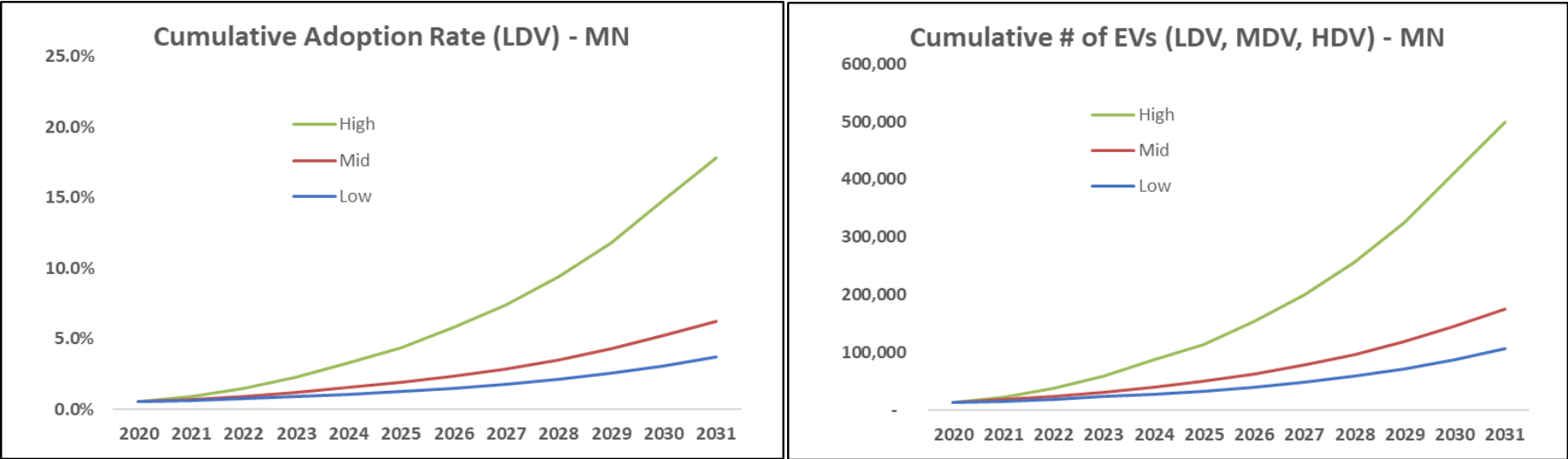
DER Forecasting – Community Solar Gardens



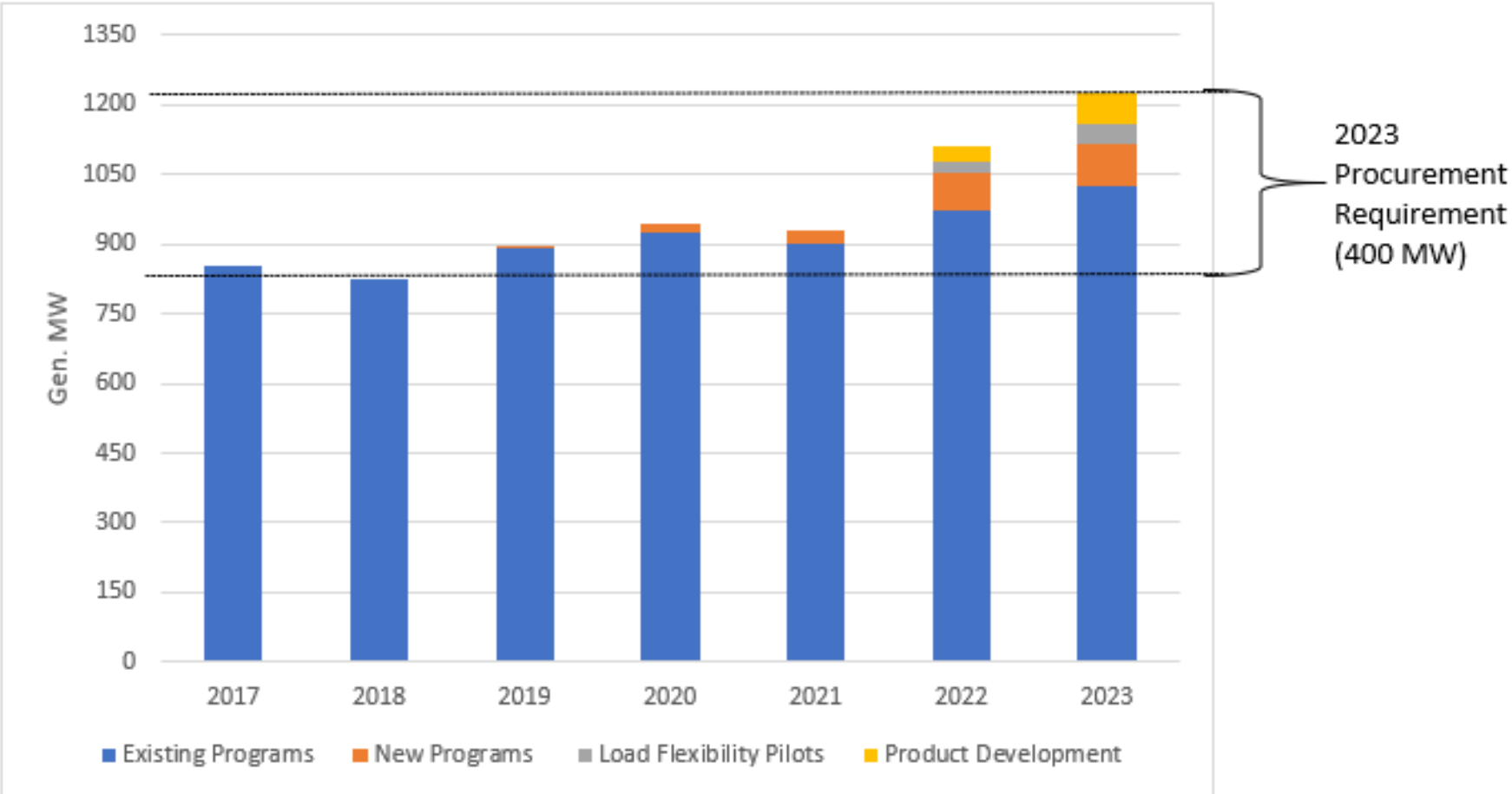
DER Forecasting – PV Scenarios



DER Forecasts – *Electric Vehicles*

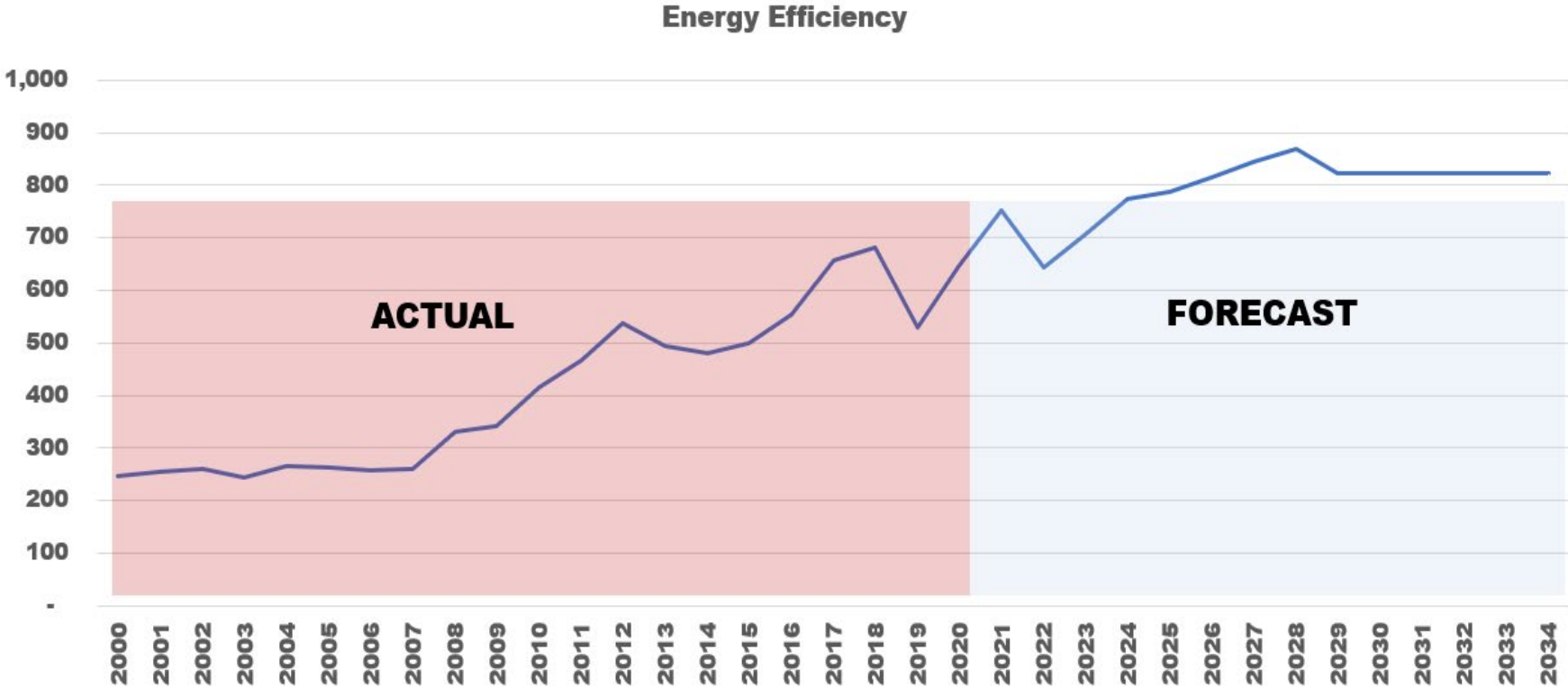


DER Forecasts – Demand Response



DER Forecasts – *Energy Efficiency*

Increase in Energy Efficiency ~780 GWh per year average



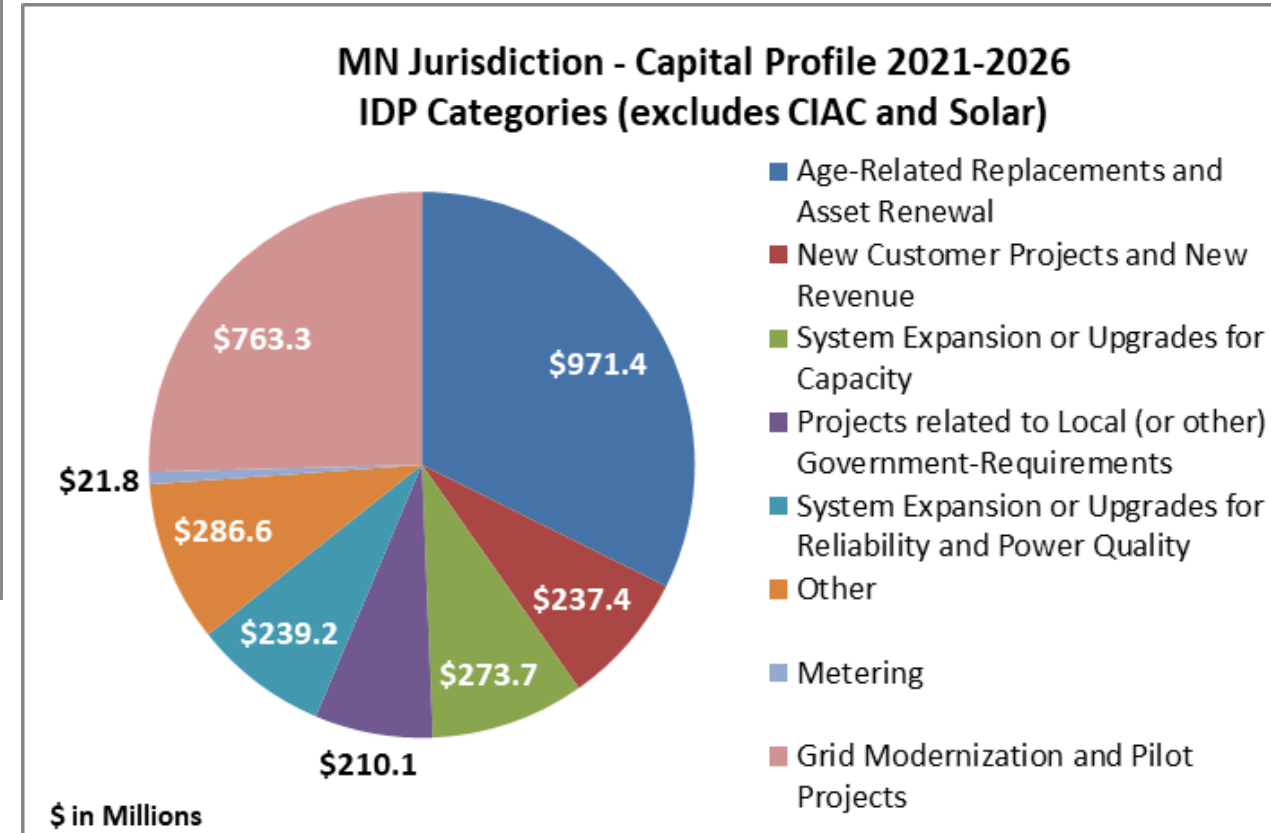
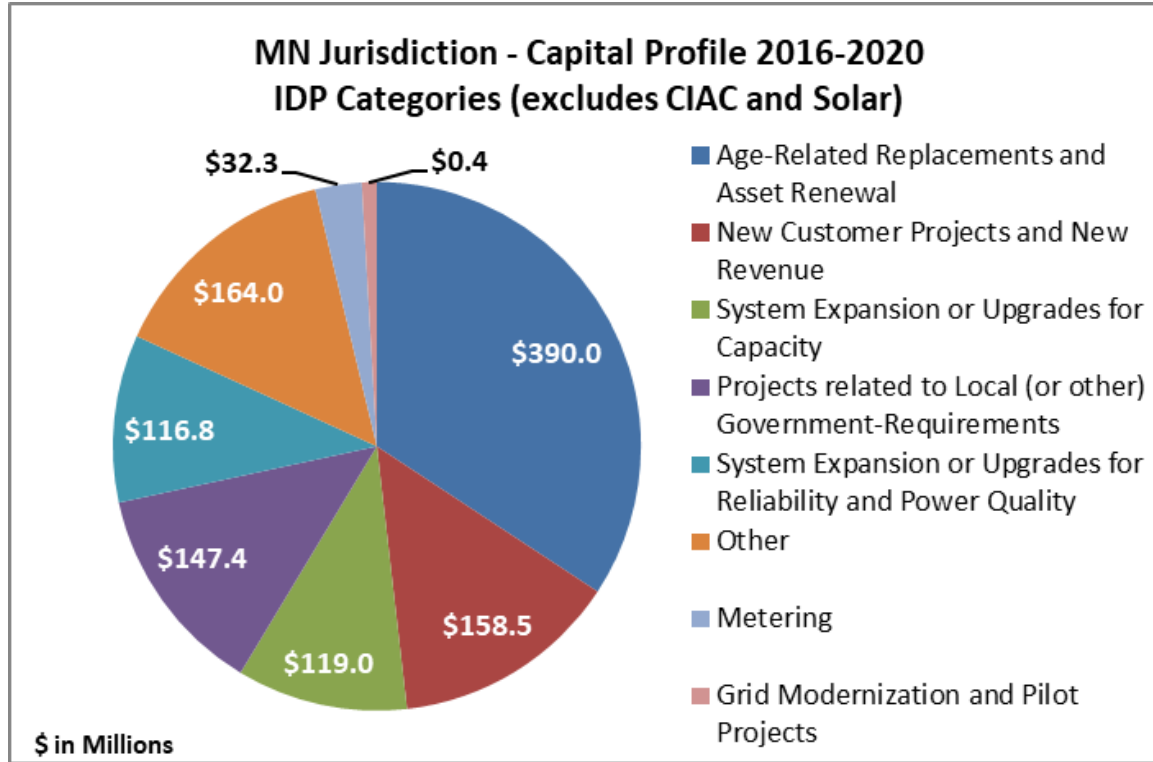
NSPM DISTRIBUTION CAPITAL SNAPSHOT
5-Year Historic Actuals and 5-Year Forward Budgets



IDP Investment Categories

- **System Expansion or Upgrades for Capacity**
- **Age-Related Replacements and Asset Renewal**
- **System Expansion or Upgrades for Reliability and Power Quality**
- **New Customer Projects and New Revenue**
- **Grid Modernization and Pilot Projects**
- **Projects related to local (or other) government-requirements**
- **Metering**
- **Other**

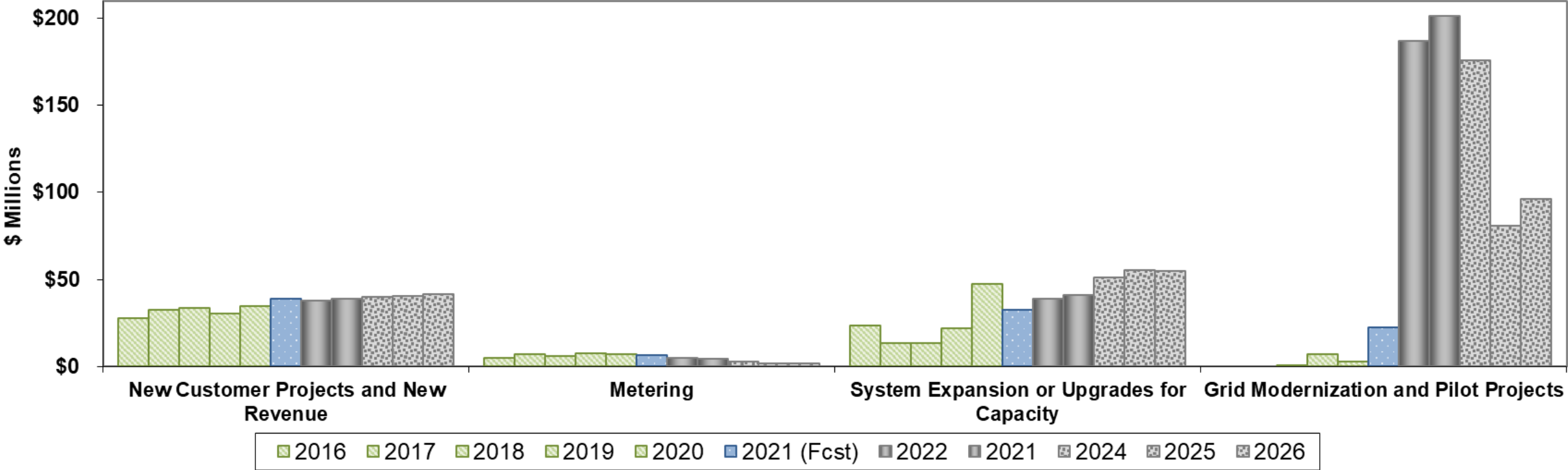
Capital Budget – IDP Investment Categories



*The Advanced Planning Tool (APT) was previously represented in Other but has since moved to a different business area (Business Systems) and is no longer represented in Distribution.

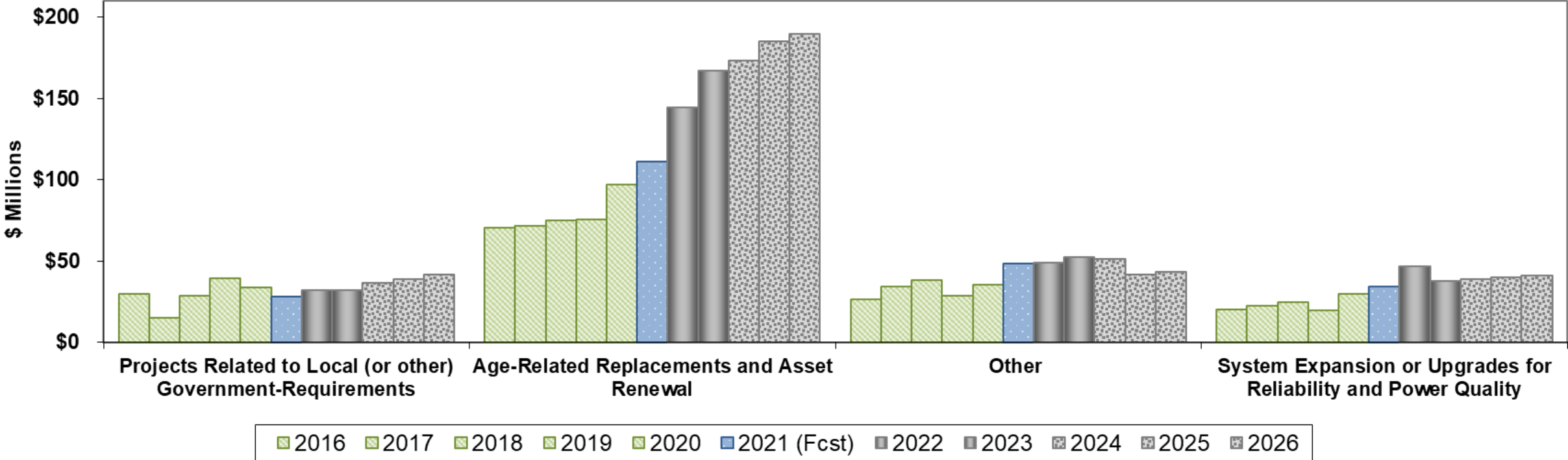
Capital Budget – Trend by Category

MN Jurisdiction - Capital Profile 2016-2026
(excludes CIAC and Solar)



Capital Budget – Trend by Category (cont'd)

MN Jurisdiction - Capital Profile 2016-2026
(excludes CIAC and Solar)



NON-WIRES ALTERNATIVES ANALYSIS

Plus exploration of stacked values with stakeholders

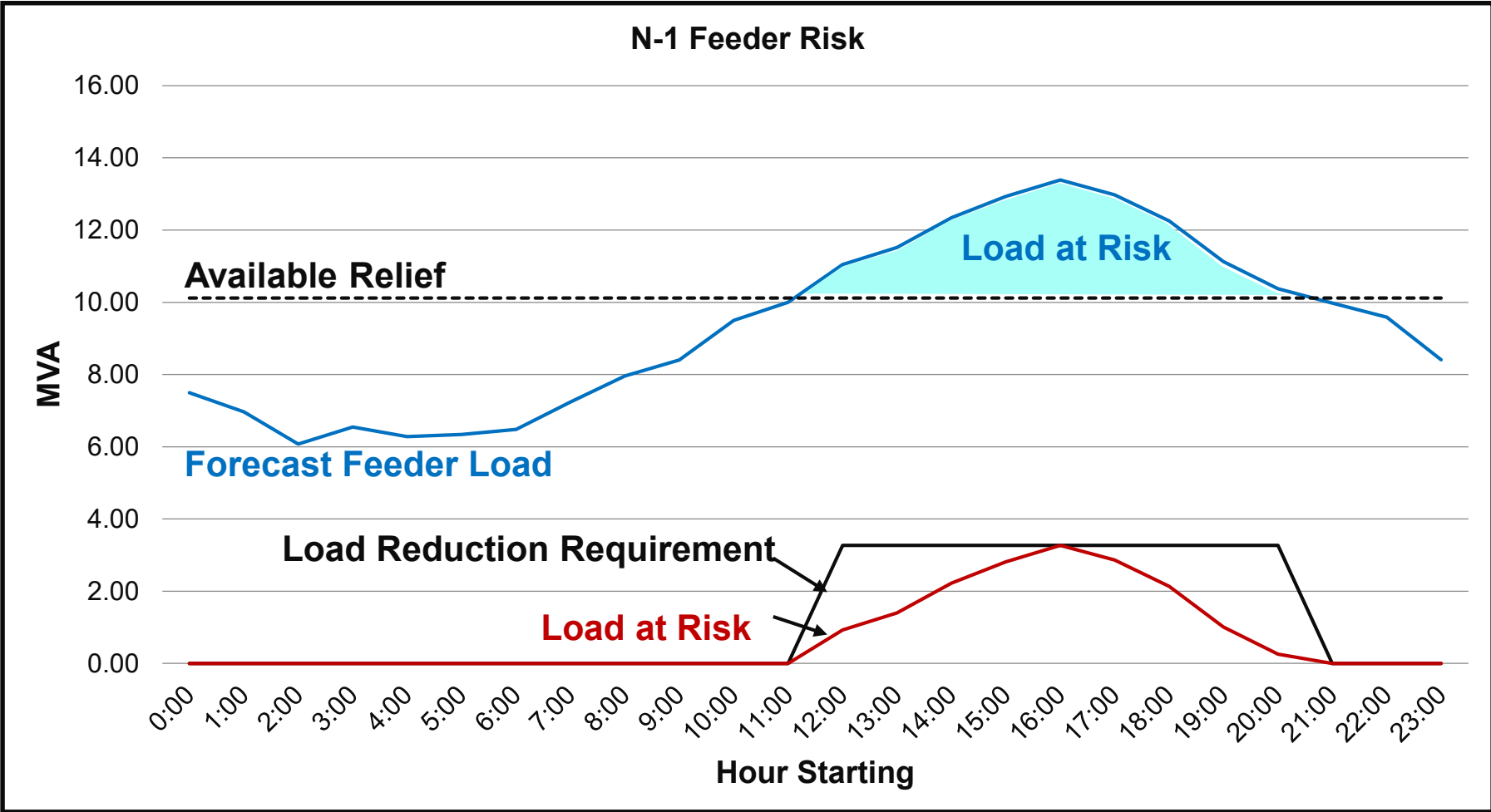


IDP Requirements and Commitments – NWA

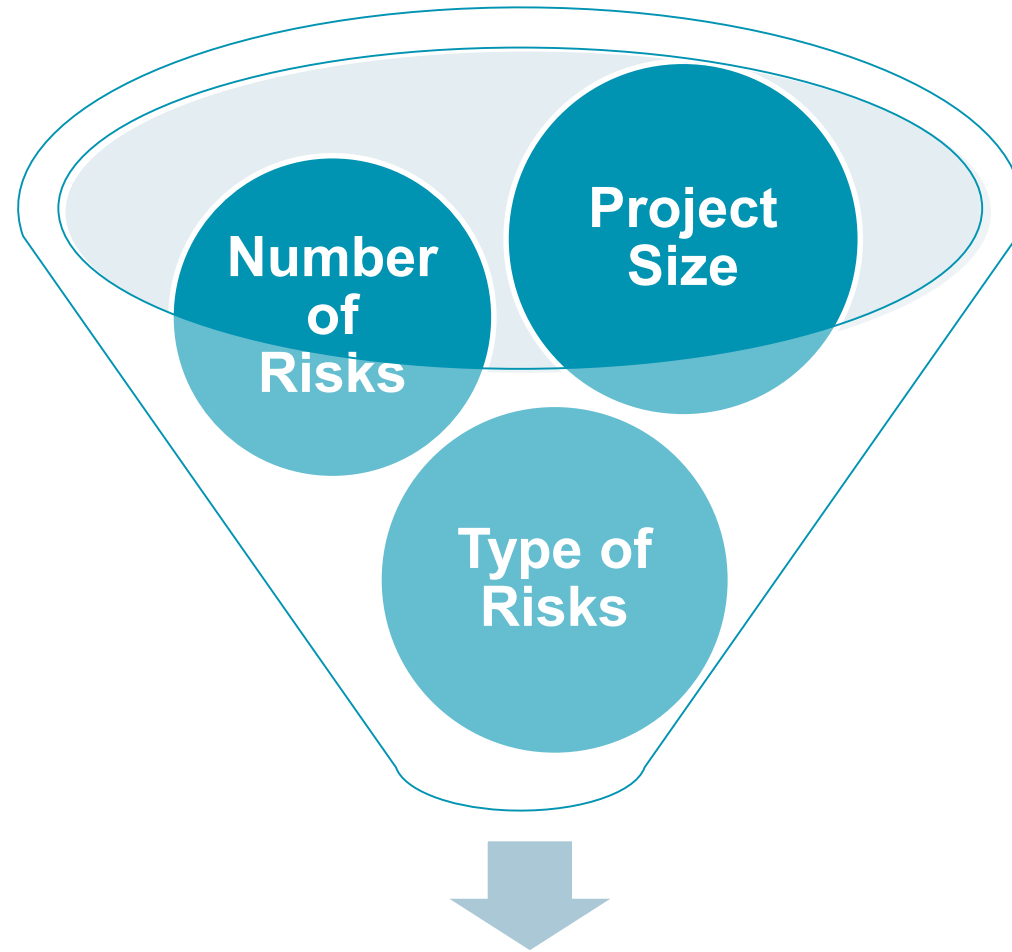
Base IDP Requirements for NWA:

- **Xcel must file an annual update of baseline financial data and non-wires alternatives analysis.**
- **For any distribution project in the current year or 5-year budget that costs \$2 million or more, provide an analysis on how non-wires alternatives compare in terms of viability, price, and long-term value. Provide the following information:**
 - Project types that would lend themselves to non-traditional solutions (i.e., load relief or reliability)
 - The timeline needed to consider alternatives to traditional project types
 - Cost threshold of any project type that would need to be met to have a non-traditional solution reviewed
 - A discussion of the proposed screening process for potential non-wires alternatives
- **Xcel must engage stakeholders in further advancing the Company's NWA Analysis, including, but not limited to, screening criteria, analysis methodology and assumptions, and NWA evaluation parameters.**
- **2021 Commitments (in 2019 IDP proceeding) – The Company will consider a broader set of values and revenue streams in future NWA analyses and continue working with stakeholders on NWA analysis.**

Illustrative Example – Load Reduction Requirement

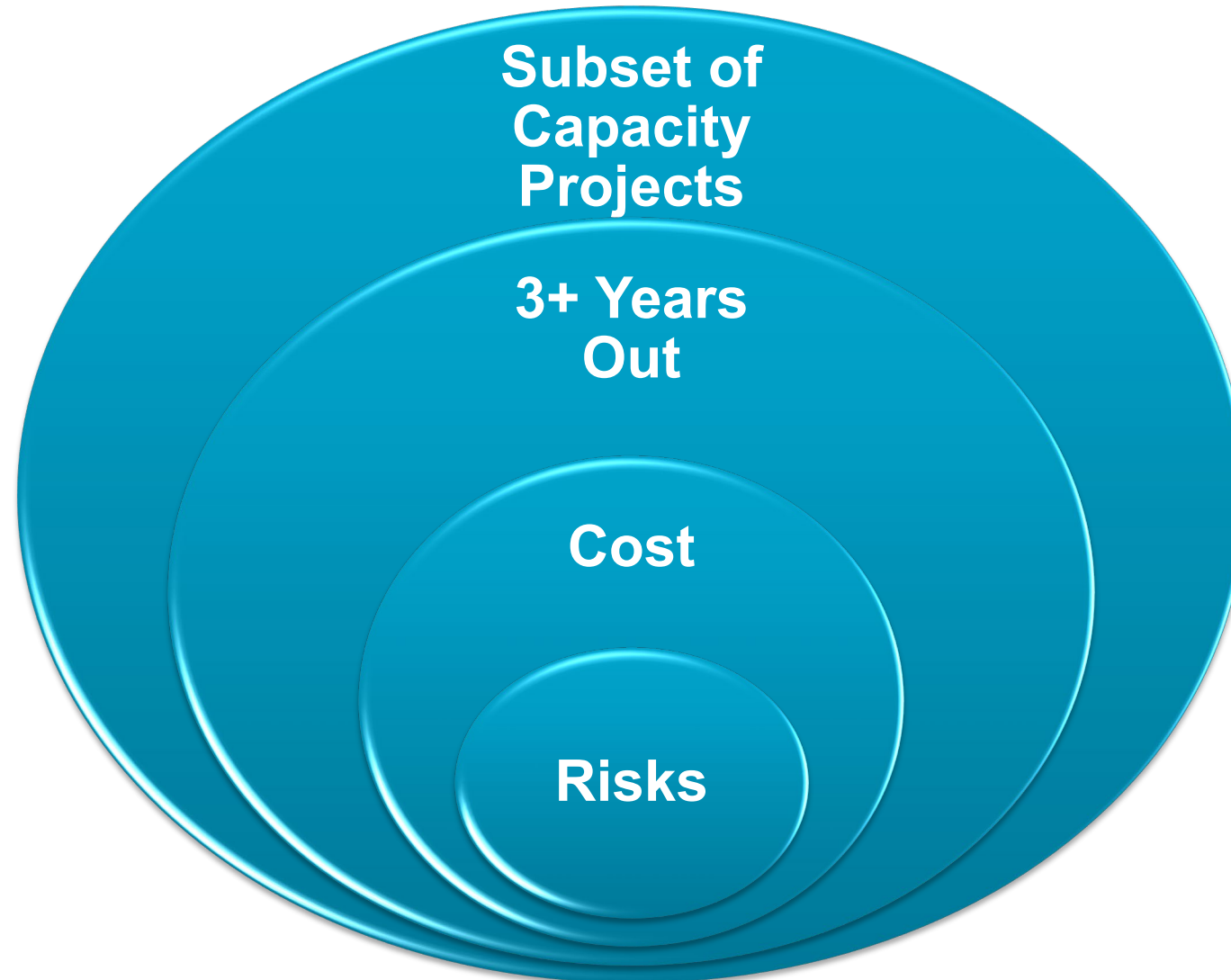


Identifying Candidate Projects – *Assessing NWA Project Viability*



Potentially Viable Projects

Project Viability Analysis



NWA Analysis Balancing Act

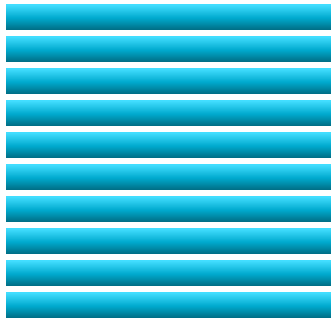


Stakeholder Feedback

- **General support for continuing expansion of NWA analysis to include additional stacked values**
- **Stakeholders had an opportunity to emphasize which stacked values are most relevant to an NWA analysis**
- **Interest in NWA pilot projects**
- **A majority indicated that they would participate in an RFI/RFP if issued for an NWA project**

Proposed NWA Process Overview

Identify System Risks
↓
Develop Traditional Projects

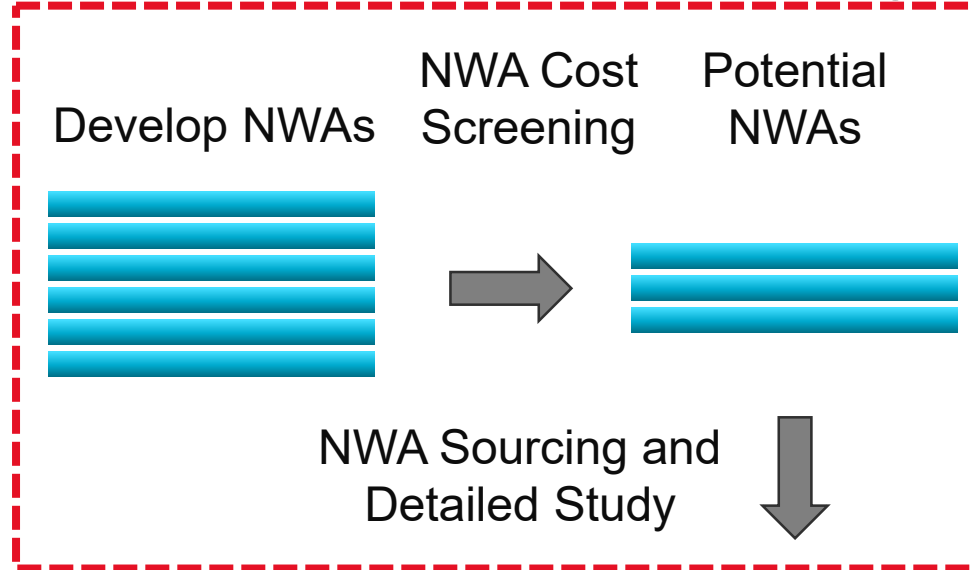


Apply Screening Filters

1. Size: >\$2M in cost
2. Type: Capacity
3. Timing: Year 3+



Stacked Values – Detailed Study



Considered in Detailed Study

- Avoided Distribution System Losses
- Avoided Distribution System O&M
- Distribution System Voltage
- Credit and Collection
- Risk – Utility/Host Customer
- Reliability – Utility/Host Customer
- Resilience – Utility/Host Customer
- Host Customer Non-Energy Impacts
- Resilience – Societal
- Economic & Jobs
- Public Health
- Low-Income Societal
- Energy Security

Considered in Cost/Benefit Screening

- Avoided Energy Generation
- Avoided Generation Capacity + MISO Reserves
- Avoided Transmission Capacity
- Avoided Transmission Losses
- Avoided Distribution Capacity
- Program Administration
- Interconnection Fees
- Avoided GHG Emissions + Other Environmental

Implement NWAs!



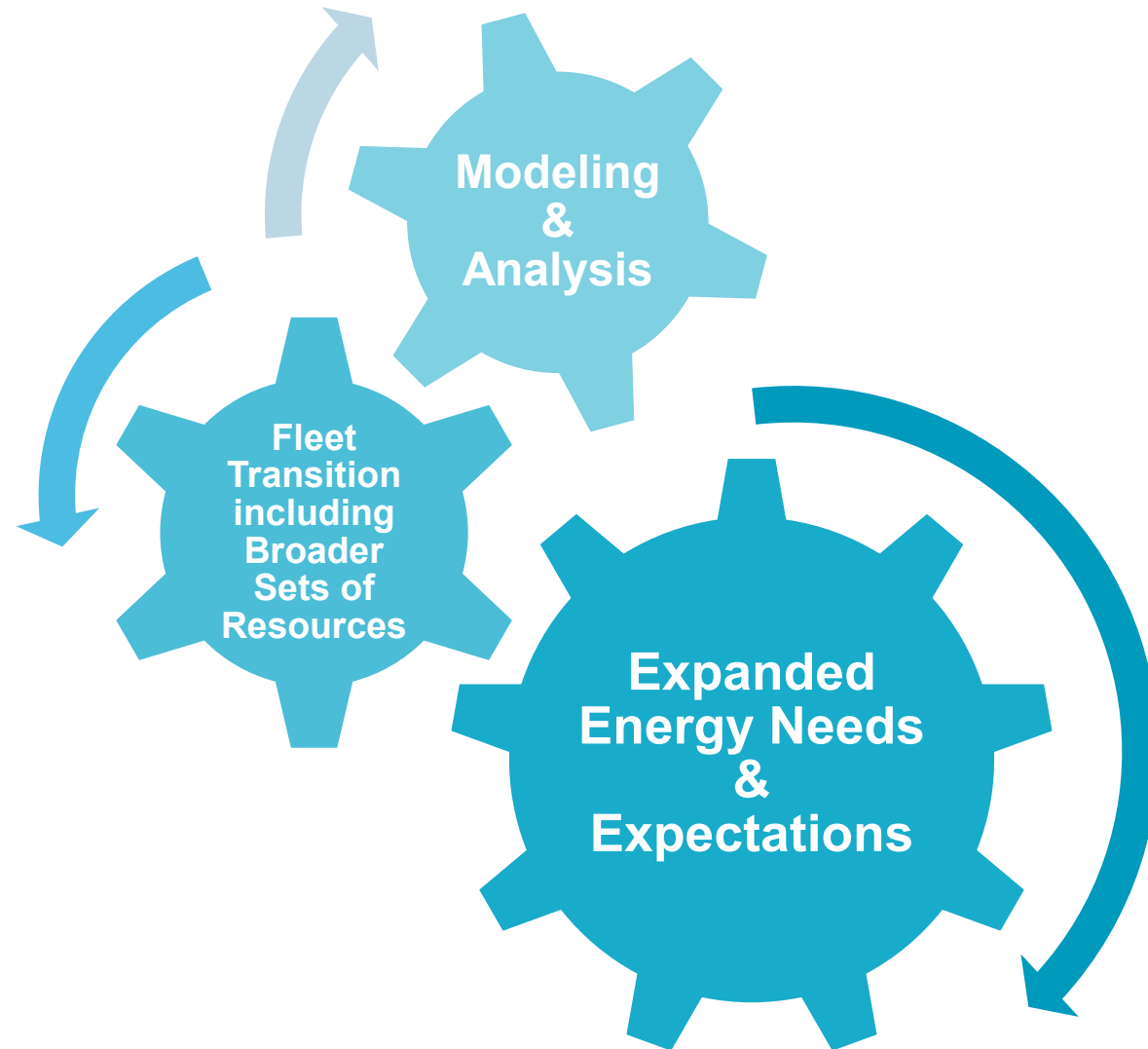
Reshaping our NWA Analysis – *Current vs. Proposed NWA Screening Method*

Aspect/Component	Current Method	Proposed Method
Timeframe	Full NWA lifetime	10-year deferral period*
Ownership Model	Utility ownership	Load reduction contract or utility ownership
Load Reduction Requirement	Exact MWh of load at risk on peak day	Peak output for the duration of the risk
Stacked Values	No stacked values	Stacked values included
Pro-Rating Values	No pro-rating, full values included	Values pro-rated for just the load reduction period (ARR split)
Solar Performance	PVWatts TMY simulation for one location in Minnesota	PVWatts TMY simulation for five locations in Minnesota

* Subject to change.

INTEGRATED PLANNING

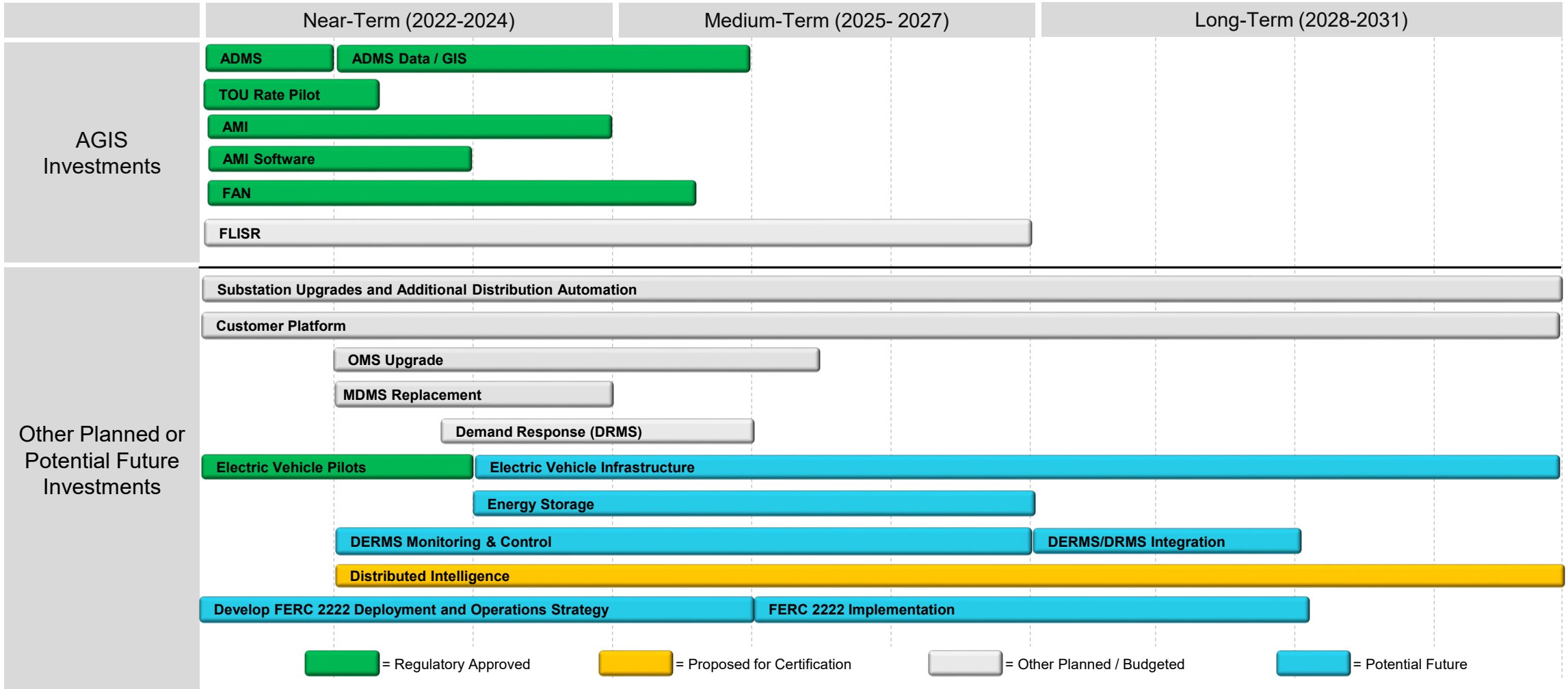
Integrated Distribution-Transmission-Resource Planning







ADVANCED GRID PLANS



Advanced Grid Plan – Building on a Foundation



Advanced Grid – Overview

GRID VISIBILITY AND CONTROLS		Network	Meters
Advanced Distribution Management System (ADMS)	Fault Location, Isolation and Service Restoration (FLISR)	Field Area Network (FAN) & Home Area Network (HAN)	Advanced Metering Infrastructure (AMI)
 <ul style="list-style-type: none"> Advanced centralized software or the “brains,” enhances the operation of the distribution grid Enables improved reliability, management of DERs, and improved efficiency when operating the grid Enables enhanced visibility and control of field devices (including customer meters via AMI) 	 <ul style="list-style-type: none"> ADMS provides fault location prediction and the automatic operation of intelligent grid devices Reduces outage durations and the number of customers impacted by an outage Enabled by intelligent field devices, FAN, and ADMS 	 <ul style="list-style-type: none"> Two-way communications network Connects intelligent grid devices and smart meters with software Enables enhanced remote monitoring and control of intelligent field devices and advanced meters 	 <ul style="list-style-type: none"> Focused on the deployment of smart meters and software Provides near real-time communication between software and meters Data and AMI functionality enable new products and services and improves customer experience

Advanced Grid – ADMS

- **Certification granted 2016**
- **2016 –2021 deployment timeframe**
- **Deployment of ADMS software and hardware**
- **Software in production October 2020**
- **Three distribution control centers in Minnesota**
 - Go-live for first two April 2021
 - Go-live for third September 2021
- **Enables improved reliability, management of DER and efficiency when operating the grid**
- **Enables enhanced visibility and control of field devices**



Advanced Grid – AMI



- **Certification granted 2020**
- **Deployment of meters and software**
- **Planned deployment of 1.4 million AMI meters**
 - 2022-2024 deployment timeframe
- **Provides near real-time communication to meters**
- **Enables new products and services for customers**
- **Enables enhanced planning and operations**



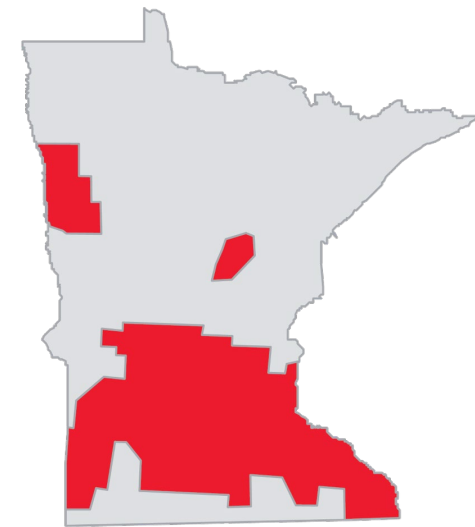
Distributed Intelligence

Overview

- **Current generation of AMI meters includes “grid edge” computing capability**
- **Enables local processing of real-time meter information to enhance customer services and grid operations**
- **Potential solution categories:**
 - Reliability
 - Safety and Security
 - Energy insights
 - Controls and Demand Management
 - Electric Vehicles and DERs
 - Grid Optimization

Advanced Grid – FAN

- **Certification approved 2020**
- **Deployment of WiSUN and public cellular**
- **2021 –2024 deployment timeframe**
 - Deployed by geographic area in advance of AMI meters
- **Provides two-way communication**
- **Provides near real-time communication**
 - Between meters and software
 - Between field devices and ADMS



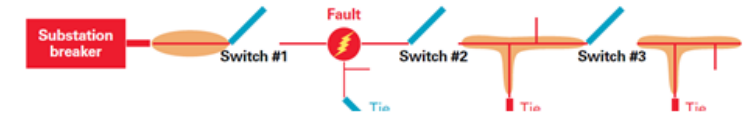
Advanced Grid – FLISR

- Included in pending Rate Case
- Deployment of intelligent field devices
 - Includes FAN communication
 - Integration with ADMS
- 2021 –2027 deployment timeframe
- Enables fault location prediction
- Enables automatic restoration
- Enhances reliability of the distribution grid

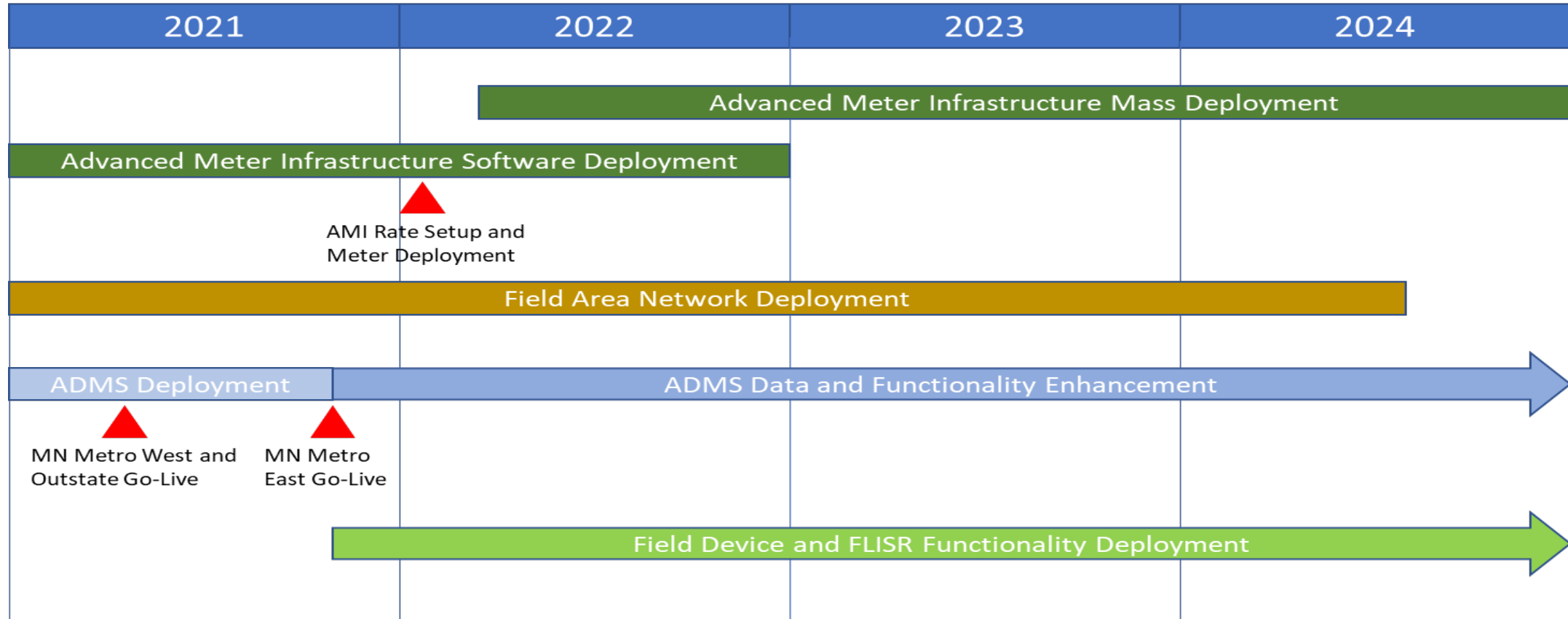
Fault Location Isolation and Service Restoration (FLISR)

- Open points close to energize unaffected parts of the system
- Crews dispatched to make repairs and restore service

Fault
Location
Isolation
Service
Restoration



Advanced Grid – Summary



Customer Products and Services Roadmap – Advanced Grid

	DAY ONE (2022)	NEAR TERM (2022-2025)	FUTURE (2025+)
ENHANCE THE EXPERIENCE	<ul style="list-style-type: none"> Energy Usage Dashboard Enhanced Web and Mobile Apps Enhanced Outage Notifications Green Button Connect My Data 	<ul style="list-style-type: none"> Emergency and Safety Notifications Energy Usage Alerts and Notifications Personalized Notifications Power Quality Analysis 	<ul style="list-style-type: none"> Artificial Intelligence Enabled Notifications Smart Premise Restoration Enhanced Microgrid Integration Smart Safety Disconnect
KEEP BILLS LOW	<ul style="list-style-type: none"> Enhanced Communication Options with Behind the Meter Systems (HAN) 	<ul style="list-style-type: none"> Whole Facility Monitoring Rate Advisor Time Varying Rates Virtual Energy Audits 	<ul style="list-style-type: none"> Smart Rates Enhanced Automated Demand Response
CLEAN ENERGY		<ul style="list-style-type: none"> Demand management optimization Enhanced access to battery storage and electric vehicles Green notifications and controls Enhanced DER enablement 	

Enabled or enhanced by Distributed Intelligence

Proposed Certification – Resilient Minneapolis Project

Overview

- **Grew out of 2019 IDP Minneapolis NWA pilot request, then proposed in 2020 Relief & Recovery petition**
 - Responding to pandemic and civil unrest → partner with BIPOC-led organizations to improve community resilience at critical sites
- **Responsive to Minnesota IDP objectives**
 - Enhance security, reliability and resilience of grid; enable greater customer engagement, empowerment, and options for energy services; demonstrate how local microgrids can be leveraged for the benefit of all Xcel Energy customers
- **Advances broader equity, energy affordability, emission reduction, and workforce development goals**
- **Total budget of approximately \$9 million**

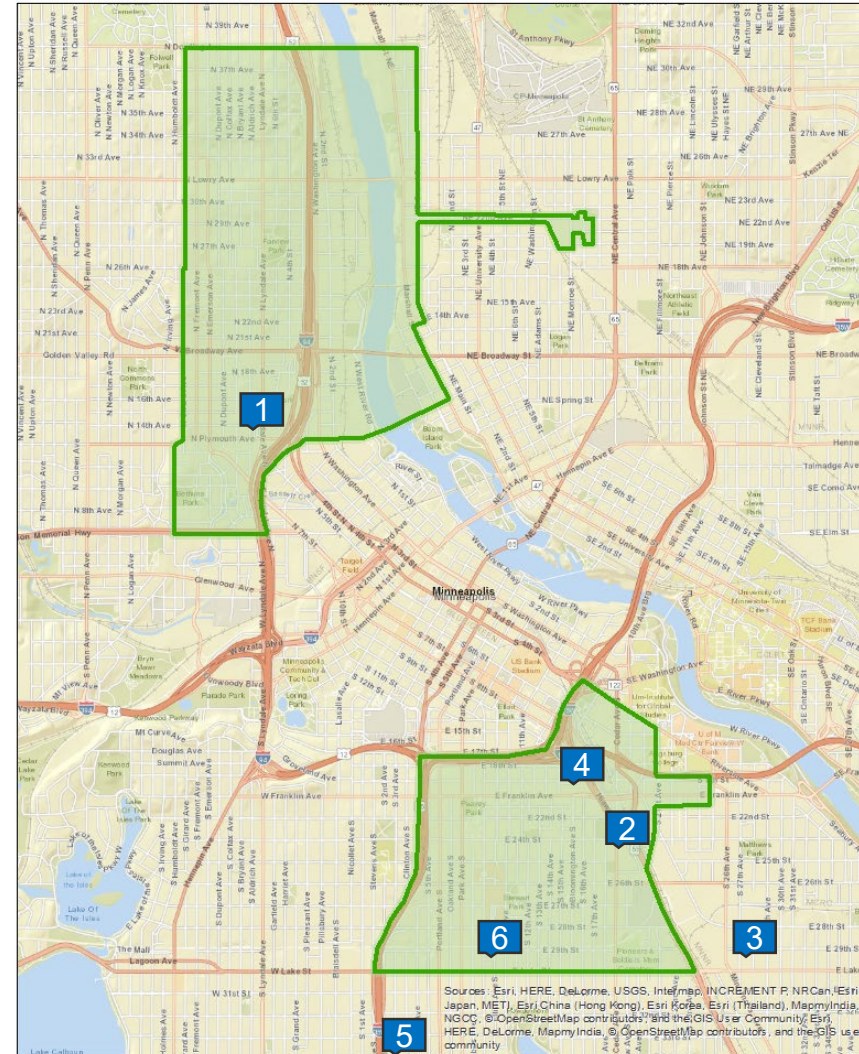
Resilient Minneapolis Project

Application Process

1. Renewable Energy Partners:
North Minneapolis Community Resiliency Hub
2. Native Sun Community Power Development:
Little Earth of United Tribes
3. Seward Redesign Inc:
Downtown Longfellow Community (Coliseum Building)
4. Minneapolis American Indian Center
5. Sabathani Community Center
6. Friends of Global Market
Midtown Exchange Campus

- Formal application process with scoring criteria and weights
- Review by internal and external reviewers with deep relationships in these communities
- “Co-creation” process with selected applicants

Minneapolis Green Zone Boundaries



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, OpenStreetMap contributors, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, OpenStreetMap contributors, and the GIS user community

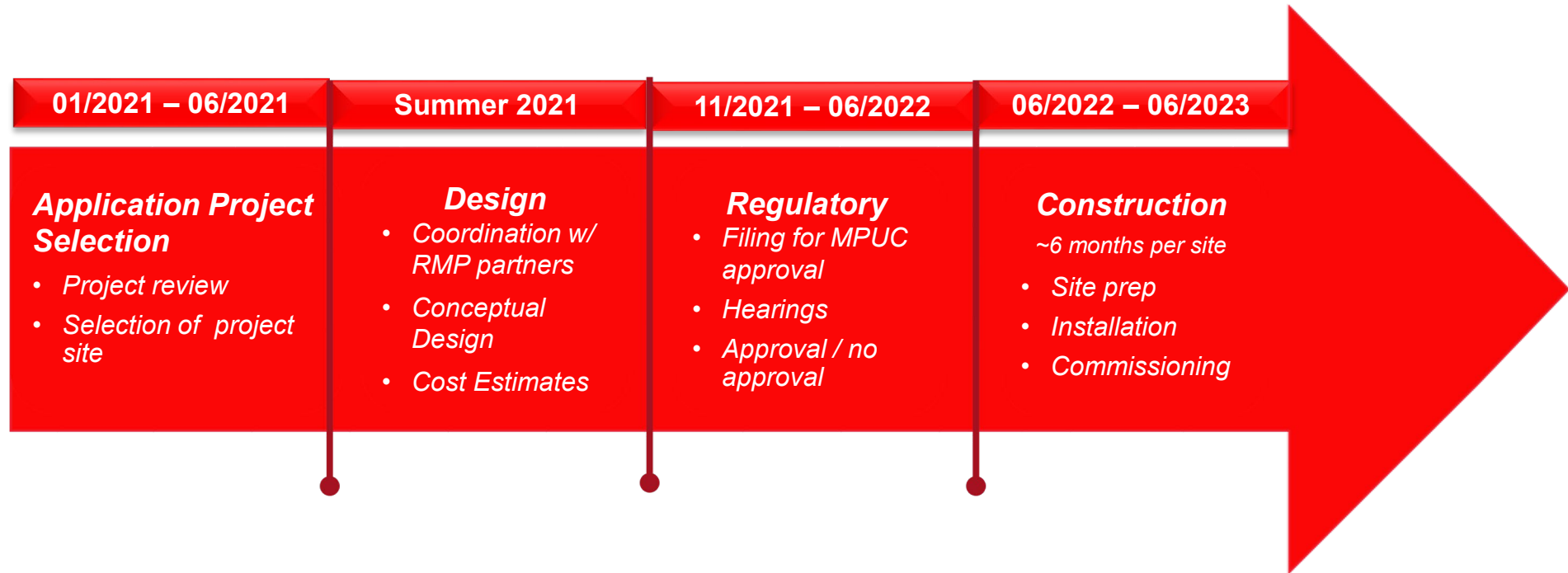
Resilient Minneapolis Project

Common characteristics across 3 sites

- **All include solar, battery systems, and microgrid controls to provide resiliency in outages and deliver a range of grid services**
 - Bulk system capacity, local distribution system support (peak shaving, ancillary services, hosting capacity), price arbitrage, emission avoidance
- **BIPOC career training and workforce diversification**
- **Some sites implementing additional measures (HVAC, efficiency, etc.) that address energy affordability**
 - These costs not included in request for certification, but working with applicants on how to fund

Resilient Minneapolis Project

TIMELINE AND NEXT STEPS



Note: Timeline is approximate and subject to change as it depends on discussions with partners as well as the regulatory process which has no set approval timeline.

