Non-Wire Solutions –
Planning and Implementation

Soumya Tiwari, Sr Manager - Electric Power Engineers

Prepared for Lawrence Berkeley National Laboratory March 23, 2026

Agenda

Today's Agenda

Non wire Alternatives – Planning and Implementation

- NWA Assets and Design Considerations
- From Grid Constraints to NWA – Planning & Forecasting
- Identifying NWAs – Levels of Targeting
- NWA Screening Criteria
- Benefit-Cost Analysis & Value Stacking
- Implementation & Procurement
- Stakeholder Engagement
- Challenges and Pitfalls

Introduction

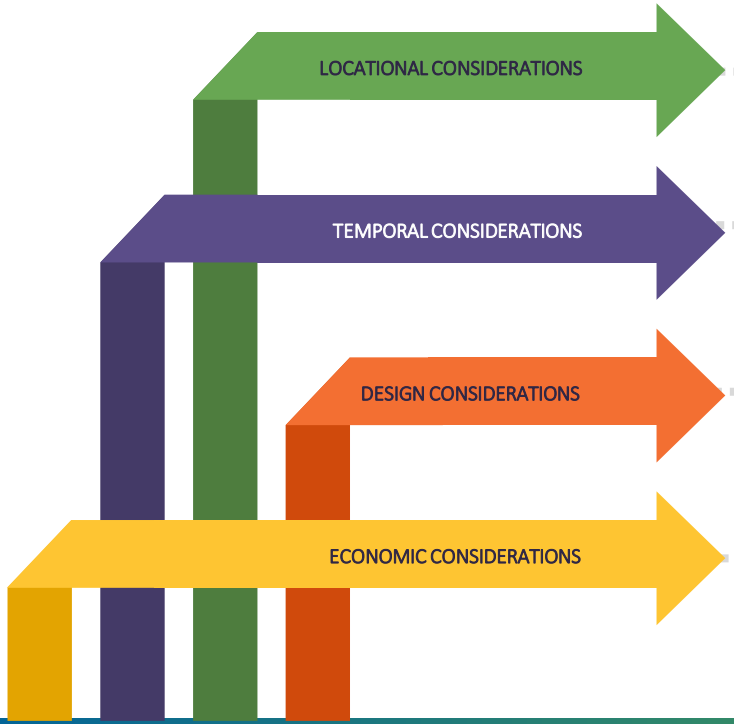
Non-wires Alternatives Assets

- **Demand Response** - Load reduction/shift triggered by price signals or dispatch events (manual or automated), including direct load control and pre-programmed autonomous responses.
- **Energy Storage** - Dispatchable charging/discharging resources providing peak shaving, voltage support (via inverter VAR control), and contingency support as needed.
- **Managed EV Charging** - Controlled charging (or discharging, where enabled) to shift load away from peak windows and mitigate localized transformer/feeder overloads.
- **Energy Efficiency** - Load reduction through equipment upgrades or operational improvements; reduces baseline demand but is non-dispatchable
- **Distributed Generation** - Local generation that reduces net feeder load during production hours. When paired with smart inverter functions or storage, can provide voltage regulation and limited dispatchability.
- **Grid Software and Controls –** Software and control enabled strategies like dynamic phase balancing, Volt/Var control, etc. which can optimize and improve existing system utilization.

What Grid Needs Can NWA Address?

NWA Benefit Category	Traditional Solution	Non-Wires Alternatives	Asset Types Considered
Capacity	Upgrade transformer, reconductor, build new feeder or substation	Reduce net peak load at constrained location (real power injection or load reduction during peak window)	DR, BESS (dispatchable), Managed EV charging, Solar+storage, etc.
Voltage Regulation	Capacitor banks, voltage regulators, load tap change upgrades, reconductoring	Real & reactive power injection/ absorption; Volt/VAR control; coordinated inverter response	Smart inverters (Volt/VAR curves), BESS, etc.
Reliability	Circuit ties, redundant feeders, sectionalizing, new substation	Local generation support during outage, black-start capability	Grid-forming grid-edge resources (GERs) such as grid-forming inverter or synchronous generator)

NWA Design Considerations



Spatial and siting constraints – electrical proximity to the constrained asset and feeder topology determine whether GERs can effectively relieve the identified constraint

Alignment of resource availability with the violation window, including output variability, sustainability of response (duration/frequency), and lifetime relative to the deferral horizon

Appropriate **sizing of the NWA portfolio**, deployment lead times, reliability and firmness of contribution, and customer participation assumptions

Benefit-cost evaluation (BCA) of NWAs versus wires alternatives, accounting for GER performance uncertainty, lifecycle costs, and other factors

Planning and Operational Considerations

From Grid Constraints to NWAs

STEP 1

Identify the Need

- *Specify asset at risk (transformer, feeder, substation), type of violation (thermal, voltage, reliability), and planning horizon*

STEP 2

Technical screening

- *Based on specified criteria such as cost, location, constraints, and timing*

STEP 3

Identify NWA Portfolio

- *Evaluate which NWA portfolio can deliver the required capability at that location*

STEP 4

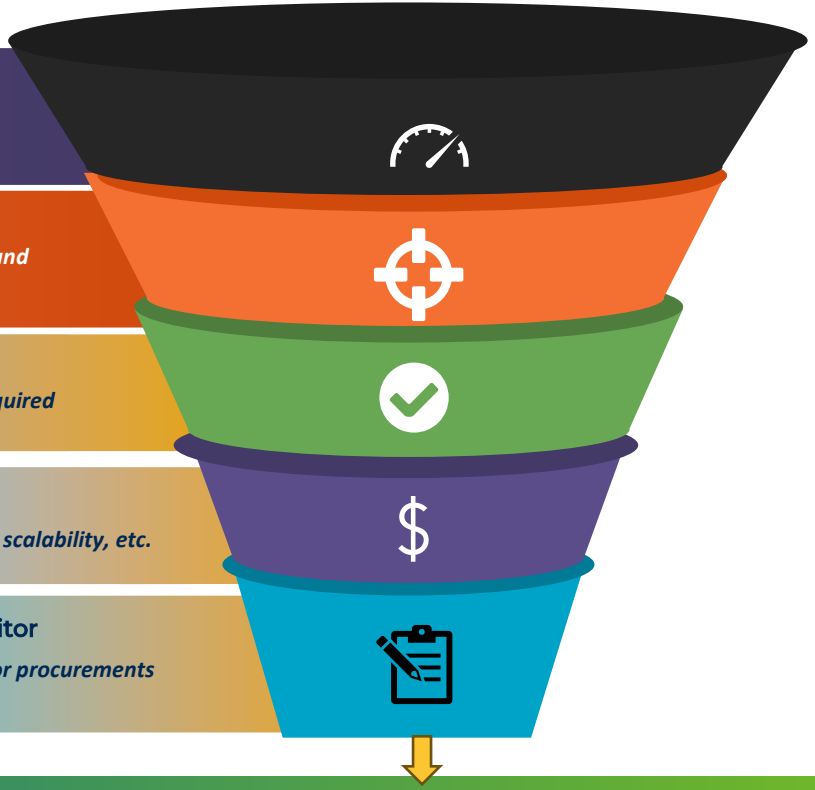
Economic Evaluation

- *Benefit-cost analysis, value stacking, scalability, etc.*

STEP 5

Implement and Monitor

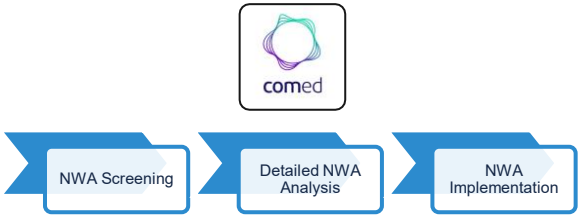
- *Use pricing, programs or procurements*
- *Monitor performance*



NWAs must be locationally and temporally aligned, capable to impact the constraint and economically defensible

NWA Process Examples

Various utilities across industry provide their own NWA framework/process



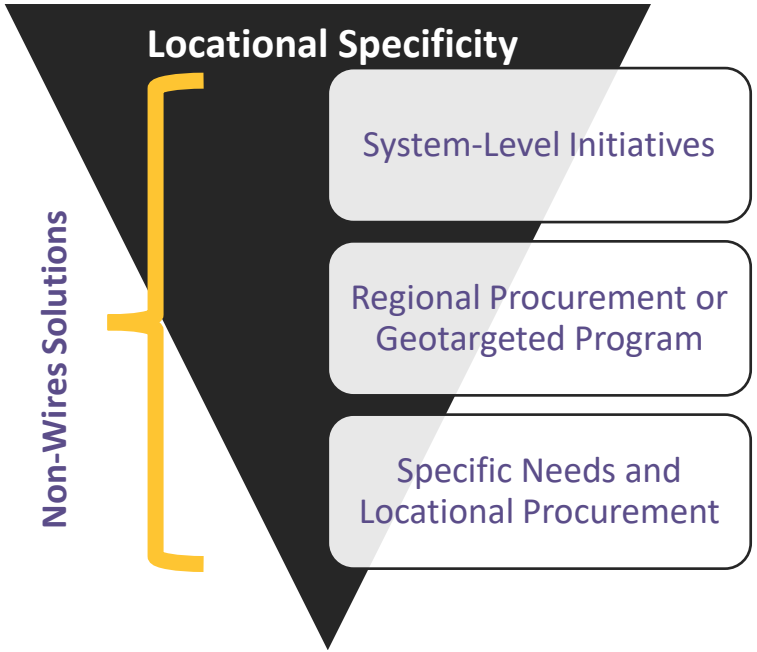
ComEdison NWA Framework [Source]		
NWA Screening	**Detailed NWA Analysis**	**NWA Implementation**
Study substations and feeders to identify need for potential upgrade to relieve capacity-related system constraints	Detailed NWA screening • NWA analysis and portfolio optimization • Operational integration • Economic feasibility	Conduct RFP for NWA solution
Is traditional upgrade cost ≥ $3.0 M?	Propose NWA solution and determine cost	Review RFP response
Is the project need date ≥3 years?	Compare BCA between conventional upgrade and NWA solution	Determine whether a feasible NWA solution exists
		Select final solution

PacifiCorp Non-Wires Solution (NWS) Framework [Source]	
Preliminary NWS Analysis	Detailed NWS Analysis
High-level review of recent planning studies, areas, and data available to perform analysis to confirm grid need identified and NWS feasibility	Detailed review and analysis of a specific area/circuit and grid need to determine potential NWS following the preliminary NWS analysis; includes increased granularity and an examination of potential NWS impacts on the grid need
Preliminary NWS analysis ensures that the circuit grid need identified is suitable for NWS before performing more detailed analysis that requires significant additional time	The detailed NWS requires: • Increased grid need granularity • 24-hour circuit peak and generation load shapes • 24-hour customer type load shapes • Modeling potential NWS to address grid need

Forecasting to Identify NWA

Load and GER Forecasts	
	Time Series Forecasting
	• Must capture magnitude, duration, frequency, and timing of peak events to identify risk windows and appropriate solution sizing • Supports DER dispatchability and operational use cases.
	Component Based Forecast
	• Separate forecast elements for Base Load, Emerging Loads, and Load Modifiers including electrification
	Incorporation of GERs
	• Accounts for existing installed GERs and dependability analysis • Accounts for future GERs
	Provides Locational and Temporal Granularity
	• Provides sufficient granularity to identify targeted grid investments at the appropriate time
	Scenario and Uncertainty Analysis
	• Has ability to develop a range of forecasts to account for ranges of outcomes

Identifying NWA Opportunities – Levels of Targeting



- No specific locational drivers; impact to specific grid needs is coincidental
- Examples: Lighting (LED) conversions, net metering

- Tailor procurement, programs and incentives to target areas of expected future distribution needs
- Example: Value of DER tariffs

- Dedicated procurement of specific size/type of resource to meet known locational constraint
- Example: Microgrid for reliability

Identifying Opportunities – Geotargeting

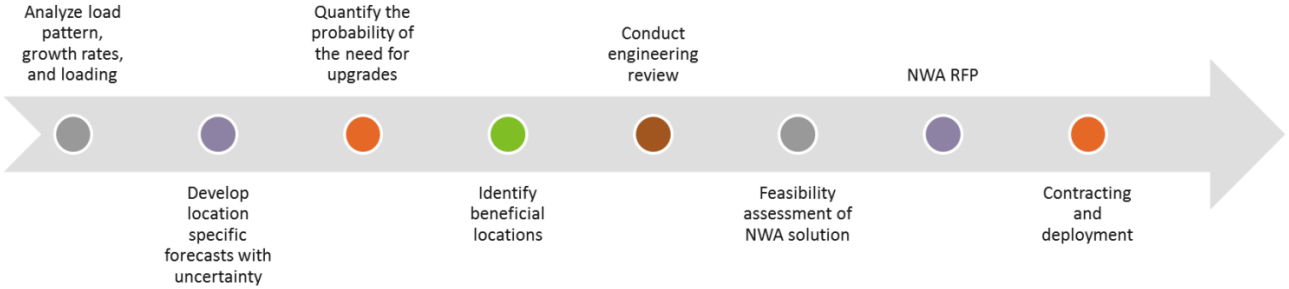
Proactive Approach to System Needs in High Growth/Constrained Areas

- **Tailored Solutions**: Geotargeting allows utilities to tailor solutions to specific areas where growth is expected to outpace the existing grid's capacity, preventing bottlenecks and overloads before they occur.
- **Local Resource Optimization**: Encourages the development and integration of local energy sources, which can alleviate demand on the grid and reduce transmission and distribution losses.
- **Scalable and Flexible**: Geotargeting solutions can be scaled up or down as needed, providing flexibility to adapt to actual growth patterns and changes in energy consumption behavior.
- **Deferral of Capital Expenditure**: Can delay or eliminate the need for expensive upgrades to transformers, substations, and distribution lines by managing load growth through targeted NWAs.

Identifying Opportunities for New Deployments

Example – Central Hudson Peak Perks (Geotargeting Programs)

- Established in 2016, the program is primarily aimed to reduce peak electricity demand, which in turn could defer or eliminate the need for additional network reinforcement.
- By targeting specific areas with the highest demand or where the system was most constrained, Central Hudson could optimize its demand-side management efforts.



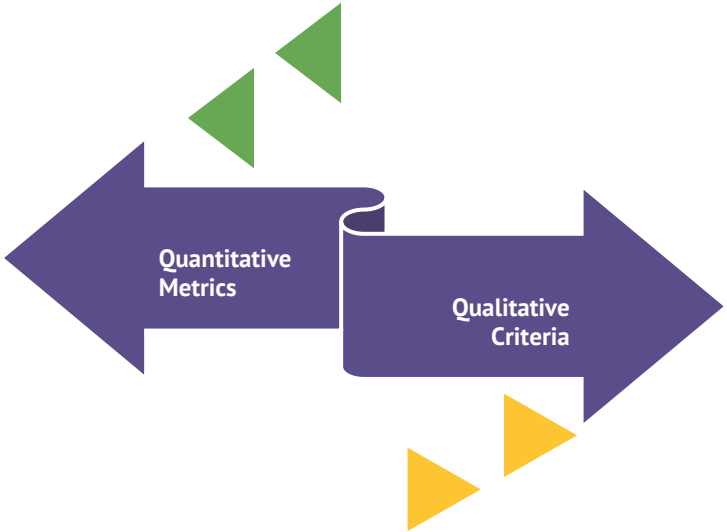
Central Hudson's process for identifying NWA projects [2025 DSIP]

- "Locations with a 10% or greater likelihood of triggering an infrastructure investment by 2035 (ten years) are classified as beneficial locations and are subject to additional planning and engineering review, and a more detailed NWA feasibility assessment." [Source]

NWA Screening Criteria

QUANTITATIVE METRICS

- **Cost Threshold:** *Project exceeds minimum capital cost to justify NWA evaluation*
- **Lead Time:** *Sufficient time exists before in-service date to design and deploy NWA*
- **Deferral Duration**: *Deferral period is long enough to create meaningful value*
- **Cost Evaluation**: *Compare risk-adjusted lifecycle cost of NWA portfolio versus traditional wires investment*



QUALITATIVE CRITERIA

- **System Need:** *Type of need (reliability, voltage, capacity, etc.)*
- **Driver:** *Upgrade is driven by local, coincident peak growth (not asset replacement)*
- **Location Feasibility:** *NWAs can electrically influence and measurably relieve the constraint*

Screening ensures NWAs are pursued where value and feasibility align

Example - Quantitative

Ameren

[Source]

Suitability Criteria

Screening criteria used within the planning process identified above is based off of three pillars. Projects that meet the screening criteria will then have a BCA (benefit-cost analysis) conducted to determine if the potential benefits outweigh the project costs.

Project Types: Capacity expansions and some systems performance projects such as reliability are to be evaluated.

Project Cost: Projects above a $3 million cost threshold are to be evaluated, consistent with requirements of Section 16-105.17 of the Act.

Project Timeline: Projects identified with an in-service date three to five years into the future are to be evaluated.

In addition to the suitability criteria listed above, Ameren Illinois uses good engineering judgement in considering implementation of NWAs as it helps to ensure and verify that solutions will maintain safe and reliable operation of the grid.

NY UTILITIES

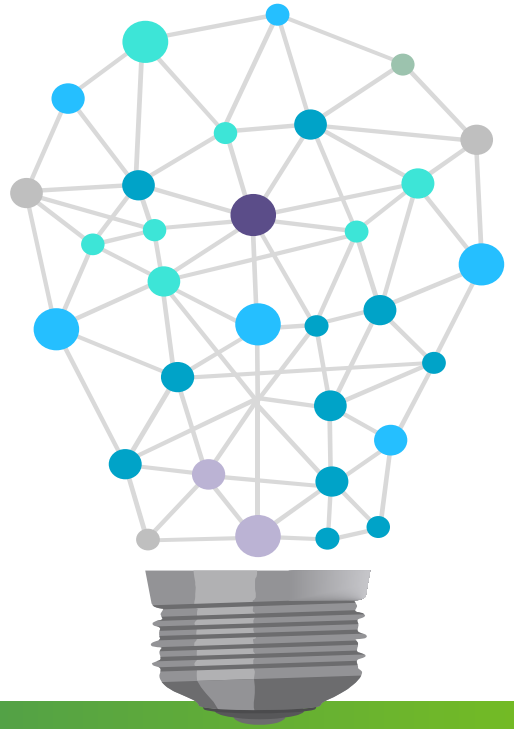
[Source]

Project Size	Criteria	Central Hudson	Con Edison	National Grid	NYSEG	O&R	RG&E
LARGE	Project Type	Load Relief and Reliability					
	Timeline	36 – 60 months	36 – 60 months	36-60 months	36 month minimum	36 – 60 months	36 month minimum
	Cost	≥ $1 million	No cost floor	≥ $1 million	≥ $1 million	No cost floor	≥ $1 million
SMALL	Project Type	Load Relief and Reliability			N/A	Load Relief and Reliability	N/A
	Timeline	18 – 24 months	18 – 24 months	18 – 24 months		18 – 24 months	
	Cost	≥ $300k	≥ $450k	≥ $500k		≥ $450k	

Benefit-Cost Analysis and Value Stacking

NWAs become competitive when they are evaluated on their full stacked value, not just avoided distribution capital cost

- ❑ **Define the deferral need clearly** (capacity need, timing, duration) and compare directly against the traditional wires solution
- ❑ **Capture the full stacked utility system value** (as applicable): avoided distribution capacity, avoided transmission, avoided generation capacity and energy, avoided losses, avoided O&M, and avoided ancillary services
- ❑ **Incorporate non-utility system impacts** where material, such as public health and economic development
- ❑ **Properly characterize GER performance** using coincidence factors, derating assumptions, and locational granularity to avoid over- or under-valuing stacked benefits
- ❑ **Optimize asset portfolios** to maximize net stacked value, not just to meet technical sufficiency



Examples – Xcel Minnesota

Element of the BCA	2019	2021	2023
Process Structure	Conceptual framework with manual, project-specific evaluation	Structured screening methodology with clearer evaluation parameters	Embedded, repeatable workflow integrated into planning
Need Definition	Peak day overload examples; N-0 vs N-1 feasibility emphasis	Peak day overload examples; N-0 vs N-1 feasibility emphasis	Formal need shape (load reduction requirement)* used for contract-like structuring
Value Stacking	Limited (mostly deferral economics)	Commitment to broaden values/revenue streams	Explicit stacked values step (8 in initial screen; more later)
Cost Allocation	Resource cost treated largely as “what it takes to meet the need”	Similar cost framing; improving assumptions	Avoided Revenue Requirement split prorates costs/values to contribution to deferral need
Decision Factor	“Cost competitive/not cost competitive” vs wires	“Viability, price, long-term value” comparisons	Net impact after optimization and combining risks

*See bonus slide

Xcel Minnesota

Aspect/Component	Current Method	Proposed Method
Timeframe	Full NWA lifetime	10-year deferral period
Ownership Model	Utility ownership	Utility ownership or third-party load reduction contract
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 included	Additional stacked values included
Prorated Values	No pro-rating; full values included	Values prorated for just the load reduction period (ARR split)
Solar Performance	PVWatts TMY simulation for one location in Minnesota	PVWatts TMY simulation for multiple locations in Minnesota

Summary of Key Aspect Change from 2021 to 2023 Responsive to Stakeholder Feedback [Source]

Initial Value Stack Being Considered [Source]

- 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

Additional Value Stack Being Considered [Source]

- 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

Approaches to Implementing NWAs

Various approaches to achieving Non-Wires Alternatives

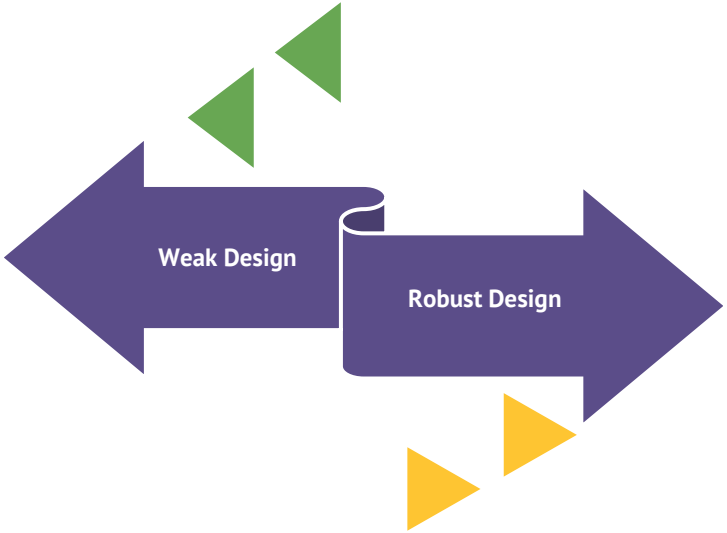
Utility Owned Non-Wires Solution	• **Description:** Utility identified, owned and managed assets to offset grid needs — e.g., utility scale BESS; utility owned microgrid remote grid • **Advantages:** Utility maintains full control over solution • **Disadvantage:** Can be costly and economics typically for large needs
Procurement based on Defined Need	• **Description:** Utility identified and procured grid edge assets to offset grid needs; traditional approach to NWA today through RFP process based on specific size requirements and needs • **Advantages:** Utility procures only the distribution service required (MW relief, duration, availability) without owning the full asset • **Disadvantage:** Geographically small area and economics are often very limiting
Programmatic based incentives	• **Description:** Utility identified, and structured program such as ***locational value of DER*** program • **Advantages:** High diversity puts less risk on each individual participant; able to include other potential value streams if economic • **Disadvantage:** Less locational certainty, participation depends on customer adoption
Pricing/Tariff based	• **Description:** Utility uses rate design and pricing signals to influence customer load shapes • **Advantages:** Highly scalable and technology agnostic; can shift load broadly and reduce system peaks with low utility operational burden • **Disadvantage:** Response varies by customer behavior, enabling technology, and persistence over time

Effective Procurement determines outcome

A well-designed procurement framework unlocks credible NWA portfolios

WEAK DESIGN

- Requirements loosely defined
- No defined window
- One size fits all RFPs
- Loosely defined performance structure
- No clarity on value stacking
- High delivery risk
- Unclear M&V

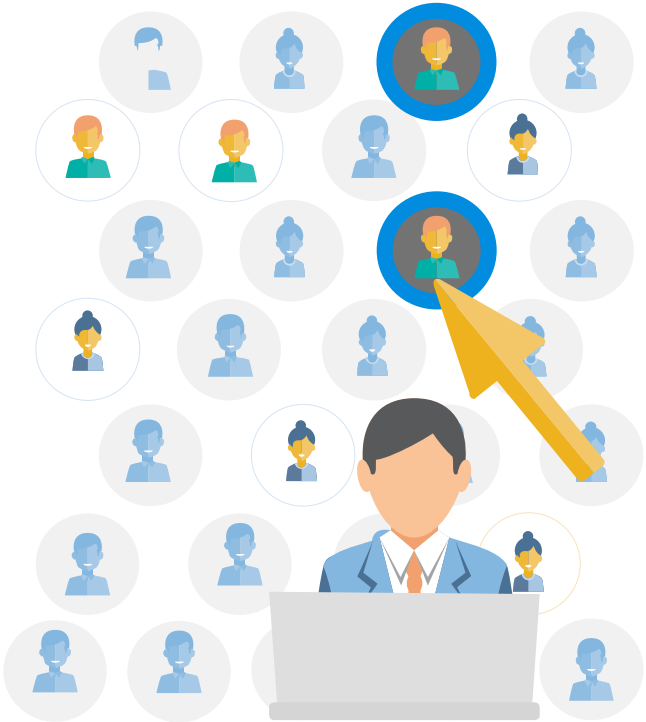


ROBUST DESIGN

- Precise MW, hours, seasons, contingency defined
- Resource-specific eligibility & contracts
- Clear availability & dispatch requirements
- Explicit value stacking monetization
- Defined measurement & verification (baseline method, telemetry granularity)

Stakeholder Engagement

- Early and Structured Engagement
  - Engage internal and external stakeholders early to shape durable NWA frameworks, rules, and evaluation criteria
- Approach
  - Use Request for Information (RFI) and technical workshops to test market capability before issuing RFP
  - Validate resource availability, aggregation feasibility, and performance assumptions in targeted locations
- Clean and Targeted Procurement
  - Define NWA products precisely (MW, duration, availability, telemetry, penalties)
- Transparency
  - Clearly communicate screening criteria, evaluation methodology, and decision framework
- Performance Alignment
  - Establish measurable performance metrics and verification protocols

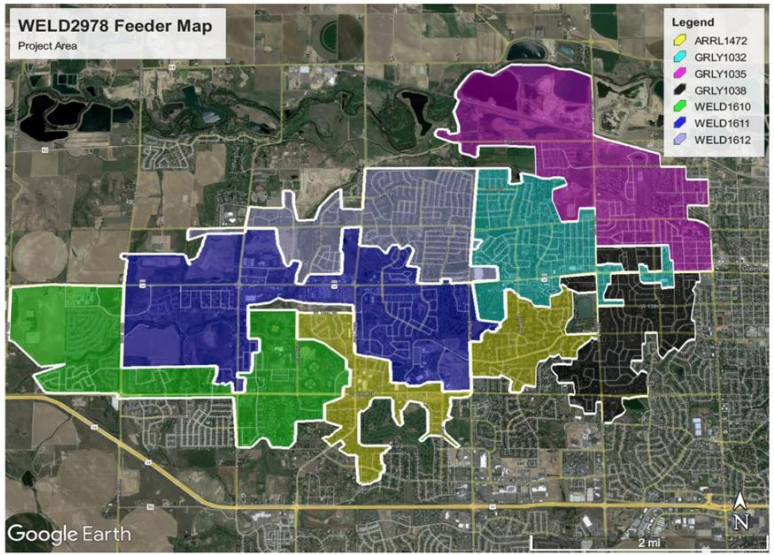


Xcel Colorado – Distribution Services Approach

In May 2023, Xcel Energy (PSCo) issued an RFP to solicit NWAs for two capacity-driven projects to defer system upgrades

- *Goal: **Defer $4.1M** for new feeder from 2025 to 2031 for each project location*
- *Expected to utilize demand response, energy efficiency, energy storage, and/or distributed generation*

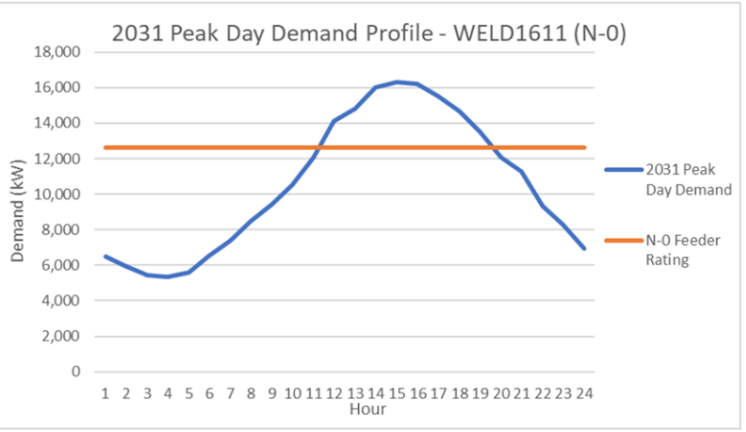
Area of Need



Timing of the Need

Asset	Capacity Need (MW)	Need Period (Hours)	Peak Hours	Deferral Period (Years)	120-Day Load Relief Period
WELD1611 (N-0)	4.6	10 hours	11:00 – 20:00	2025 - 2031	June 1st – September 28th
WELD1611 (N-1)	11.5	20 hours	4:00 – 23:00	2025 - 2031	
GRLY1032 (N-1)	7.0	21 hours	3:00 – 23:00	2025 - 2031	

Table 7: Timing for System Risk Relief Requirements



Xcel Colorado – Distribution Services Approach

Independent Evaluator (IE) Reviewed Why No Bids Were Received and Potential Solutions

- ***NWA suitability screening may have excluded potential candidates***
  - *Five projects removed due to risk concerns related to supply chain/equipment procurement*
  - *Projects excluded where risks occurred for a high number of hours, although energy efficiency or hybrid solutions (e.g., minor wires upgrades combined with GERs or utility-owned storage) may have partially mitigated the need.*
- ***No RFI was conducted prior to issuance of RFP***
  - *Vendors lacked advance insight into the opportunity size, timelines, and requirements.*
  - *IE recommended using an RFI in the future to understand market capabilities, timelines, and indicative costs before launching a formal solicitation*
- *IE recommended **clarifying magnitude, timing, and duration of need**, and allowing responses to the full or reduced need*
- *IE recommended existing GERs, and GERs in the interconnection queue, be explicitly incorporated into needs assessments, with aligned dispatch and availability assumption*
- *IE recommended providing guidance on continued use, relocation, or additional revenue pathways to address uncertainty around post-deferral use of resources, which may have impacted bidder economics*

Challenges and Pitfalls

- Value Stacking Requires Tight Operational Coordination
  - Distribution vs. transmission vs. wholesale value streams may need operational coordination
  - Ensuring value stacking does not erode primary use case
  - Risk of double counting
  - Contract structure needs to reflect dispatch hierarchy

- Process Burden to Deliver One NWA
  - Establishing process end to end to frame and implement one NWA
  - Cross department alignment

- Performance and Reliability Risks
  - Enrollment uncertainty
  - Underperformance
  - Reliability of GERs to be available when needed

Current State of NWAs

NWAs are Maturing, Needs More Work and Standardization

NWAs are recognized in distribution planning process; they are no longer one-off experimental pilots

Many utilities are still refining how NWAs are integrated into real-time operations and system planning workflows

Jurisdictions are strengthening BCA methodologies and refining value stacking frameworks, moving toward greater transparency, consistency, and standardization

Moving from targeted procurements to repeatable, scalable models is a work in progress

Clearer guardrails are needed to prevent double counting while enabling participation in multiple programs and markets

Questions?

Contact Us

EPE Consulting, Ltd.

Soumya Tiwari

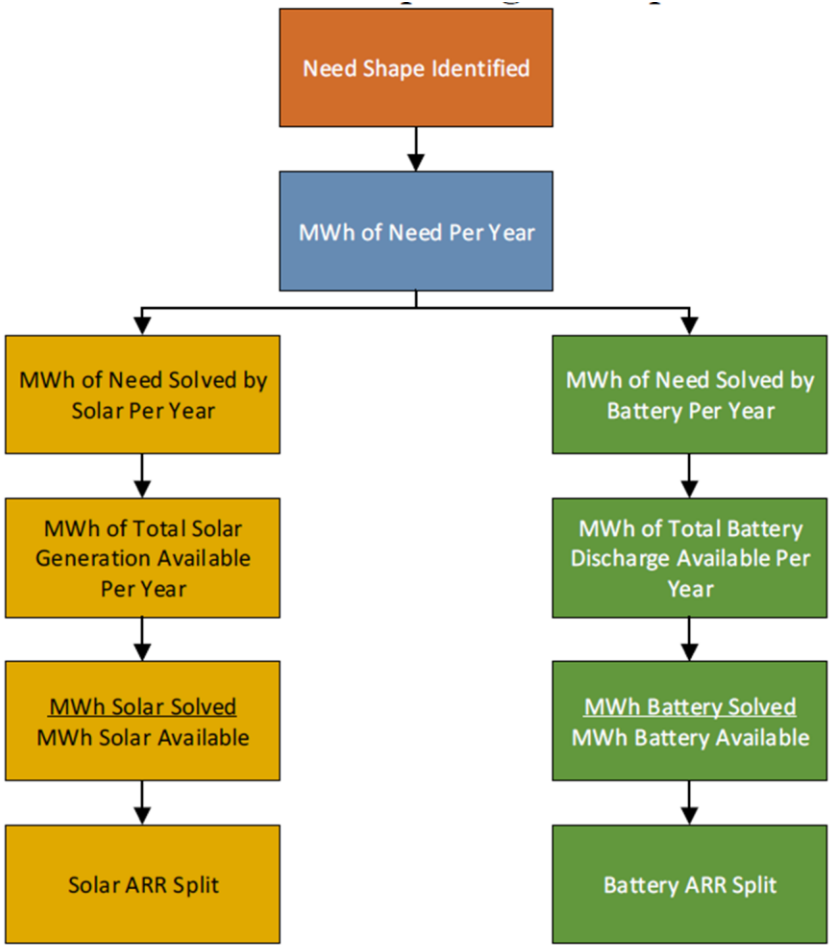
Sr. Manager – Grid Modernization
Electric Power Engineers
Email: stiwari@epeconsulting.com

Website: EPE Consulting Ltd.

IEEE PES ENERGY AND POLICY FORUM

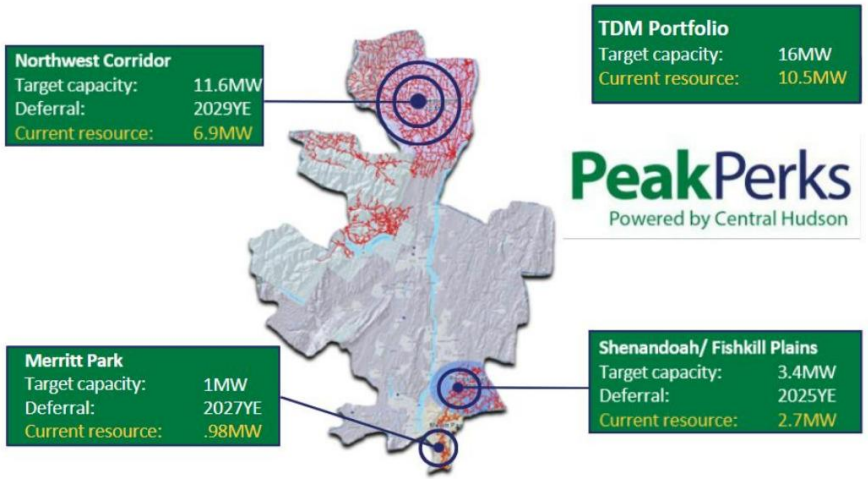
Bonus Slides

Xcel Energy Minnesota



Example – Central Hudson Peak Perks

2017-18 NWA Projects	Targeted Load Relief (MW)	T&D Deferral Period	Date Solicitation Issued	Status
Shenandoah / Fishkill Plains	3.4MW	2025 YE	Nov 2014	Ongoing NWA
Northwest Corridor / Transmission Upgrade	11.6MW	2029 YE	Nov 2014	Ongoing NWA
Merritt Park / (2) Distribution Feeder Upgrades	1MW	2027 YE	Nov 2014	Ongoing NWA



- Northwest Corridor need identified in 2015 planning process: 11.6 MW of load relief by 2029
- Merritt Park system need identified in 2015 to defer two distribution feeder upgrade: 1 MW load relief by 2027
- Utility anticipates achieving the target capacities

Disclaimer

Copyright Notice