



414 Nicollet Mall
Minneapolis, Minnesota 55401

April 17, 2019

—Via Electronic Filing—

Daniel P. Wolf
Executive Secretary
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota 55101-2147

RE: APRIL 10, 2019 STAKEHOLDER WORKSHOP PRESENTATION
INTEGRATED DISTRIBUTION PLAN
DOCKET NO. E002/CI-18-251

Dear Mr. Wolf:

Northern States Power Company, doing business as Xcel Energy, submits to the Minnesota Public Utilities Commission the presentation from our April 10, 2019 Stakeholder Workshop.

We have electronically filed this document with the Commission, and copies have been served on the parties on the attached service list. Please contact Amber Hedlund at 612-337-2268 or amber.r.hedlund@xcelenergy.com or me at (612) 330-6064 or bria.e.shea@xcelenergy.com if you have any questions regarding this filing.

Sincerely,

/s/

BRIA SHEA
DIRECTOR, REGULATORY AND STRATEGIC ANALYSIS

Enclosure
c: Service list



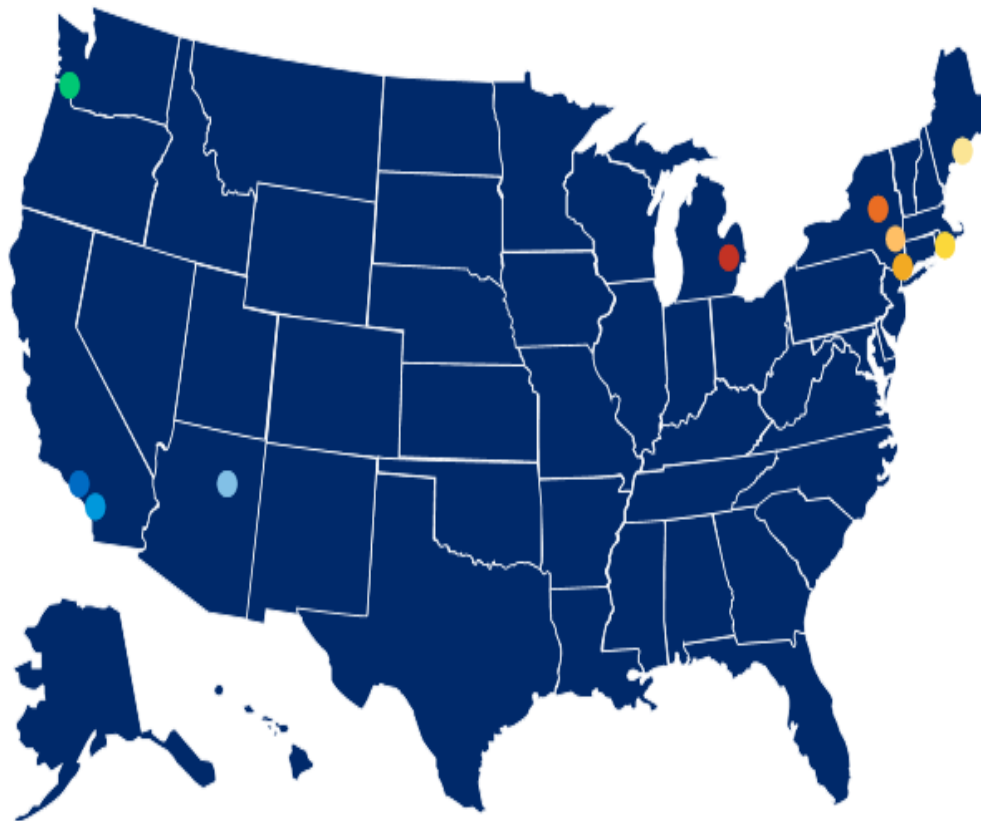
Integrated Distribution Plan

Workshop 1-19

Non-Wire Alternatives Analysis

April 10, 2019

National Case Studies – Summary



- **BPA—SOUTH OF ALLSTON**
ALLSTON, WA
- **SCE—VIRTUAL POWER PLANT**
LOS ANGELES, CA
- **SCE—DESI 1**
ORANGE, CA
- **APS—PUNKIN CENTER**
PUNKIN CENTER, AZ
- **CONSUMERS ENERGY—
SWARTZ CREEK ENERGY SAVERS**
SWARTZ CREEK, MI
- **NATIONAL GRID—OLD FORGE**
OLD FORGE, NY
- **CENTRAL HUDSON GAS &
ELECTRIC—PEAK PERKS PROGRAM**
MID-HUDSON RIVER, NY
- **CON ED—BROOKLYN QUEENS
DEMAND MANAGEMENT**
BROOKLYN, NY
- **NATIONAL GRID—TIVERTON
NWA PILOT**
TIVERTON/LITTLE COMPTON, RI
- **GRIDSOLAR—BOOTHBAY PILOT**
BOOTHBAY PENINSULA, ME

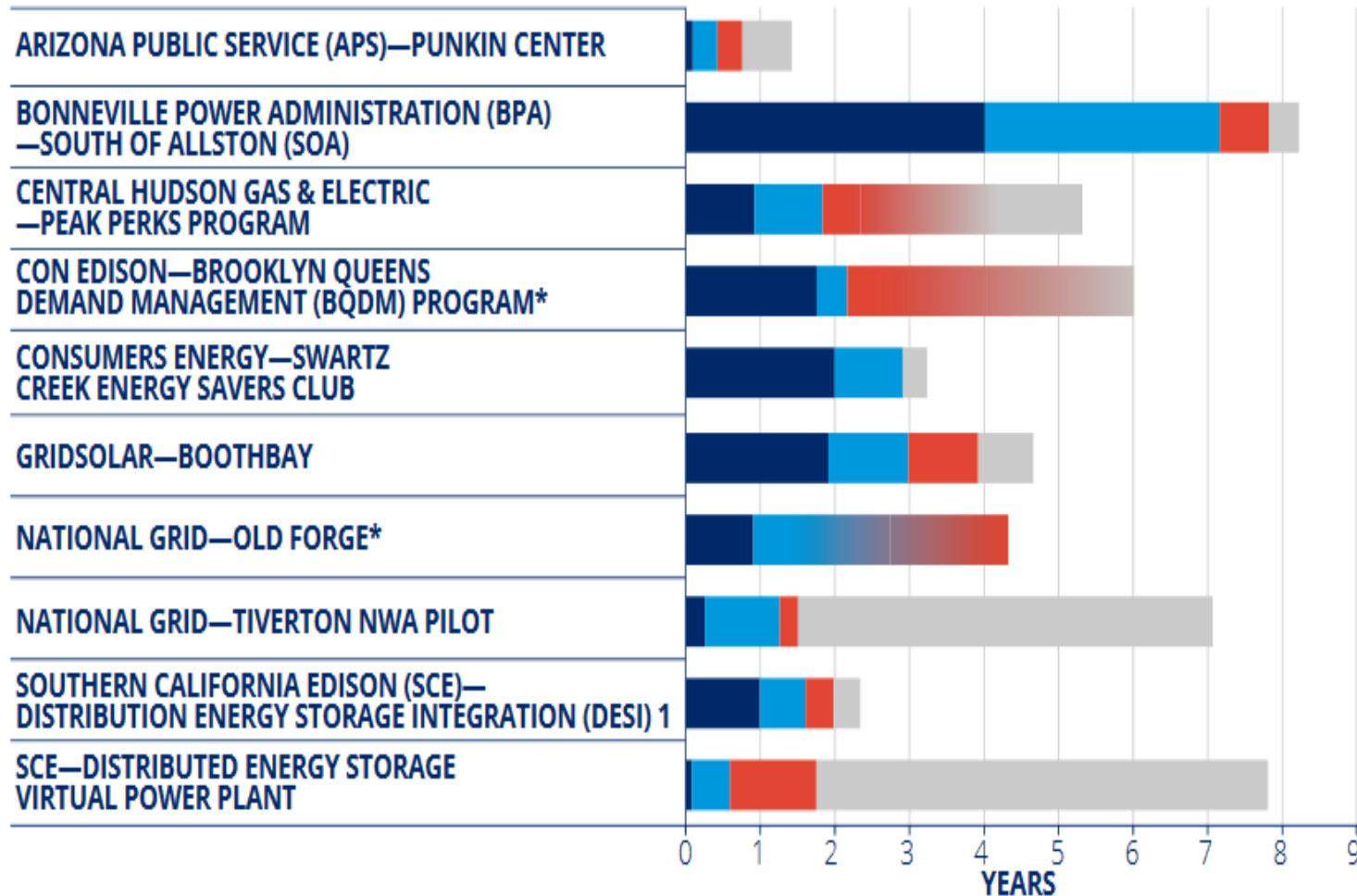
Source: SEPA, PLMA, and E4TheFuture, 2018.

UTILITY, KEY PROJECT IMPLEMENTER—PROJECT NAME	PROJECT SIZE
ARIZONA PUBLIC SERVICE—PUNKIN CENTER	2 MW, 8 MWh
BONNEVILLE POWER ADMINISTRATION—SOUTH OF ALLSTON	200 MW Inc. 200 MW Decr. 100 MW Relief
CENTRAL HUDSON GAS & ELECTRIC—PEAK PERKS DEMAND MANAGEMENT PROGRAM	16 MW
CON EDISON—BROOKLYN QUEENS DEMAND MANAGEMENT (BQDM) PROGRAM	52 MW
CONSUMER ENERGY—SWARTZ CREEK ENERGY SAVERS CLUB	1.4 MW
GRIDSOLAR—BOOTHBAY	1.85 MW
NATIONAL GRID—OLD FORGE	19.8 MW, 63.1 MWh
NATIONAL GRID—TIVERTON NWA PILOT	330 kW
SOUTHERN CALIFORNIA EDISON—DISTRIBUTION ENERGY STORAGE INTEGRATION (DESI) 1	2.4 MW, 3.9 MWh
SOUTHERN CALIFORNIA EDISON—VIRTUAL POWER PLANT (VPP)	85 MW

Case Studies: Drivers & Challenges

UTILITY, KEY PROJECT IMPLEMENTER—PROJECT NAME	T&D CHALLENGE	DRIVERS	SOURCING
ARIZONA PUBLIC SERVICE—PUNKIN CENTER	Thermal constraint on feeder	Regulatory Mandate, Internal Management Decision	Direct procurement (competitive bidding)
BONNEVILLE POWER ADMINISTRATION—SOUTH OF ALLSTON	Transmission grid constraint	Internal Management Decision	Direct procurement
CENTRAL HUDSON GAS & ELECTRIC—PEAK PERKS DEMAND MANAGEMENT PROGRAM	Distribution constraint	Regulatory Mandate	Customer Program
CON EDISON—BROOKLYN QUEENS DEMAND MANAGEMENT (BQDM) PROGRAM	Sub-transmission feeder constraint at substation	Regulatory Mandate, Internal Management Decision	Customer Program
CONSUMERS ENERGY—SWARTZ CREEK ENERGY SAVERS CLUB	Distribution constraint	Regulatory Mandate, Internal Management Decision	Customer Program
GRIDSOLAR—BOOTHBAY	Distribution constraint and reliability	Regulatory Mandate, Internal Management Decision, Public Input	Direct procurement (competitive bidding, sole-sourced)
NATIONAL GRID—OLD FORGE	Distribution constraint and grid resiliency	Internal Management Decision	Direct procurement (competitive bidding, sole-sourced)
NATIONAL GRID—TIVERTON NWA PILOT	Feeder substation upgrade deferral	Internal Management Decision	Customer Program
SOUTHERN CALIFORNIA EDISON—DISTRIBUTION ENERGY STORAGE INTEGRATION (DESI) 1	Distribution constraint	Internal Management Decision	Direct procurement (competitive bidding, sole-sourced)
SOUTHERN CALIFORNIA EDISON—VIRTUAL POWER PLANT (VPP)	Long term local capacity constraints	Internal Management Decision with Regulatory Mandate	Direct procurement (competitive bidding, sole-sourced)

Case Studies: Project Timelines



■ IDEATION ■ PLANNING ■ PROCUREMENT/SOURCING ■ IMPLEMENTATION

Key Insights

PLANNING AND SOURCING	IMPLEMENTATION	
	PROJECT IMPLEMENTATION	TECHNOLOGY-SPECIFIC IMPLEMENTATION
Open and technology-agnostic approaches can help with project success	Plan for internal development	Launching energy efficiency first allows longer lead times for other DER solutions
Procurement processes and bidding responses require more time than originally anticipated	Community outreach helps overall reception and likelihood of project success	Demand response encompasses a wide range of technologies and was met with varying levels of success across six case studies
Uncertainty of load growth is a challenge for utilities but a strength for NWAs	Recruitment and customer engagement requires a multipronged approach	Energy storage implementation has its share of obstacles, including: siting, reliability requirements, interconnection, and system impact challenges. These challenges are largely due to the nascency of storage technologies
Know as much about your service territory as possible to inform program recruitment		
Utilities often use a benefit-to-cost assessment to evaluate NWA opportunities		

NWA IDP Requirements

Detailed discussion of all distribution system projects in the filing year and the subsequent 5 years that are anticipated to have:

- Total cost greater than two million dollars
- For projects in the filing year provide an analysis on how non-wires alternatives compare in terms of viability, price, and long-term value

Provide information on the following:

- Project types that would lend themselves to non-traditional solutions (i.e. load relief or reliability)
- A timeline that is needed to consider alternatives to any project types that would lend themselves to non-traditional solutions (allowing time for potential request for proposal, response, review, contracting and implementation)
- Cost threshold of any project type that would need to be met to have a non-traditional solution reviewed

A discussion of a proposed screening process to be used internally to determine that non-traditional alternatives are considered prior to distribution system investments are made.

NWA Analysis High-Level Considerations

- **NWA Attributes**

- Generate, discharge, or reduce downstream electricity consumption that mitigates the system risk/issue

- **Candidate Projects**

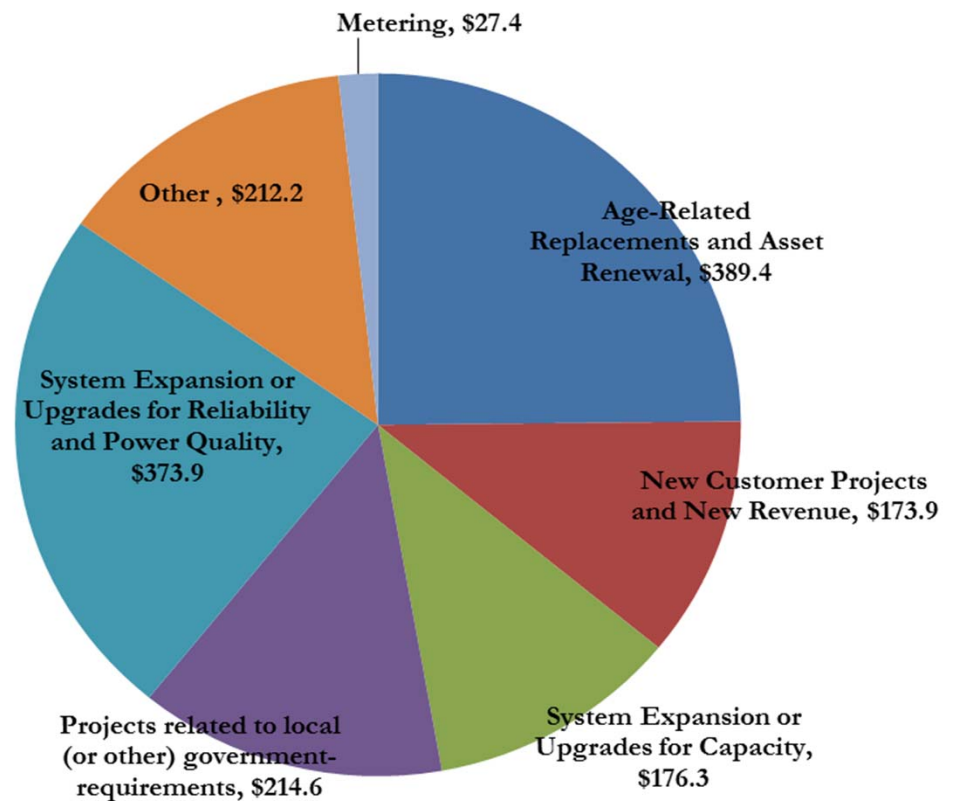
- Project Type(s)
- Project Timing

First Filter – *Capacity Projects*

Project Types –

- Age-Related & Asset Health
- Grid Modernization
- Local Government-Driven
- Metering
- New/Customer-Driven
- **System Expansion/
Upgrades – *Capacity***
- System Expansion/
Upgrades – *Reliability &
Power Quality*
- Other

Budgeted Distribution Capital Profile by IDP Category
State of Minnesota – Electric Jurisdiction (2018-2023)
(millions)



***Discussion:* High-Level Considerations**

Reliable Feeder Risk Analysis

Total N-1:
0 + 1 + 2 =
3 MW at risk

Feeder 1
 Section 1
 Load = 3 MW

Feeder 1
 Section 2
 Load = 3 MW

Feeder 1
 Section 3
 Load = 3 MW

Feeder
 Breaker
 Feeder #1



Switch



Fault

Tie to
 Feeder #2
 Load = 7.3 MW
 Capacity = 10 MW
0 MW at risk

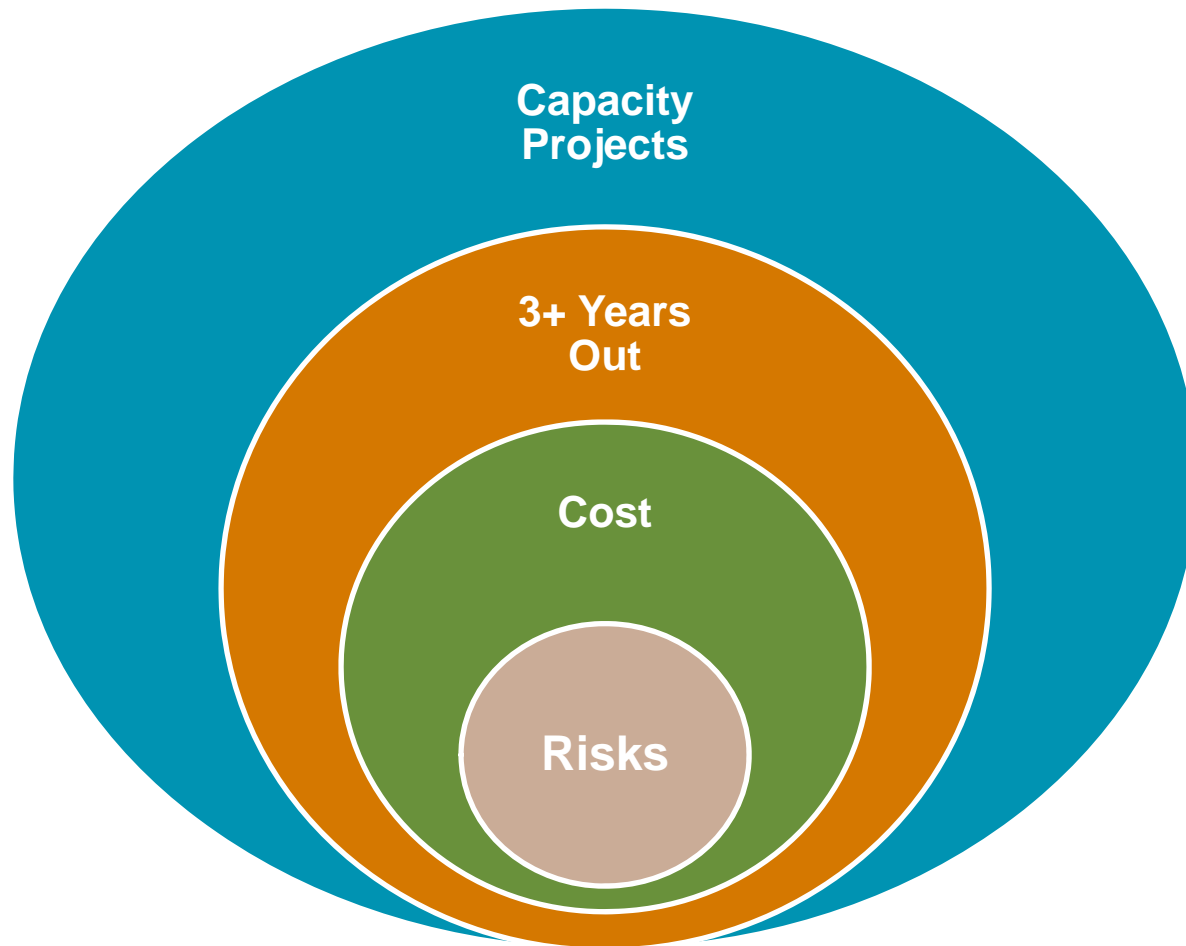
Tie to
 Feeder #3
 Load = 8.3 MW
 Capacity = 10 MW
1 MW at risk

Tie to
 Feeder #4
 Load = 9.1 MW
 Capacity = 10 MW
2 MW at risk

Key

-  Switch - Normally Open
-  Switch - Normally Closed

Project Viability Analysis – Proposed 2019



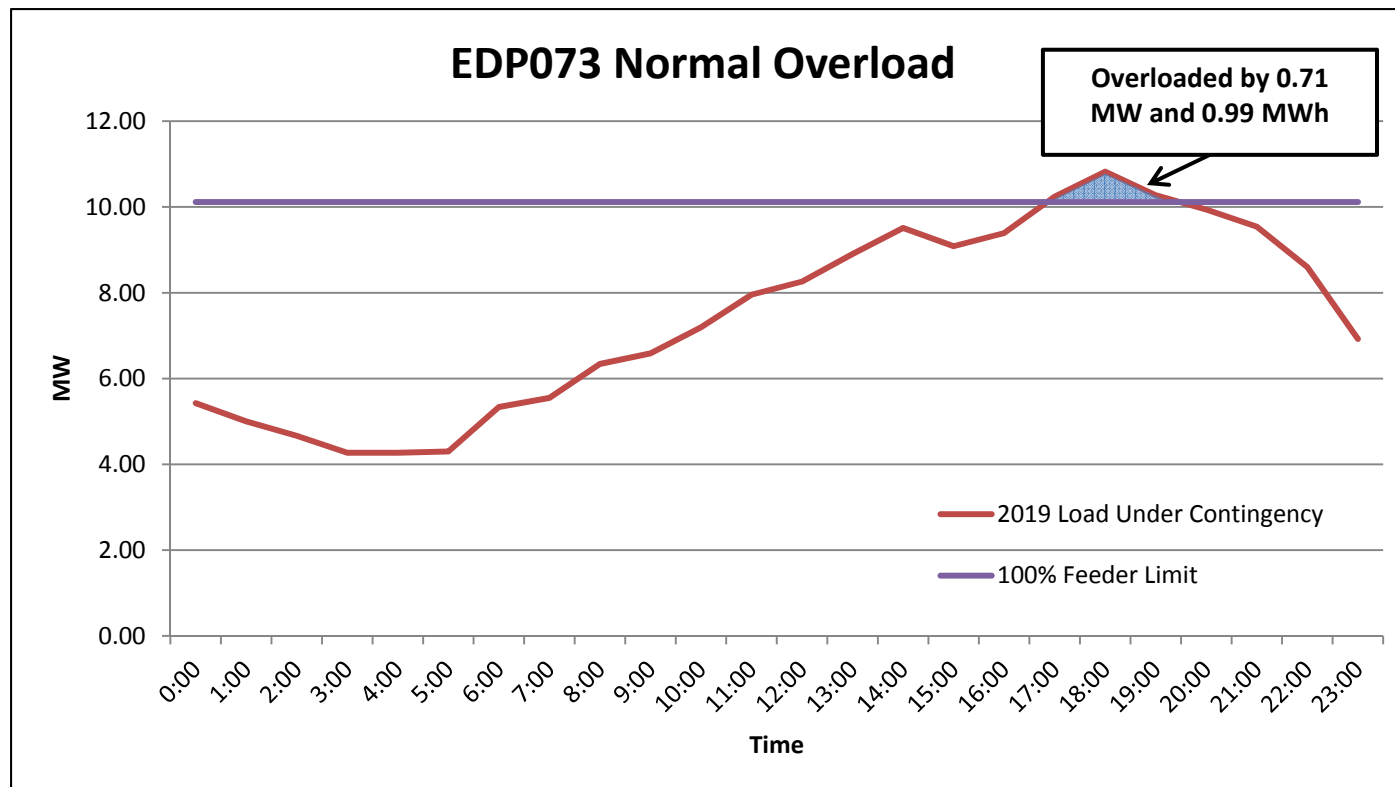
Example: Viking NWA Analysis

NWA Analysis Process

- Quantify the risks
 1. Peak day load curves
 2. MW over the limit, MWh over the limit
- Identify solution
 1. Impact of solar
 2. Impact of Demand Response
 3. Remaining necessary storage
- Estimate costs

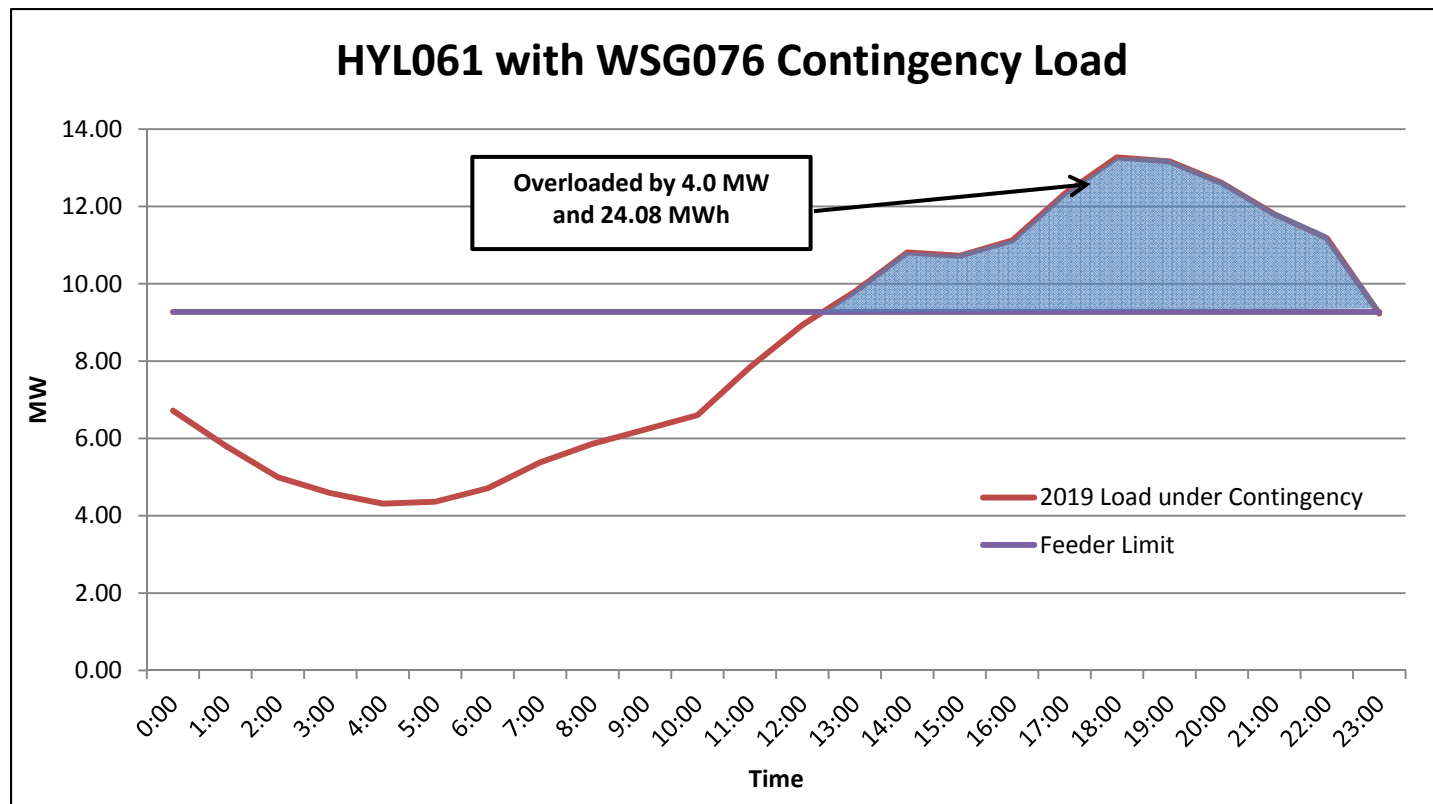
Example: Viking NWA Analysis (cont'd)

- Quantify the risk – N-0 overload



Example: Viking NWA Analysis (cont'd)

- Quantify the risk – N-1 contingency overload



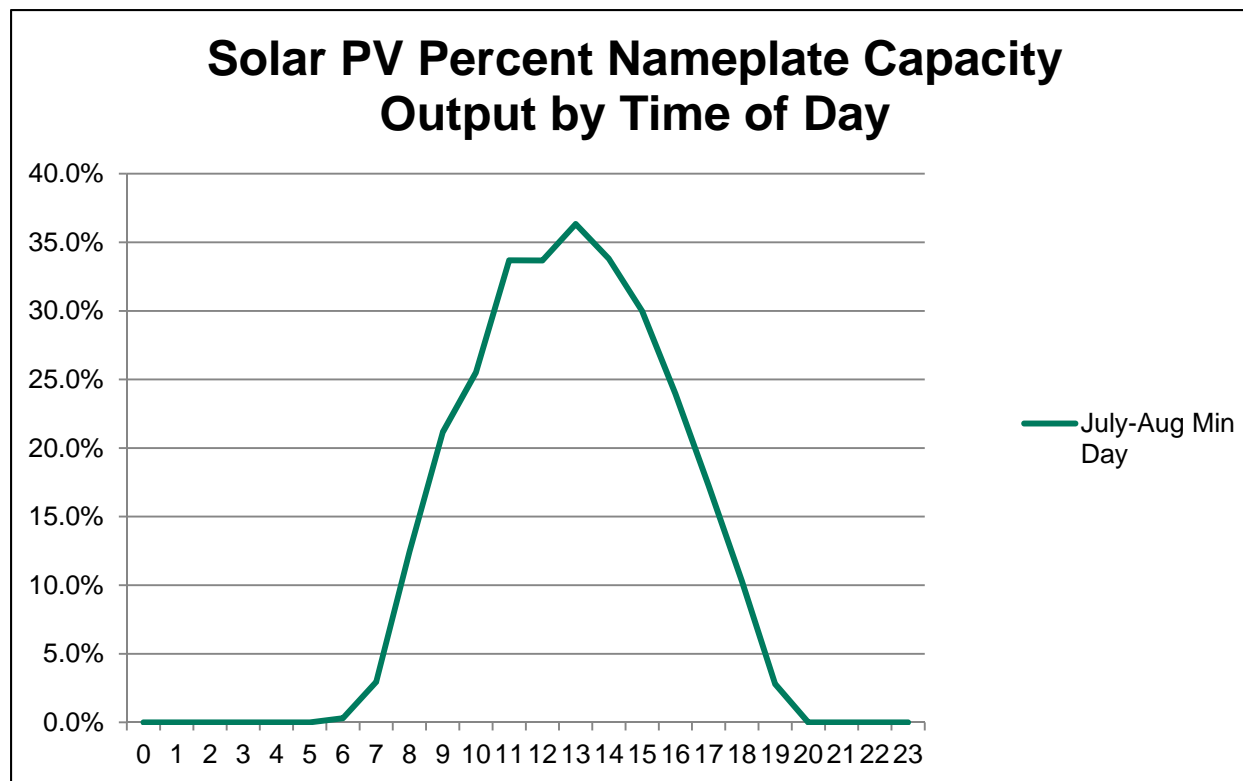
Example: Viking NWA Analysis (cont'd)

– *Associated risks*

Capacity Risk	Overload Magnitude	
	MW Overload	MWh Overload
EDP073 N-0 overload, 107%	0.71	0.99
N-1 overload on WSG065 for loss of EDP073, 2.3 MVA at risk	2.04	11.50
HYL061 N-0 overload, 101%	0.04	0.04
N-1 overload on HYL061 for loss of WSG076, 4.2 MVA at risk	4.00	24.08

Example: Viking NWA Analysis (cont'd)

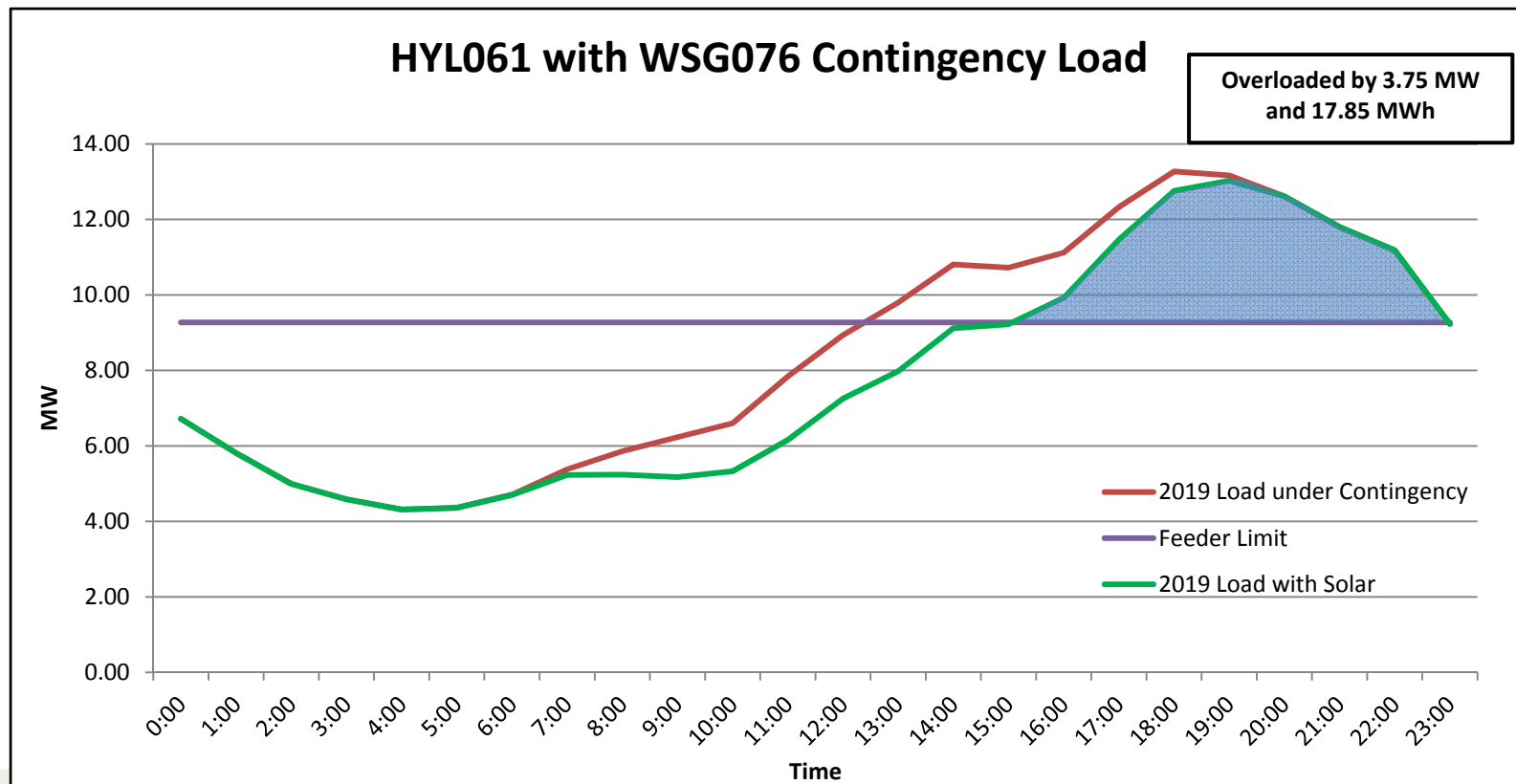
– *Impact of solar – worst case assumption*



Source: NREL PVWatts

Example: Viking NWA Analysis (cont'd)

- Impact of solar – theoretical impact of 5 MW of solar
 - Reduction of 0.25 MW and 6.23 MWh – **effectively \$2M/MWh**



Example: Viking NWA Analysis (cont'd)

Estimated costs

- Solar unit cost: \$2.5M per MW
- Storage unit cost: \$600k per MWh

Capacity Risk	Overload Magnitude		Optimal DER Solution		Estimated Cost
	MW Overload	MWh Overload	Solar PV (MW)	Battery Storage (MWh)	
EDP073 N-0 overload, 107%	0.71	0.99	0	0.99	\$595,000
N-1 overload on WSG065 for loss of EDP073, 2.3 MVA at risk	2.04	11.50	0	11.50	\$6,900,000
HYL061 N-0 overload, 101%	0.04	0.04	0	0.04	\$26,000
N-1 overload on HYL061 for loss of WSG076, 4.2 MVA at risk	4.00	24.08	0	24.08	\$14,450,000
Total			0	36.61	\$21,971,000

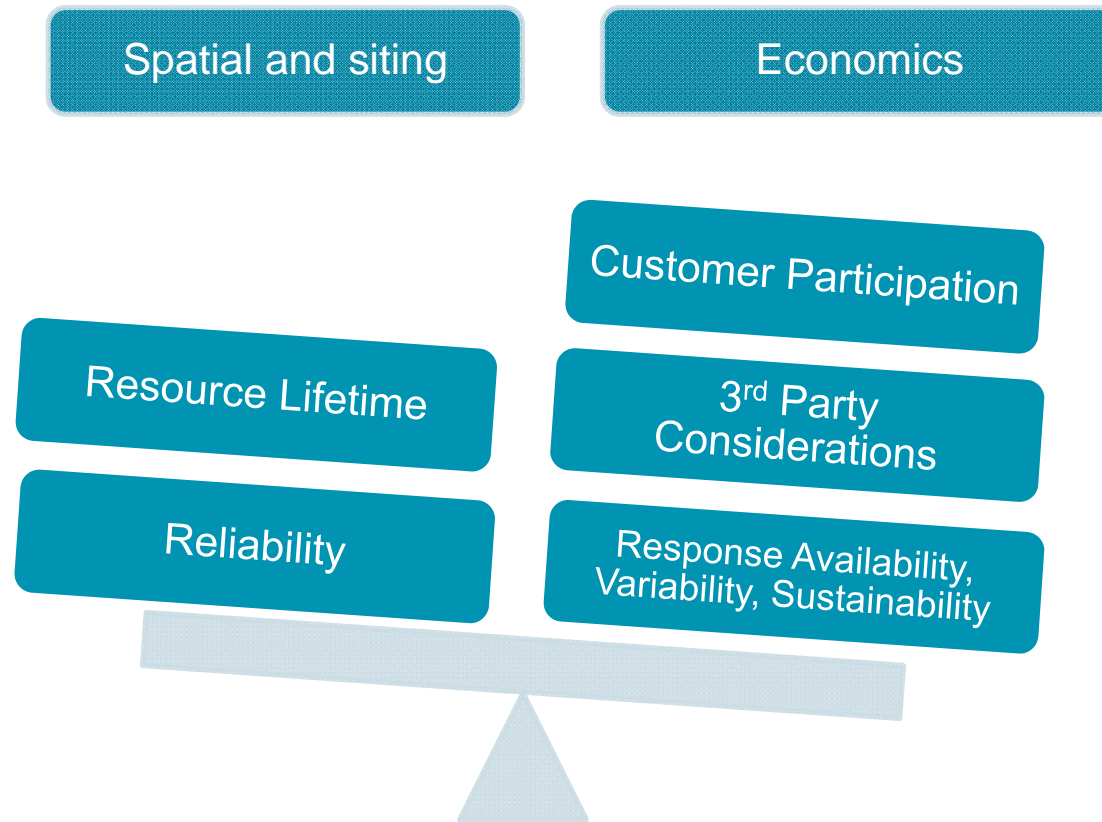
Demand Response – *Capabilities and Considerations*

- Capabilities
 - Direct Load Control Programs:
 - Saver's Switch
 - Smart Thermostat Control
 - C&I interruptible – Electric Rate Savings
 - We have the ability to control by feeder
- Considerations/Risk
 - **Penetration** of current capabilities by feeder needed for planning purposes
 - **Number of Events** – the more control found at customer site the more fatigue created
 - Must account for **MISO requirements**
 - **Additional time/resources** for marketing, event management, customer care center, etc. needed to manage at this level
 - Do not have **load data analysis** needed at a granular level for all customers to-date

Demand Response – *Analyses*

- Conducting Summer Analysis
 - Partnership with Center for Energy and Environment on GeoTargeting
 - Intend to review:
 - Control by feeder, over several days, differing hours
 - Marketing opportunities
- Analysis for Integrated Distribution Plan
 - Reviewing penetration
 - Determining appropriate hours of use by program
 - Will not be including new programs in analysis until such programs are approved for use

NWA Analysis Balancing Act



Project Viability Considerations – Case Studies

Locational: Spatial and siting limitations, the location of the constraint, and feeder siting.

Temporal: Resource availability, output variability, sustainability of response, and resource lifetime.

Additional design considerations: Sizing of NWA, alternative lead-times, reliability, customer participation, and 3rd party contractual arrangements.

Economic: Costs and benefits associated with pursuing NWA projects given DER performance and lifetime considerations in the context of the regulatory/policy landscape.

Source: EPRI, December 2018: “Guidance on DER as Non-Wires Alternatives (NWAs)”

Category	Factor to Consider	Notes
Location	Geographic	Resource availability
	Grid placement - direction of constraint	Related to nature of constraint, voltage thermal etc.
	Grid placement - proximity to constraint	Important for networked systems
	Alternate configurations	Switching schedules, contingencies
	Hosting capacity	Related to temporal factors
	Space availability	Related to physical sizing factors
	Siting issues	Safety and other restrictions
Temporal	Constraint/output coincidence - instant in time	Time of day - how does the DER output and distribution constraint coincide?
	Constraint/output coincidence - day of year	Day or season - how does the DER output and distribution constraint coincide?
	Sustainability	Duration of output from DER
	Lifetime	Short- vs long-term lifetime. Related to degradation and cycling
	Lead times	Short- vs long-term lead time. Length of procurement process. Forecasting uncertainty
	Charge/discharge times	Related to sizing
	Flexibility	Related to variability and portfolio design
	Controllability	Related to variability and portfolio design
Design Sizing	Resource variability	Related to fuel source
	Power	Related to other temporal, location and dispatchability factors
	Energy	Related to other temporal, location and dispatchability factors
	Losses/efficiency	Related to location factors
	Headroom	Related to forecasting uncertainty
	Customer participation	For EE and DR, type and number of customers
Design Reliability	Degradation	Related to temporal factors
	Lifetime	Related to degradation, cycling and forecast uncertainty
	Availability	Number of resources, many small or one large
Design Other	Probability of failure	Number of critical systems (e.g. resource, power electronics, communications) and their probability
	Third party contracting	Lead time for contracting, risk of going out of business, etc.
Economics	Portfolio design	Desired objective and optimal resource share
	Capital Costs	Related to lead times (upward and downward trend)
	Operational Costs	Fuel costs
	Maintenance Costs	Related to lifetime
	Lifetime and replacement costs	Related to planning horizon
Avoided costs	Energy, ancillary services, RPS, taxes, etc.	

Discussion: Project Viability and Analysis Considerations

Joint EPRI Project – *Modernizing Distribution Planning using Automated Processes and Tools*

- Joint EPRI Project
- Partnering with over ten other utilities
- Develop, Test, and Demonstrate new methods and tools to:
 - Support Holistic Decision Making
 - Automate Planning Assessments
 - Traditional “Wires” Alternatives
 - Non-Wires Alternatives
 - Multi-year Optimization



Joint EPRI Project - Key R&D Tasks



Develop

- Work with industry to identify gaps, new objective functions, data needs
- Develop a flexible and comprehensive planning process



Apply

- Apply new planning framework for specific utility-driven use cases
- Test, refine, and validate new planning solution



Implement

- Implement in a prototype planning platform
- Leverage advanced distribution planning analytics available in OpenDSS and DRIVE™

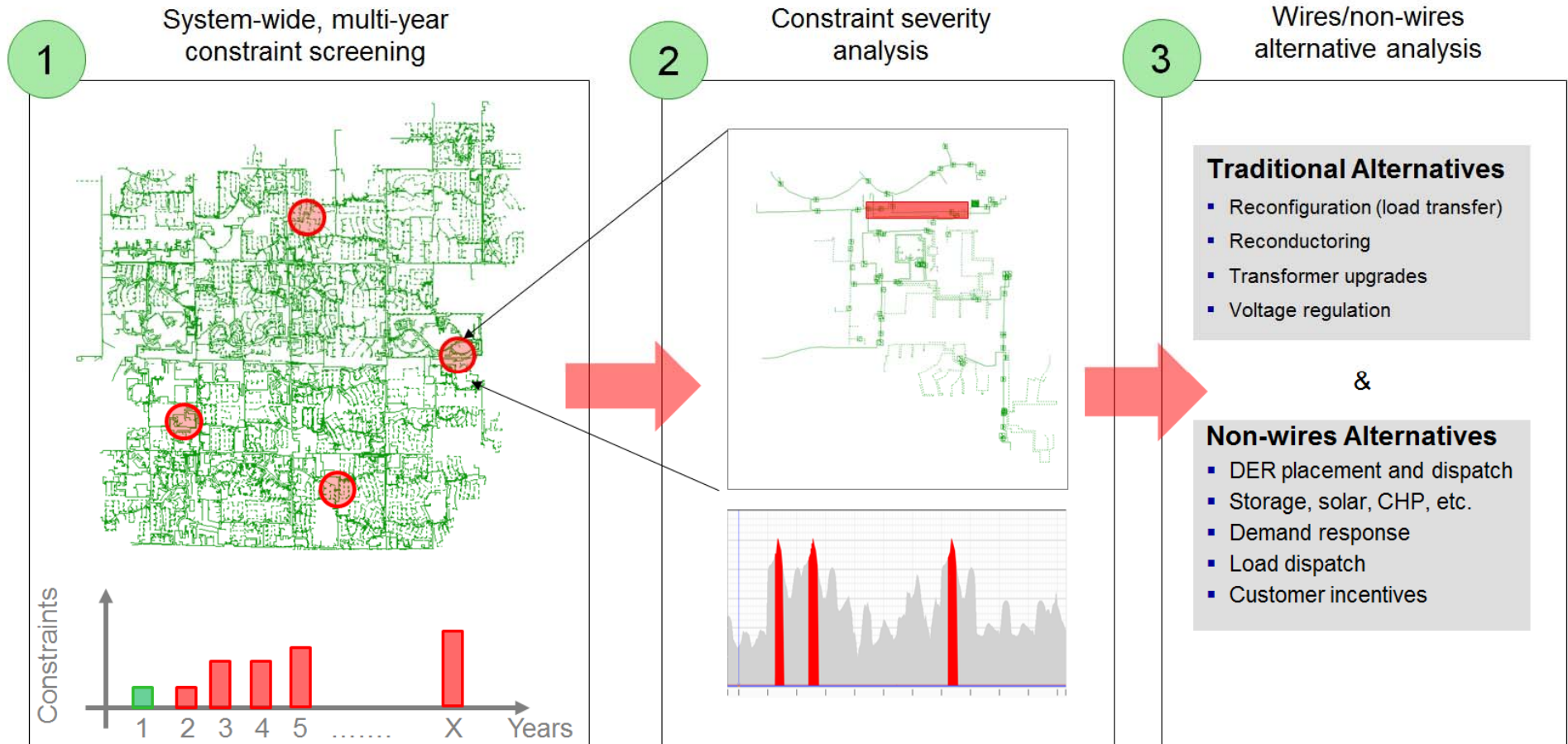


Share

- Document/share vision and lessons learned
- Provide prototype software for application and direction for future development

Joint EPRI Project - Alternative Analysis

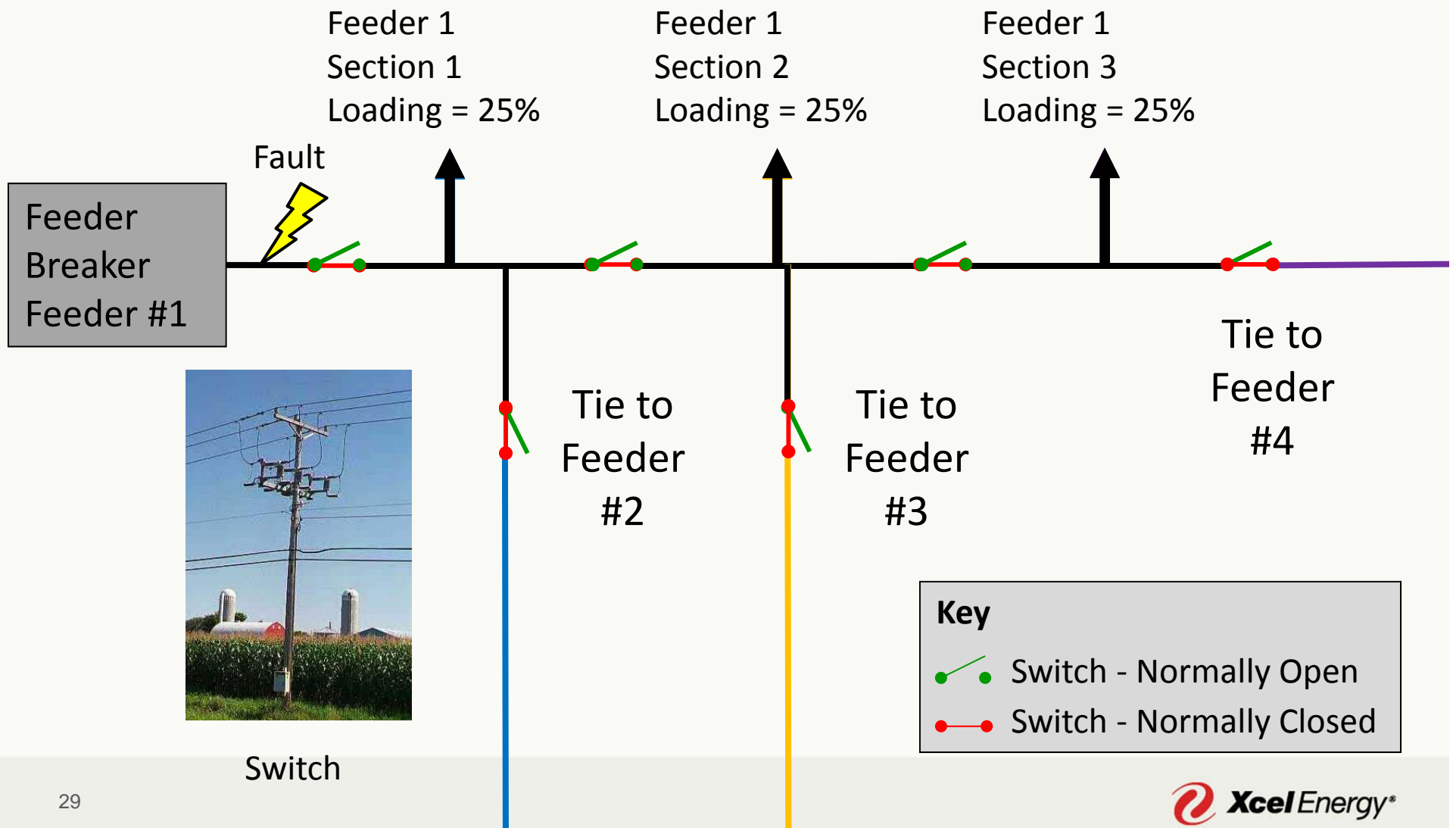
Example Use Case



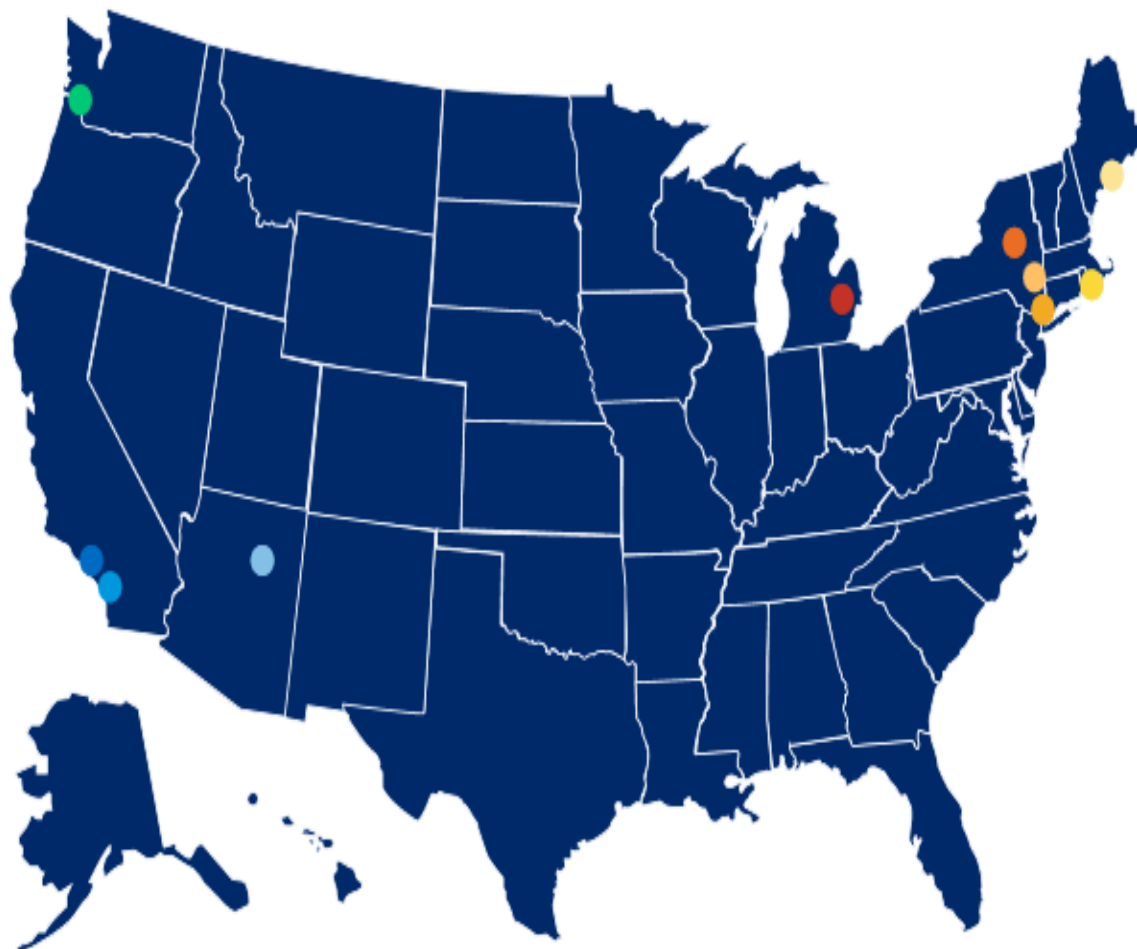
***Discussion:* What are you expecting to see in the IDP regarding our NWA analysis?**



Reliable Feeder Design



Case Studies: Overview



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ALLSTON, WA
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- SCE—DESI 1**
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NWA PILOT**
TIVERTON/LITTLE COMPTON, RI
- GRIDSOLAR—BOOTHBAY PILOT**
BOOTHBAY PENINSULA, ME

The Current NWA Marketplace

- Global spending by utilities on NWAs is forecasted to increase from \$63 million in 2017 to \$580 million in 2026
- Over 100 NWA projects are in different phases of development today



Figure 3-1
NWA Capacity by Year of Project Announcement

Source: GTM Research

Deep Dive?

- Do you think that it would be worth it to spend time focusing on a particular case study to show the process other utilities went thru?
- Con Edison Brooklyn Queens Demand Management Program would be probably the best example of a “successful” NWA project if that’s what we want to illustrate, however there are other projects that could work as well

Sources

- EPRI, December 2018: “Guidance on DER as Non-Wires Alternatives (NWAs)”
- E4TheFuture, Smart Electric Power Alliance, PLMA, November 2018: Non-Wires Alternatives: Case Studies from Leading U.S. Projects

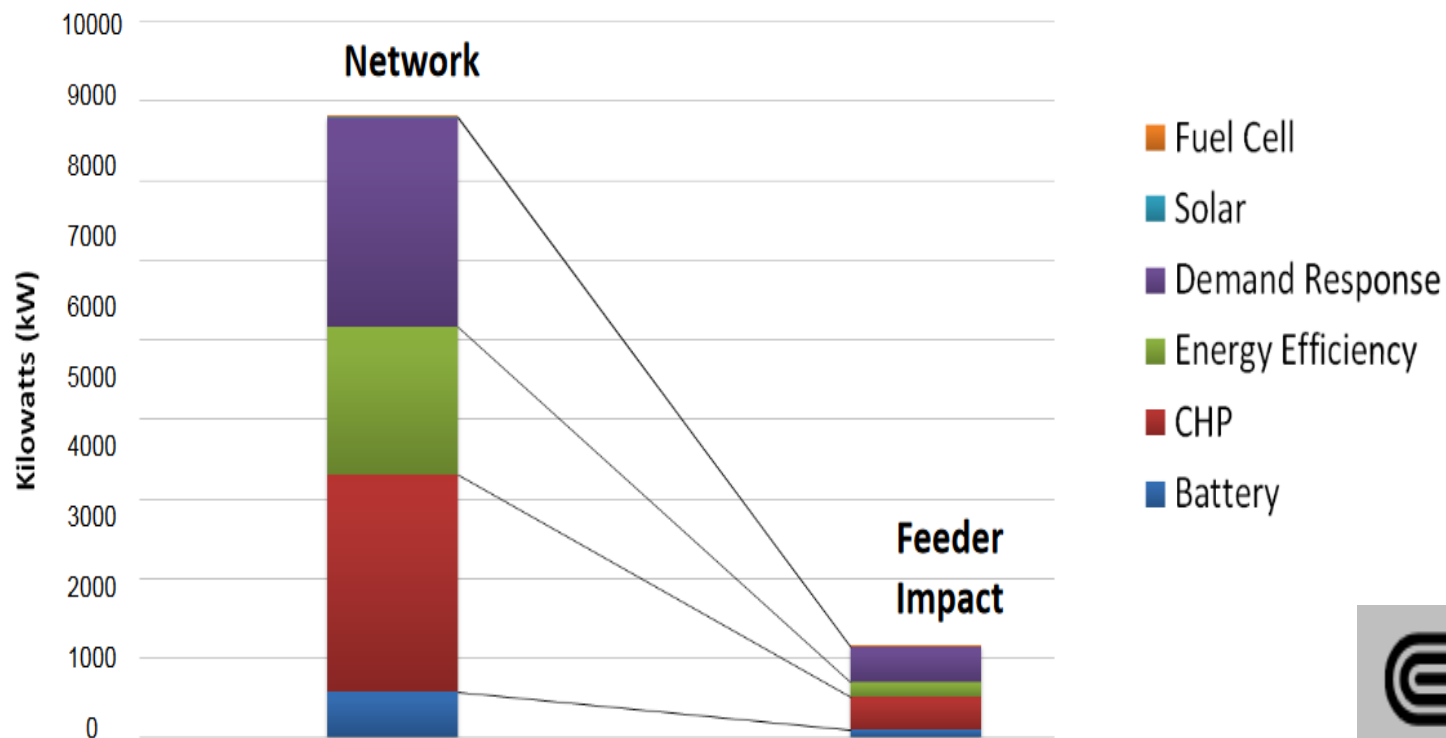
Case Studies: Considerations

- While case studies are helpful in determining potential challenges, NWAs are nascent and there is no standard approach
- Each case study has situations unique to that particular area that therefore make it difficult and inaccurate to apply to NSP
 - Wide variation in NWA technologies applied
 - Variation in locational requirements
 - Specific peak shaving requirements unique to each feeder
 - i.e. 5MW for 11 hours for 20 summer days
 - Customer make up: Residential vs Commercial vs Industrial
 - Operational elements

Case Studies: RFP Results

RFP Response Results *Illustrative*

NWA Potential Project



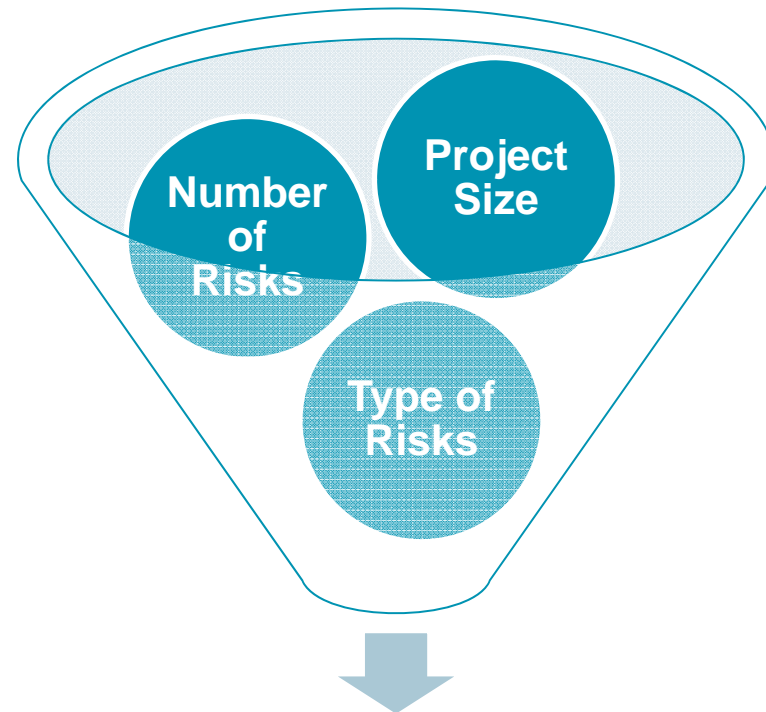
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Avoided costs	Energy, ancillary services, RPS, taxes, etc.	

Source: EPRI, December 2018: "Guidance on DER as Non-Wires Alternatives (NWA)"

Battery Storage Assumptions

- Beth's team is going to work on a slide or two on costs for battery projects – for example project management, Scada integration, business systems oversight, PI integration, siting costs, etc
- NOT SURE WE WANT THIS SLIDE....

Assess NWA Project Viability – 2nd Level Considerations



Potentially Viable Projects

CERTIFICATE OF SERVICE

I, Jim Erickson, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota

xx electronic filing

Docket No. E002/CI-18-251

Dated this 17th day of April 2019

/s/

Jim Erickson
Regulatory Administrator

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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Kenneth A.	Colburn	kcolburn@symbioticstrategies.com	Symbiotic Strategies, LLC	26 Winton Road Meredith, NH 32535413	Electronic Service	No	OFF_SL_18-251_Official
Generic Notice	Commerce Attorneys	commerce.attorneys@ag.state.mn.us	Office of the Attorney General-DOC	445 Minnesota Street Suite 1800 St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_18-251_Official
George	Crocker	gwillc@nawo.org	North American Water Office	PO Box 174 Lake Elmo, MN 55042	Electronic Service	No	OFF_SL_18-251_Official
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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Curt	Dieren	curt.dieren@dgr.com	L&O Power Cooperative	1302 S Union St Rock Rapids, IA 51246	Electronic Service	No	OFF_SL_18-251_Official
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Kristen	Eide Tollefson	healingsystems69@gmail.com	R-CURE	28477 N Lake Ave Frontenac, MN 55026-1044	Electronic Service	No	OFF_SL_18-251_Official
Bob	Eleff	bob.eleff@house.mn	Regulated Industries Cmte	100 Rev Dr Martin Luther King Jr Blvd Room 600 St. Paul, MN 55155	Electronic Service	No	OFF_SL_18-251_Official
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Oncu	Er	oncu.er@avantenergy.com	Avant Energy, Agent for MMPA	220 S. Sixth St. Ste. 1300 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_18-251_Official
James C.	Erickson	jericksonkbc@gmail.com	Kelly Bay Consulting	17 Quechee St Superior, WI 54880-4421	Electronic Service	No	OFF_SL_18-251_Official

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
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