Distributed Energy Resources Planning

Training for States on Distribution System and Distributed Energy Resources Planning

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January 24, 2024

Western Regional Training

Agenda

- Introduction
- DER Forecasting
- Hosting Capacity Analysis
- Non-Wires Alternatives
- Questions

INTRODUCTION

Types of DERs

Solar Photovoltaic Systems

Wind Turbines

Energy Storage Systems

Combined Heat and Power

Electrical Vehicles

Managed or Price-Based Charging

Grid Interactive Buildings

Building equipped with smart appliances and energy management systems to contribute in EE and DR programs

Energy Efficiency

Microturbines

Localized generation using natural gas

Distribution Planning with DER

Planning Goals:

- Understand and prepare for the future
- Meet customer needs in a timely and efficient manner

Who does Distribution Planning?

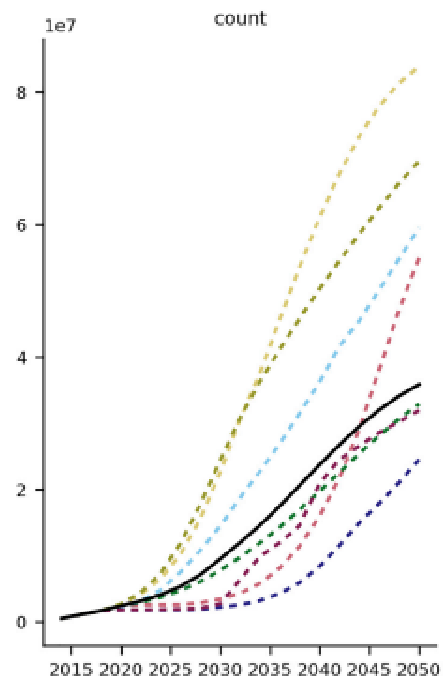
- Everyone who controls a distribution system that changes over time
- Investor-owned utilities (IOUs), Municipal Utilities, Cooperatives, Campuses, etc.

DER are driving changes in Distribution Planning

- Increasing visibility, scrutiny, and importance to customer outcomes
- Significantly more complex due to DER considerations

Planning for DER Growth – Predict, Identify, Resolve

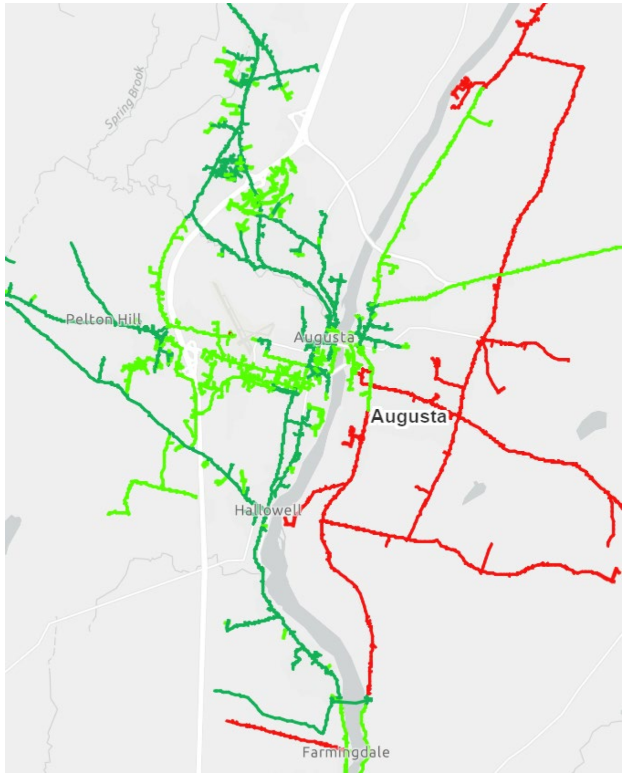
DER Forecasting



- Estimate Future Adoption
- Understand System Impacts

[Source]

Hosting Capacity Analysis



- Identify System Constraints
- Inform Applicant Siting/Sizing

[Source]

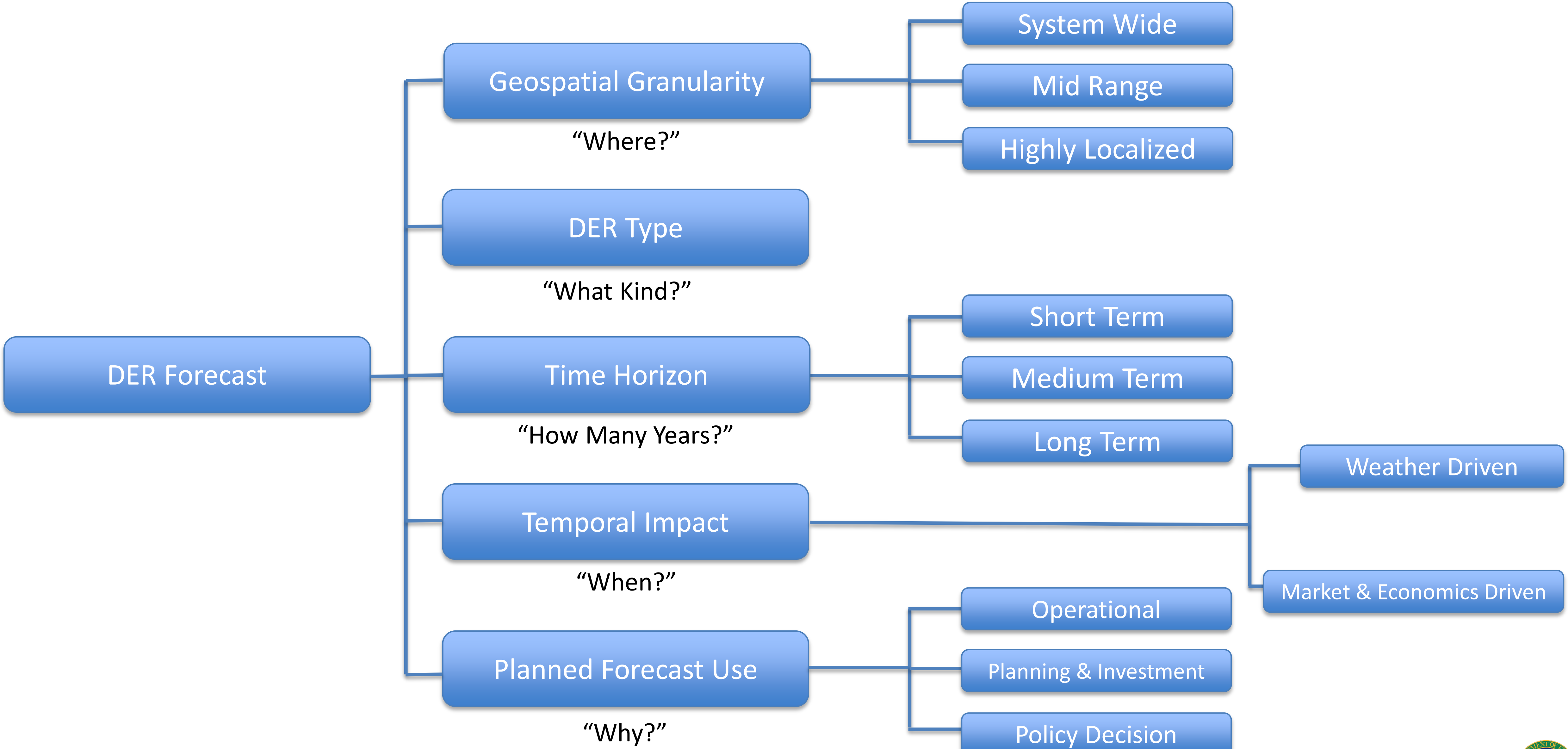
Non-Wires Alternatives

- Leverage DER As a Resource
- Mitigate System Needs Efficiently

[Source]

DER Forecasting

DER Forecasts – Methodology Design Elements



Geospatial Forecast – System Wide

Highly Aggregated Data

This level of data aggregation is crucial for grasping **overarching trends** and for planning at a broader system level.

RTO/ISO Level Forecast:
Regional grid operator-level data provides a **regional outlook**, encompassing **multiple states** or a significant part of a state. This level is key for understanding **regional energy trends, transmission planning, and managing the electricity market**.

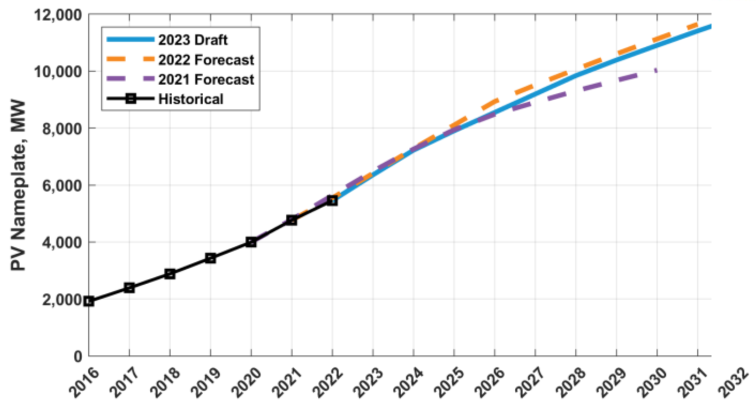
State Level Forecast
These forecasts offer insights into the future energy needs and resource availability for an **entire state**, aiding in **policy-making and statewide energy planning**.

Utility Wide Forecast
Forecasting at this level focuses on the specific needs and trends within a **utility's service area**. It is essential for the utility's own **planning, infrastructure development, and meeting regulatory requirements**.

Policy Drivers	Other Drivers
Feed-in-tariffs (FITs)/Long-term procurement	Role of private investment in PV development
State Renewable Portfolio Standards (RPS) programs	Future equipment and installation costs
Net energy metering (NEM) and retail rate structure	Future wholesale and retail electricity costs
Federal investment tax credit (ITC) and federal depreciation	Costs and issues associated with grid infrastructure constraints and needed upgrades
Federal trade policy	Siting issues

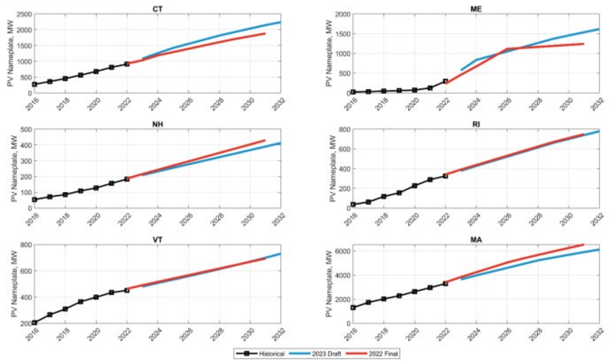
Factors influencing Uptake of Distributed PV– ISO NE [Source]

Historical vs. Forecast



Regional PV Nameplate Capacity Growth

Historical vs. Forecast



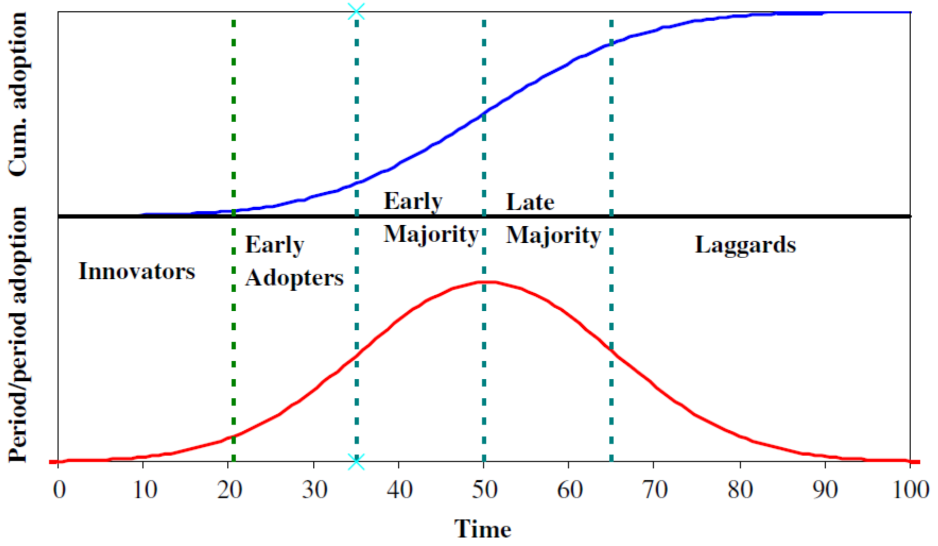
State PV Nameplate Capacity Growth

Source: ISO NE 2023 PV Forecast

Geospatial Forecast – Highly Localized – Propensity Modeling

Highly Localized Forecast

Highly localized spatial DER forecast refers to detailed analysis at the **customer level**, diving into the granular aspect of individual customer behaviors and preferences. This analysis is referred to as **customer propensity analysis**, and it uses a wealth of **customer/community specific data** to estimate the **probability that an individual customer adopts** a technology.



Adoption Diffusion Curves [source]

Source – Forecasting Load on Distribution Systems with DERs

Bass Diffusion and Fisher-Pry are two common models to build to build logistical S-Curve adoption models.

Geospatial Forecast – Mid Range

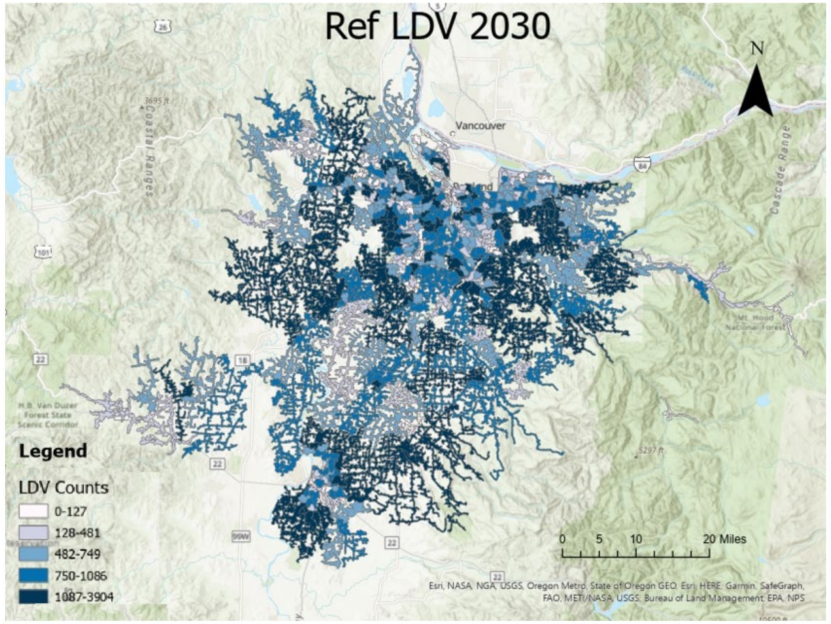
Mid Range Forecast

Mid range spatial forecast provides a balance between system level and highly localized forecast. It is derived from the **disaggregation of system-wide** data or the **aggregation of highly localized** forecasts.

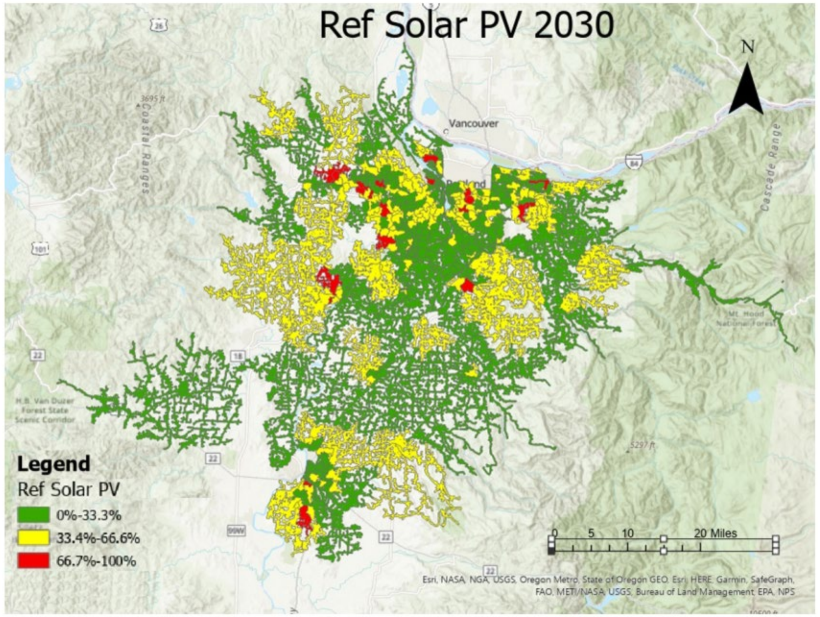
Distribution Feeder/Substation Level:
Forecasts at this level usually are focused on DER uptake for **specific feeder or substations** within a utility network. These forecasts are impactful in assessing the **impact of growth** of DERs **on segments of the distribution grid and targeting mitigation strategies**.

ZIP Code/County Level:
This level involves DER forecasting for **smaller, administratively defined** areas like zip codes or counties. It provides a **more localized view** than state or utility forecasts, allowing for **finer planning** and analysis that considers the **specific characteristics and needs** of these areas.

Census Tract Level
These forecasts are the most localized within the mid range category and cover **small, relatively homogenous regions** defined for statistical purposes. This helps in aligning the **DER planning** strategies to a **specific community or neighborhood**.



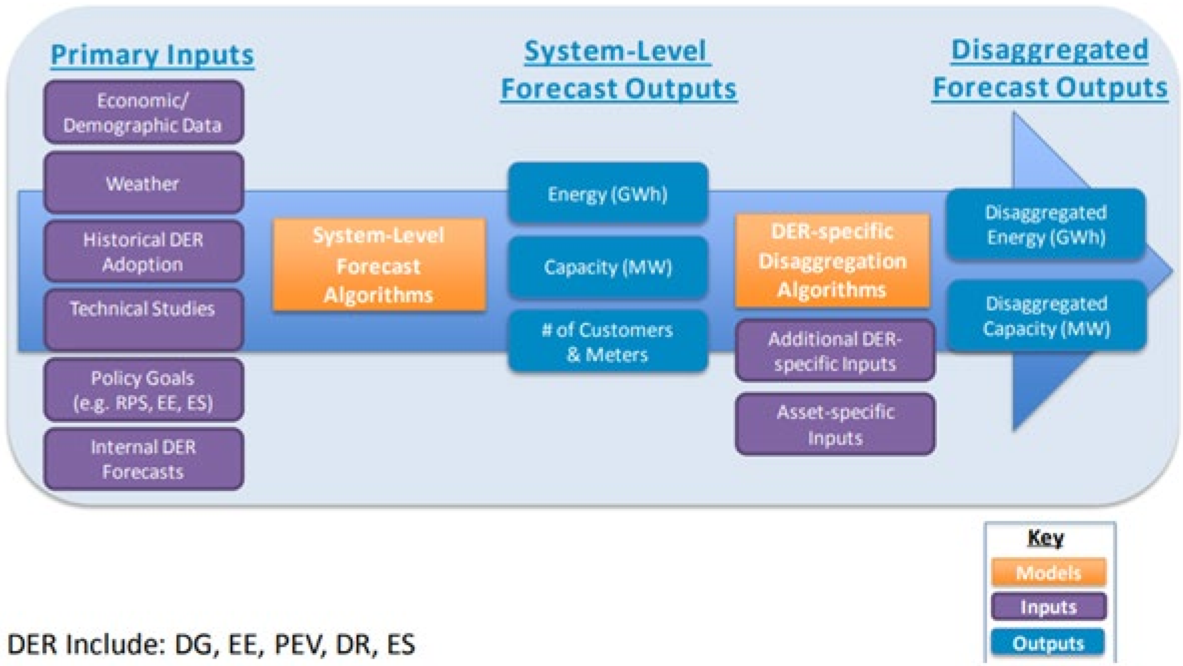
PGE Reference case LDV and Solar PV adoption at the feeder level in 2030



Source PGE Load and DER forecast

DER Forecast Disaggregation - Purpose

- Disaggregation refers to the method of distributing a system-wide forecast of DERs for a **specific utility service area** down to **individual circuit levels**.
- The primary aim of disaggregation methodologies is to pinpoint, as accurately as possible, the likely locations for the adoption of new DERs.
- It involves considering multiple factors, ultimately to pinpoint customer behavior, which is inherently uncertain.
- The disaggregated forecast is then used as an **input to distribution planning studies**.



Source – Overview of System Level Forecasting

Source: Distribution Forecast Working Group Presentation

DER Disaggregation Techniques

Source – [Forecasting Load on Distribution Systems with DERs]

Proportional Allocation

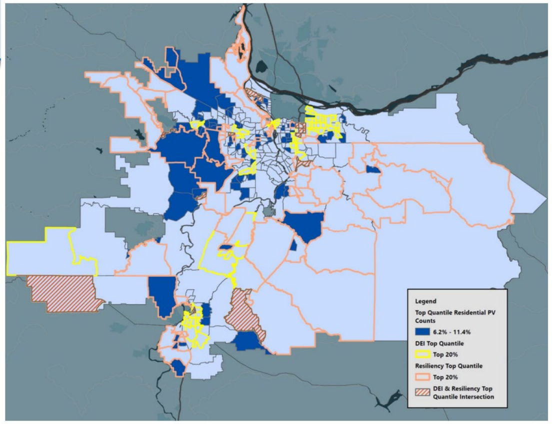
- Allocates system-level DER forecast to individual circuits using specific local distribution data
  - Proportional to Load
  - Proportional to # of Customers
  - Proportional to Existing DER
- Another approach is to use adoption patterns of one technology (e.g., PV) to drive adoption for another (e.g., energy storage)

Propensity Models

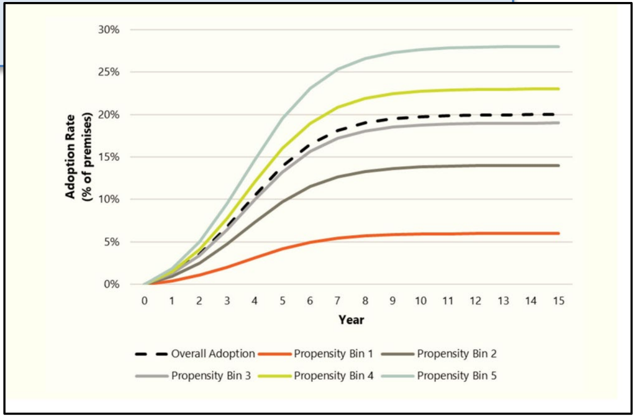
- Propensity models use customer characteristics to compute a propensity score. Based on the score, a fraction is computed as the ratio of the score for that area divided by the sum of scores across all areas.
- For example, the propensity model can be estimated using ZIP code data where the models relate historical adoption to customer characteristics in each ZIP code.
- Statistics- based (Regression and ML)

Adoption Model

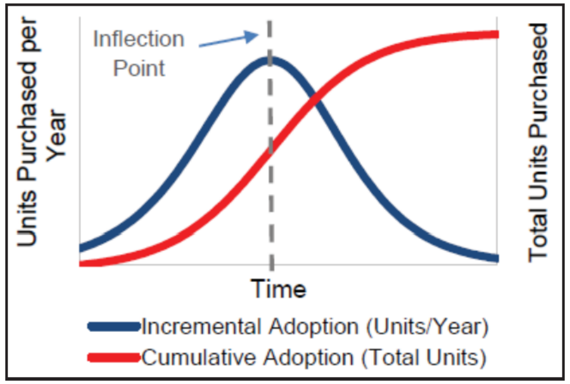
- This uses a bottom-up adoption approach based on adoption patterns and estimated adoption model parameters.
- These models are S Curve-based. They forecast technology adoption based on characteristics of early adaptors, market factors, and adoption rates, applied to the remaining potential.



Solar PV Locational Adoption PGE



PGE Propensity Scoring Results



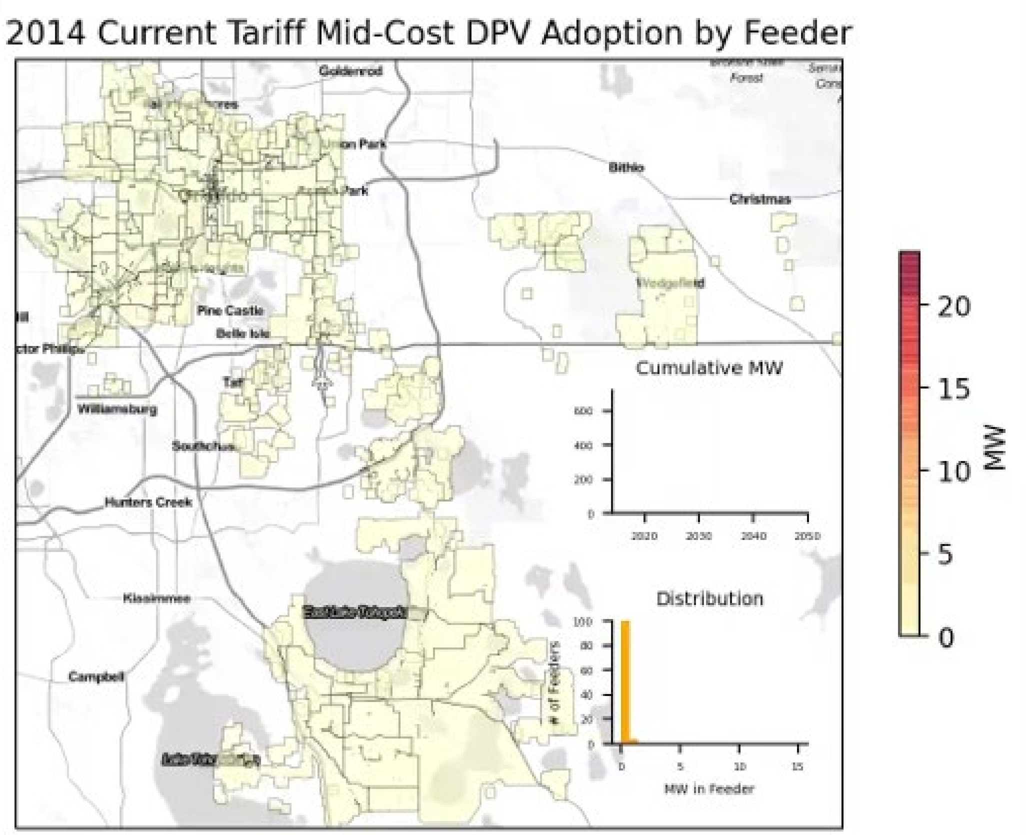
Generalized S-Curve Model
Source [SCE DFWG Progress Report]

Source PGE [Load and DER forecast]

Adoption Modeling - NREL's dGen Tool

dGen is a forecasting tool which simulates customer decisions to adopt DERs based on future DER adoption factors like economics, market conditions, and policy incentives.

- dGen models the decisions of individual 'agents' (which can be households, businesses, or other entities) based on their unique circumstances and the broader market environment.
- It offers detailed geographic modeling, allowing for analysis at national, state, and more localized levels.
- The tool incorporates a wide range of variables, including energy prices, policy incentives, and technological advancements.



Click here to view as an animated model from 2014-2050. Source – NREL dGen Model Applications

Planning Forecast Duration – Short, Medium and Long Term

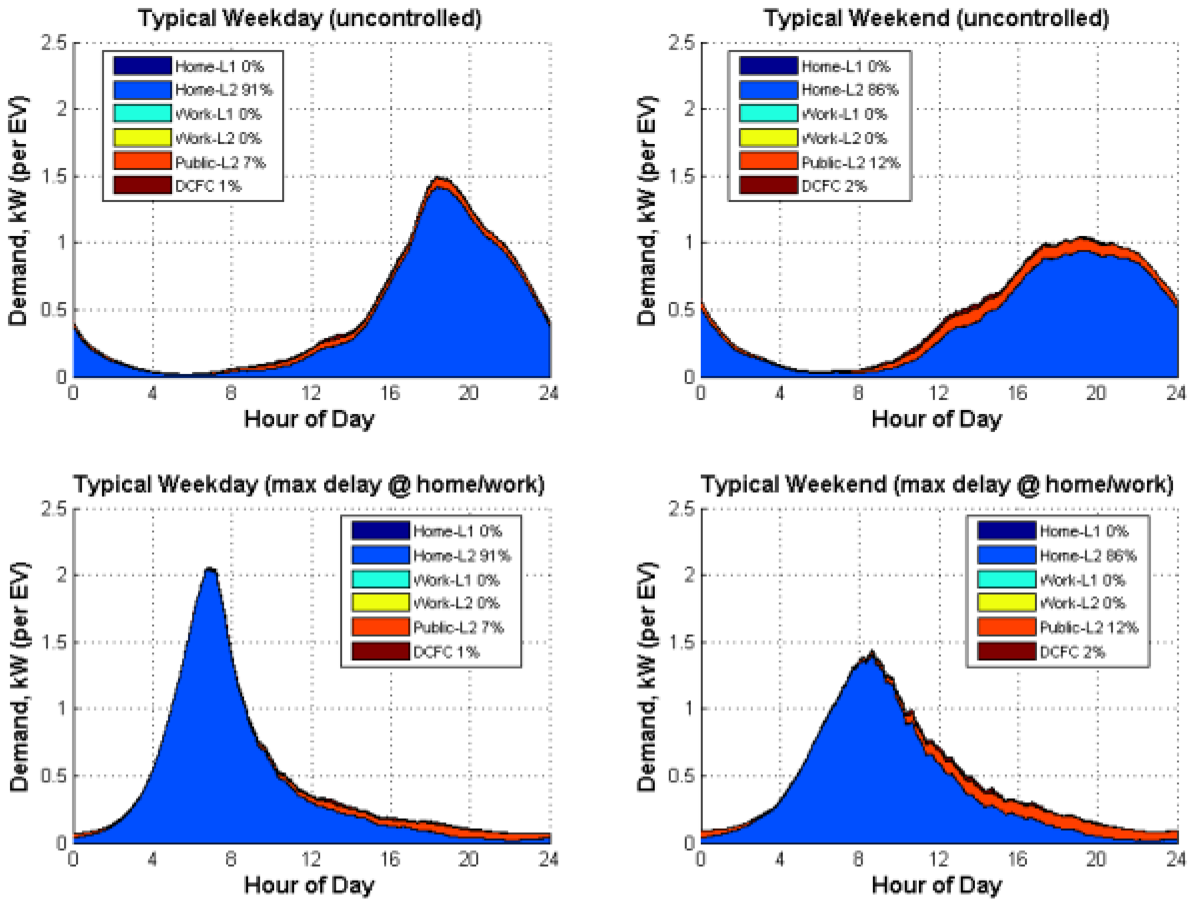
Short Term	Medium Term	Long Term
0-3 Years	3 – 10 Years	10+ Years
Focus: Centered around upcoming **operational requirements** with DER penetration for stable grid operations, preparing for **immediate growth and operational contingencies.**	**Focus**: **Infrastructure planning** with upcoming DER growth, integration of new technologies, and regulatory policy updates. **Common Historical Practice: 5-Year Planning Forecast** **Increasing Focus on 10-Year Forecast for Capital Plans**	**Focus**: Align with strategic objectives like **achieving clean energy targets** and adapting to **major technology shifts**. Useful to guide long term investments, policy decisions, and direction for sustainable future.

DER Temporal Impact – When?

Actual DER Load or Generation Profiles can vary significantly based on many factors

- Solar PV: Lat/Long, DC:AC ratio, Tracking, Shading, Direction & Azimuth
- Electric Vehicles: EV-specific or Time of Use Rates, Managed Charging, Availability, Location
- Battery Storage: Individual Use Case, Value Stack Incentives, Import/Export Restrictions

Determining expected resource profiles is critical to <u>converting adoption forecasts into system impacts.</u>



EV Charging Demand Profiles Under Varying Control and Incentive Regimes

Source: [DOE 2019 Summary Report on EVs at Scale]

Scenario Modeling

Scenario modeling

- Examines how different variables could shape future DER adoption and subsequent **system needs as a whole**
- Attempts to forecast for **multiple potential pathways** in order to **inform investment plans**
- Varying factors like technology adoption rates, economic conditions, and policy changes provide a range of possible outcomes.
  - Example: Solar adoption under varying compensation structures

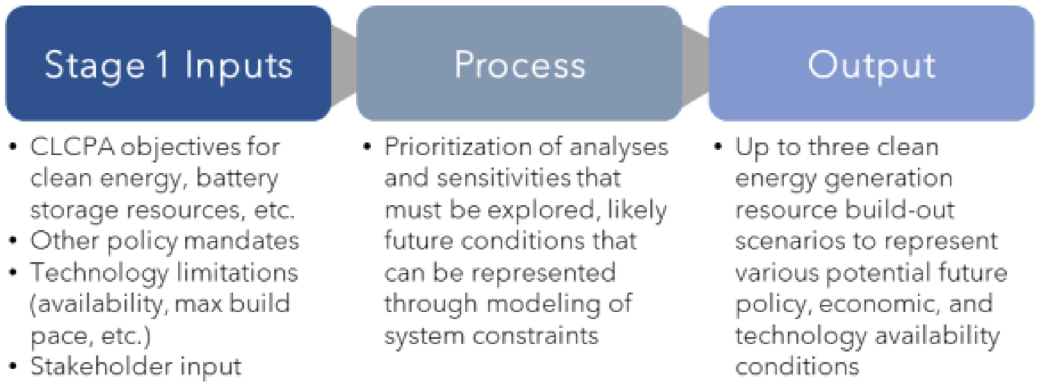
Key Components of Scenario Modeling

- **Adoption Rates -** Analyzing how quickly consumers might adopt various DER technologies under different circumstances.
- **Technological Developments -** Considering advancements in DER technologies and their potential effects on adoption and efficiency. For instance, developments in EV technologies have greatly impacted EV uptake and consumer behavior changes.
- **Policy and Regulatory Changes** - Assessing the impact of potential future policy shifts, building code requirements, and other regulatory changes.
- **Market Dynamics** - Understanding how changes in energy prices, consumer preferences, and economic conditions could influence DER growth.
- **Incentive Structure** – Assessing how different incentive and pricing changes can impact DER growth, including time of use rates and PV and EV incentive programs.

General Goals

- **Identify "no regret" investments -** Focus on actions and investments that will be beneficial across most/all potential future scenarios
- **Prepare for the future** - Prepare for longer-term needs that may arise, "future-proof" when making investment decisions.
- **Facilitate goal achievement -** Make investments necessary to facilitate reaching goals where appropriate

NY Coordinated Grid Planning Process
Stage 1 – Build-Out Scenarios



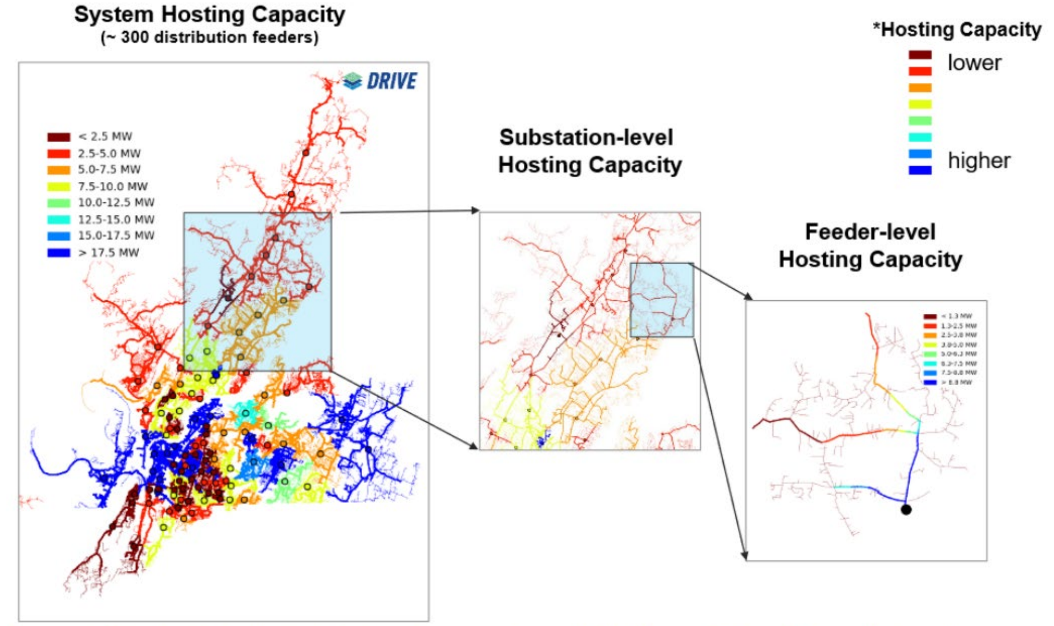
Source: [Link]

Hosting Capacity Analysis

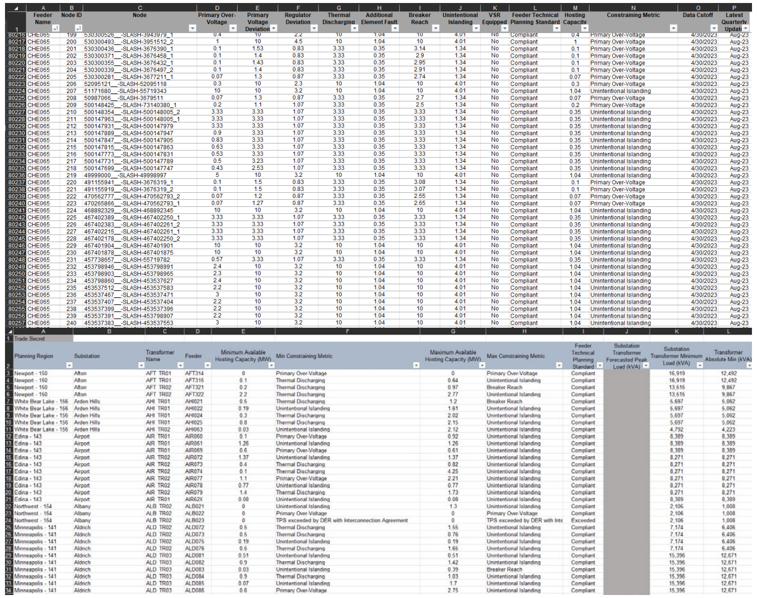
Hosting Capacity - Overview

Hosting capacity is the amount of DERs that can be **interconnected** to the distribution grid without compromising power quality or reliability, and **without necessitating upgrades** to the current control, protection systems, or infrastructure.

- Hosting capacity analysis evaluates a subset of interconnection criteria at various system locations, commonly including:
  - Thermal Limits
  - Overvoltage
  - Reverse flow limitations
  - Protection Considerations
- It is usually represented as a map, with varying level of information.
  - In some cases, utilities provide tabular information about constraints (e.g., minimum daytime load) in conjunction with maps.
- Due to scale, analysis results may not be as accurate as detailed interconnection studies, creating potential discrepancies.



Source: Jeff Smith, Methods, Applications, Opportunities and Challenges, EPRI. MPSC Distribution Planning Stakeholder Meeting, June 27, 2019, p.4.



[Xcel Energy Minnesota]() Hosting capacity study and sub feeder spreadsheets

Hosting Capacity Use Cases

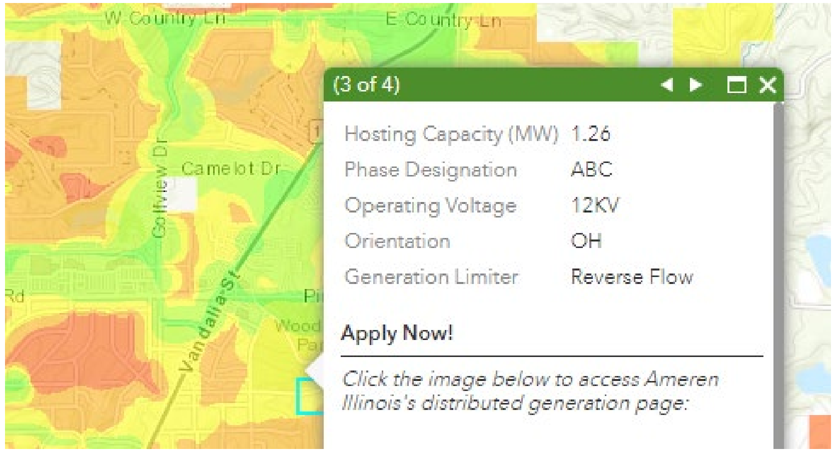
	Objective	Capability	Challenges
Development Guide	Support market-driven DER deployment	Identify areas with potentially lower interconnection costs	Security concerns; analysis/model refresh; data accuracy and availability
Technical Screens	Improve the interconnection screening process	Augment or replace rules of thumb; determine need for detailed study	Data granularity; benchmarking and validation to detailed studies
Distribution Planning Tool	Enable greater DER integration	Identify potential future constraints and proactive upgrades	Higher input data requirements; granular load and DER forecasts

Source: *U.S. DOE, Office of Electricity, Integrated Distribution Planning - Utility Practices in Hosting Capacity Analysis and Locational Value Assessment, 2018, p.3.*

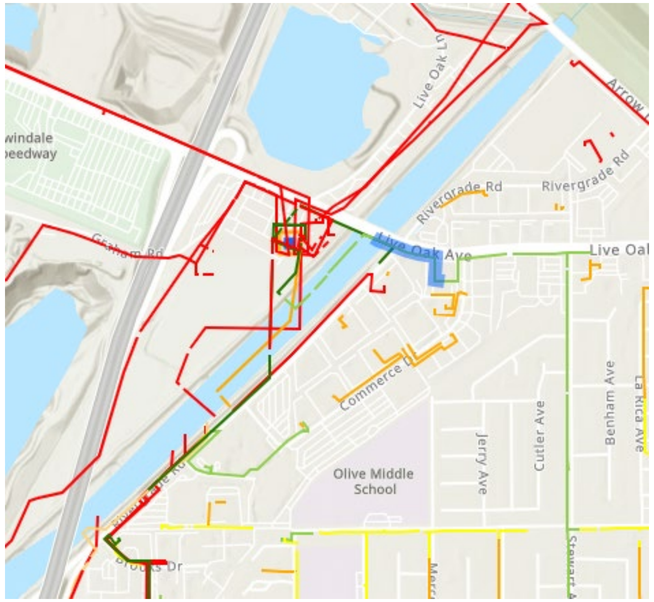
Use Case #1 - Facilitating Efficient Project Siting

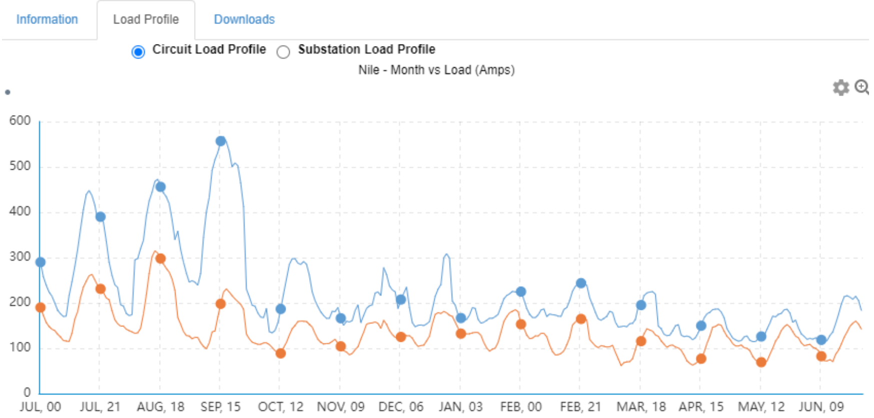
Goal: Direct project developers to sites with available capacity to **reduce the submission of non-viable applications**.

- **Basic Information:** Utilities may offer calculated DER megawatt (MW) capacity values across geographic blocks, typically visualized through a **"heat map"** indicating areas with good versus limited hosting capacity.
- **Most Effective Information**: **All data** necessary to **effectively site and size projects**, for example, calculated hosting capacity values, information on existing and queued DER projects, load profiles, grid constraints and more



Basic Hosting Capacity Map Example [Link]





Segment Level

Segment ID	236667746
Node ID	236667932
Rule 21 Screen L	Likely to Pass

	Integration Capacity (MW)	
	Static Grid	Operational Flexibility
Uniform generation	13.15	0.66
Photovoltaic	14	0.72

Circuit Level

Circuit Name	Nile
Circuit Voltage (KV)	12
Substation Name	Rio Hondo
System Name	Rio Hondo 220/66 System
Existing Generation (MW)	1.89
Queued Generation (MW)	0.26
Total Generation (MW)	2.14

Hosting Capacity Advanced Information Example

Hosting Capacity Map Information Breakdown

Hosting Capacity (HCA) Map Elements	Benefits to DER Developer
Substation location and HCA data	• Determine substation level constraints (e.g., size and voltage of transformer) • Identify equipment that may impact hosting capacity (e.g., load tap changer or regulator) • Determine approximate distance from circuit to substation
Feeder location and HCA data	• Determine feeder HCA constraints for DER load and generation • Assess if costly system upgrades are likely at a location given constraints • Identify equipment that may impact HCA (e.g., voltage supervisory reclosing)
HCA criteria violations	• Determine which violation criteria (e.g., thermal, voltage) is causing the limit, identify appropriate technical solutions to overcome constraint(s), and estimate associated costs (e.g., for system upgrade)
Substation/feeder load profiles	• Screening tool for locating DER load interconnections (e.g., storage, EV chargers) • Assess if costly system upgrades are likely at a location given constraints
DER connected and in queue	• Determine if hosting capacity is likely available to new projects

Benefits of Hosting Capacity Information to Developers – Source: Synapse Report

Common Hosting Capacity Map Design: Tensions and Trade-Offs

Topic Area	Common Utility Perspective	Common Developer Perspective
Update Frequency: (e.g., Annual, Monthly, Bi-monthly)	More frequent updates increases ongoing maintenance costs	More frequent updates improve usefulness due to increased accuracy
Level of Geographic Granularity (Blocks vs. Circuit Maps)	Aggregated maps reduce risk to utility assets (security)	Detailed circuit maps improve developer site selection capabilities
Amount of Information Provided (e.g., calculated HC, information on constraints, load profiles)	Providing additional information increases HC tool development and ongoing costs	Providing additional information increases project siting/sizing screening capability
Security Concerns (Critical Energy Infrastructure Information – CEII)	Highly detailed information may contain CEII or expose the distribution system to additional risk	HC maps are outside distribution substations and not part of the bulk power system, thus not CEII
Cost Burden	Map development and maintenance costs impact utility customer bills and are not paid by developers	HC maps reduce utility study burden and aid in compliance with state goals and programs
Data Export and Tabular Format Availability	Allowing export in tabular format may increase system security risk	Tabular results are much easier to use for prospecting good sites

Hosting Capacity Q&A Break

Use Case #2 - DER Interconnection Screening

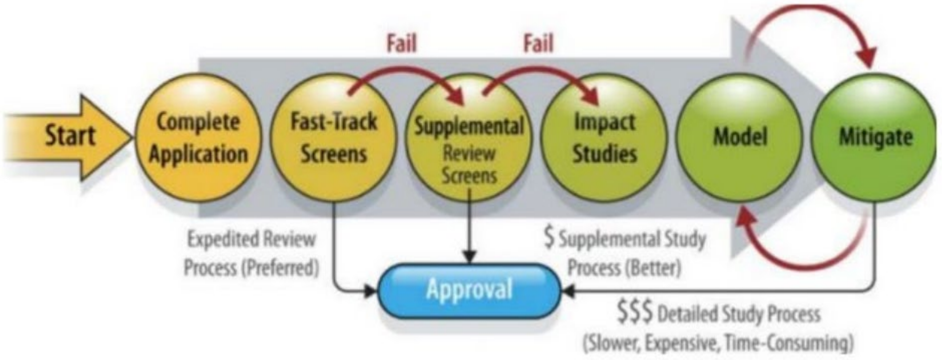
Goal: Integrate hosting capacity into the DER interconnection screening process to **<u>improve efficiency,</u>** **<u>reduce conservative assumptions, and improve screening process timelines</u>**.

Current Role in Interconnection Screenings:

- Not commonly used directly as part of interconnection screening criteria
  - Screens usually set by state codes or in utility tariffs
  - May be used to identify “restricted” or “closed” feeders
- Significant synergy between data collected for hosting capacity and data-driven screening methods
  - Use actual minimum daytime load instead of rule of thumb based on 15% of peak capacity of the feeder
  - Substation protection / reverse flow limits
  - System-wide distribution model clean-up

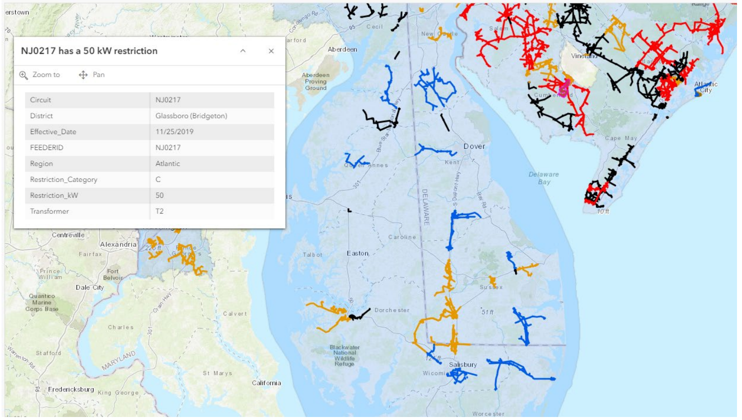
Implementation Challenges:

- Requires application/model management for queued generation and resulting system upgrades
- Models used for system-wide analysis not as trustworthy as application-specific studies (scale trade-offs)
- Difficult to account for site-specific factors (e.g., volt/var curve, co-located storage)
- Modifying screening criteria may require state-level modifications

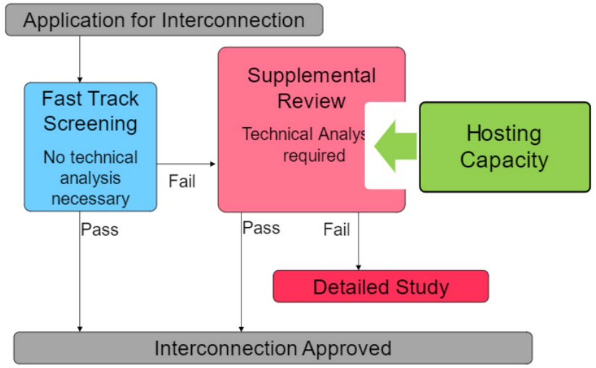


Source: NREL, Emerging Issues and Challenges in Integrating Solar with the Distribution System, May 2016.

Interconnection Screening Process



Restricted application Example



Source: Jeff Smith, Methods, Applications, Opportunities and Challenges, EPRI. MPSC Distribution Planning Stakeholder Meeting, June 27, 2019, p. 24.

Hosting Capacity Analysis Can Assist in Interconnection Screening

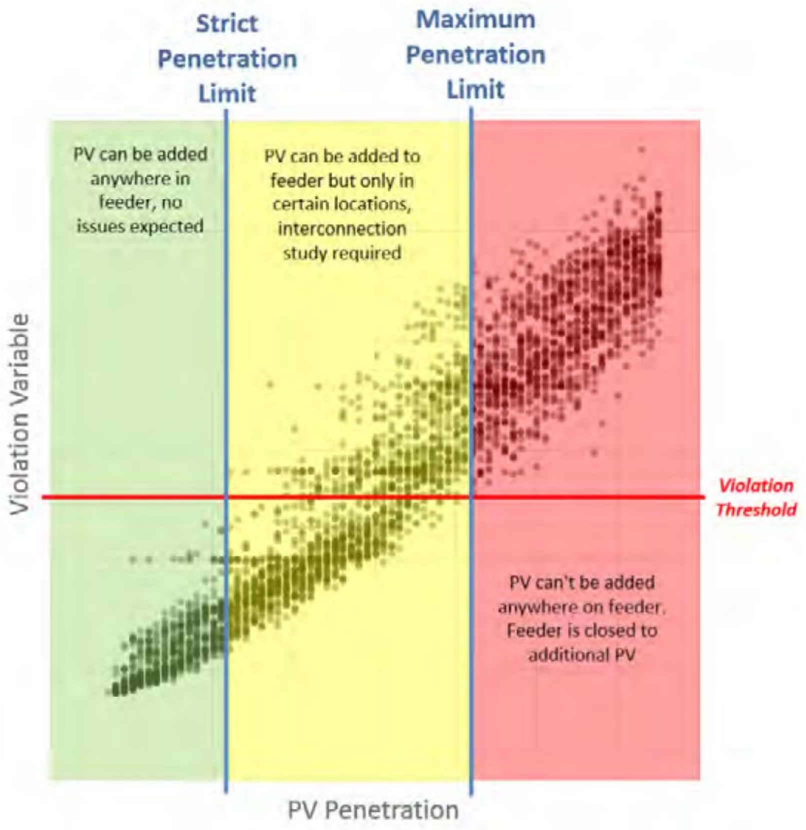
Use Case - Examples

California IOUs:

- Integrate hosting capacity information to refine the Rule 21 interconnection process
- In 2020, mandated by the CPUC to use Integration Capacity Analysis (hosting capacity) results in the interconnection process to:
  - *Determine where and when existing circuits can accommodate additional DERs without needing upgrades*
  - *Allow interconnection resources to export up to those limits [Source CPUC]*

Pepco (Washington, DC):

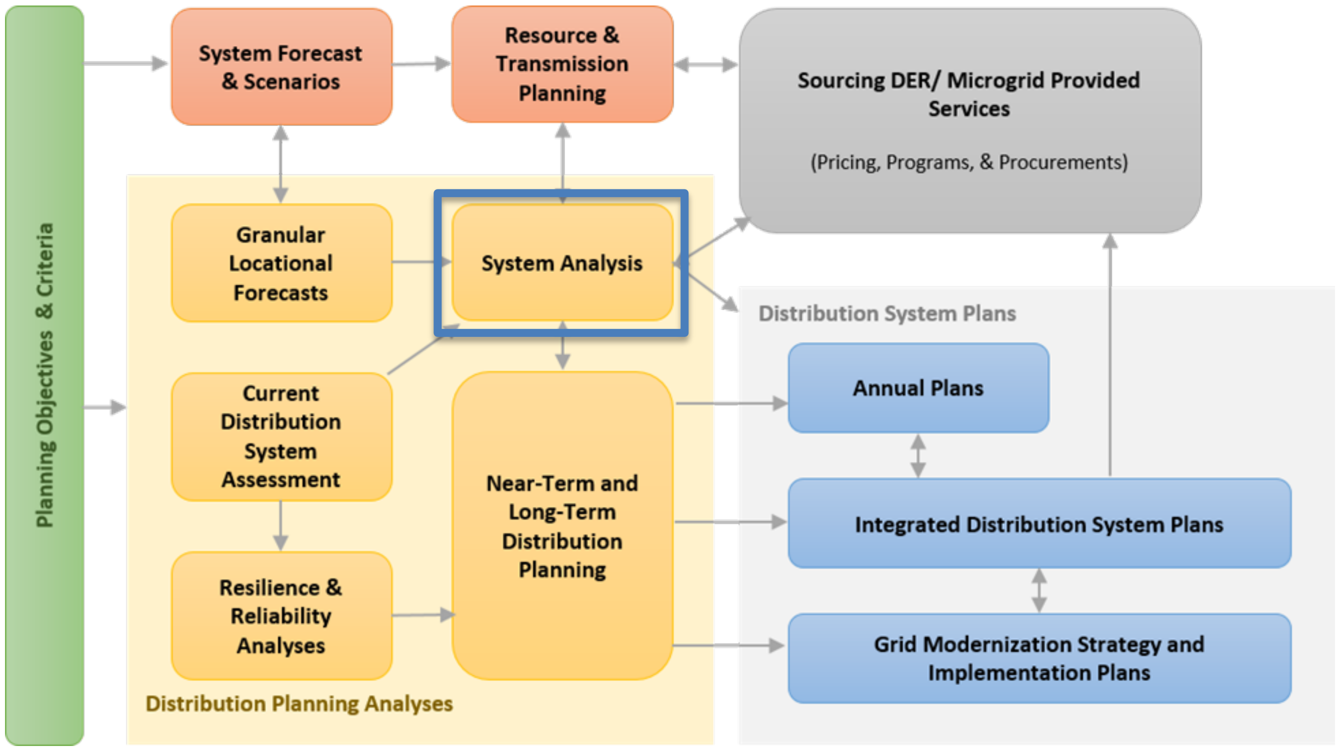
- Uses hosting capacity results along with a Heat Map to indicate existing and pending installations on feeders
- Pepco's Hosting Capacity Analysis provides customers with the ability to assess the interconnection point to estimate the available capacity on a feeder, in relation to the current and anticipated solar photovoltaic (PV) projects awaiting connection



Pepco's Definition of Strict and Maximum PV Penetration Limits – Source DE-EE0006328

Use Case #3 - Distribution Planning Tool

- Hosting capacity plays a crucial role in scenario analysis, allowing for the assessment of various 'what-if' situations concerning DER integration.
- When combined with projections of load and DER expansion, the analysis facilitates detailed evaluations of future effects on a per-feeder basis.
- Utilities can use these scenarios to consider mitigation strategies and necessary infrastructure enhancements and to conduct cost-effectiveness analyses.
- Advanced analytical capabilities will equip utilities to gauge the distribution system's readiness to leverage DER services, including non-wires alternatives, and to understand how DERs affect grid restructuring, operational tactics, and the adoption of advanced inverter technologies.



Source: Modern Distribution Grid Guidebook, DSPx Volume 4, June 2020, PNNL: Grid Architecture - Modern Distribution Grid Project

Use Case - Example

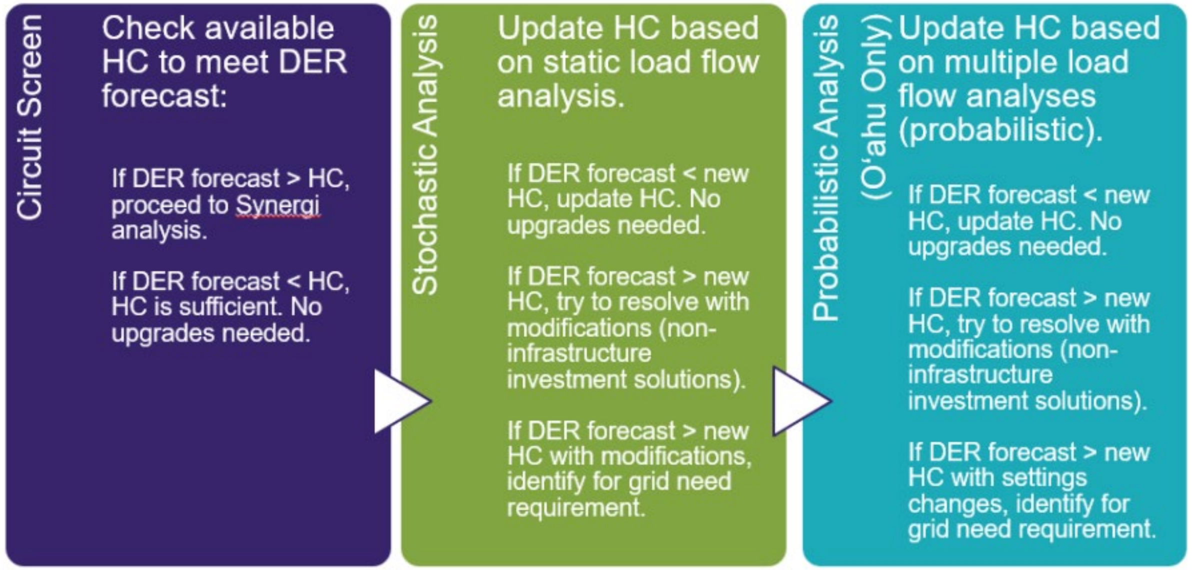
Hawaiian Electric Company:

The Hawaiian Electric Company (HECO) employs a multi-step, increasing complexity screening process to assess a circuit's capacity to host forecasted DERs through 2025.

Based on the multistep process, Hosting Capacity is categorized in the following groups by Circuit.

- **Existing Hosting Capacity Satisfies Need**: Existing hosting capacity can accommodate the total anticipated DER in year 2025. No grid needs are required.
- **Updated Hosting Capacity (Without Modifications) Satisfies Need:** Updated hosting capacity can accommodate the total anticipated DER in year 2025. No grid needs are required.
- **Updated Hosting Capacity (With Modifications) Satisfies Need:** Updated hosting capacity along with modifications that do not require infrastructure investments can accommodate the total anticipated DER in year 2025.
- **Solution Option Required:** Updated hosting capacity is unable to accommodate the total anticipated DER in year 2025. Grid need identified.

Source: HECO



Summary of Hosting Capacity Analysis – Source: HECO

Island	Total Circuits	Existing Hosting Capacity Satisfies Need (Analysis Not Required)			Total Anticipated DER in 2025 > Hosting Capacity (Analysis Required)		
		Low	Base	High	Low	Base	High
O'ahu	384			303			81
Hawai'i Island	137			76			61
Maui Island	88			52			36
Lana'i	3			1			2
Moloka'i	8			3			5
Total (All Islands)	620			435			185

Summary of Circuit Selection Screening – Source: HECO

Non-Wires Alternatives

Non-Wires Alternatives

"Non-wires alternative (NWA)" is any action or strategy that uses **non-traditional** transmission and/or distribution solutions – such as distributed generation, energy storage, energy efficiency, demand response, and grid software and controls – with the intent to **defer or replace** the need for specific **energy delivery system equipment investments**. An NWA must meet energy delivery system needs and be more **cost effective** consistent with the guiding principles of sustainable, well-planned, secure, affordable, and non-discriminatory."*

NWA Benefit Category	Traditional Solutions	NWA Solution	DER Types Considered
Capacity – Reduce thermal loading on utility equipment during peak load hours to defer upgrades	Upgrade overloaded equipment, construct new circuit or substation for segmentation	Inject power locally to reduce thermal load on equipment	Grid-following DER — e.g., PV, battery energy storage system (BESS), combined heat and power
Reliability – Provide an alternate source during loss of utility supply	Build circuit ties, construct redundant substation or circuit	Intentional island to restore service to unfaulted area	Grid-forming DER (grid-forming inverter or synchronous generator)
Voltage Support – Mitigate voltage violations	Install capacitor bank or voltage regulator, reconductor	Real and reactive power injection and absorption	Inverters with Volt/Var curves, BESS, etc.

*SEPA Non-Wires Alternatives (NWA) – Incorporating NWAs into Your Grid Modernization Program

Identifying NWA Opportunities – Levels of Targeting

System-Level Initiatives

- No specific locational drivers; impact to specific grid needs is coincidental
- Examples: Lighting LED Conversions, Net Metering

Geotargeted Programs

- Tailor programs and incentives to target areas of expected future distribution needs
- Ex: Value of DER Tariffs

Specific Grid Needs

- Dedicated procurement of specific size/type of resource to meet known constraint
- Ex: 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, thus preventing bottlenecks and overloads before they occur.

- **Local Resource Optimization**: Encourages the development and integration of local renewable energy sources, which can alleviate demand on the central 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 energy efficiency and demand response and local DERs.

Example – Brooklyn Queens Demand Management Program (BQDM)

Background

- In response to rising demand for electricity in the Brooklyn-Queens area, ConEd faced the need for a significant infrastructure upgrade—a new substation costing an estimated $1 billion.

- To avoid this costly investment, ConEd launched the BQDM program in 2014, aiming to reduce electricity demand in the target area by **52 megawatts (MW)** through demand-side management and distributed energy resources (DERs). This included 41 MW of customer-side DERs and 11 MW of DERs directly tied to the utility distribution network.

Source: "Brooklyn Queens Demand Management Demand Response Program." Business Opportunities, Consolidated Edison Company of New York, Inc, www.coned.com/en/business-partners/businessopportunities/brooklyn-queens-demand-management-demand-response-program

Example – Brooklyn Queens Demand Management Program (BQDM)

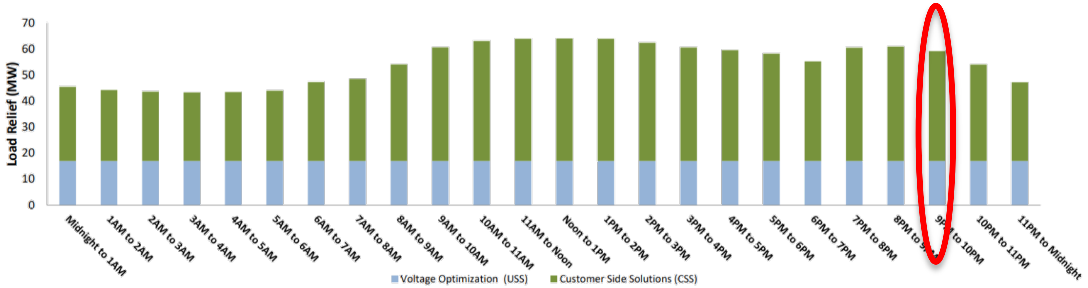
Achievements

- The BQDM program successfully met its target to reduce peak demand by 52 MW and successfully deferred the need for the new substation and provided a more cost-effective solution for managing the area's energy demand. As of Q2 2023, 61 MW of load relief was achieved at the peak (9-10 pm) including **29 MW from EE.**

Economic Impact

- With an investment of approximately $200 million—only a fifth of the cost estimated for infrastructure upgrade ($1B)—ConEd was able to achieve the required demand reduction.
- This approach offered significant savings to ConEd and its customers while still enhancing grid reliability and resilience.

BQDM PORTFOLIO	2023		
	Quarter 2	Year-to-Date	Program-to-Date
FINANCIAL ACTIVITY ($ M)			
[0] Expenditures			
Customer-sided	$ 0.53	$ 1.04	$ 107.11
Utility-sided	$ -	$ -	$ 23.74
Total Expenditures	**$ 0.53**	**$ 1.04**	**$ 130.84**
Program Cost Recovery	$ 1.15	$ 2.30	$ 76.35
CUSTOMER-SIDED PROGRAM ACTIVITY			
Energy Efficiency			
[1] Residential Direct Install			
Peak Hour kW reduction	-	-	4,930
[2] Bring Your Own Thermostat			
Peak Hour kW reduction	-	-	391
[3] Residential AC			
Peak Hour kW reduction	-	-	9
[4] Multifamily Energy Efficiency			
Peak Hour kW reduction	12	12	5,650
[5] Small-Medium Businesses Adder			
Peak Hour kW reduction	123	191	14,677
[6] Commercial & Industrial			
Peak Hour kW reduction	-	-	985
[7] NYCHA			
Peak Hour kW reduction	-	-	2,293
[8] DCAS			
Peak Hour kW reduction	38	38	505
Distributed Generation			
[9] Fuel Cell			
Peak Hour kW reduction	-	-	6,100
[10] Combined Heat & Power			
Peak Hour kW reduction	-	-	3,079
Energy Storage			
[11] Peak Hour kW reduction	-	-	4,000
Customer-Sided Portfolio kW reduction at Peak Hour	**173**	**241**	**42,620**



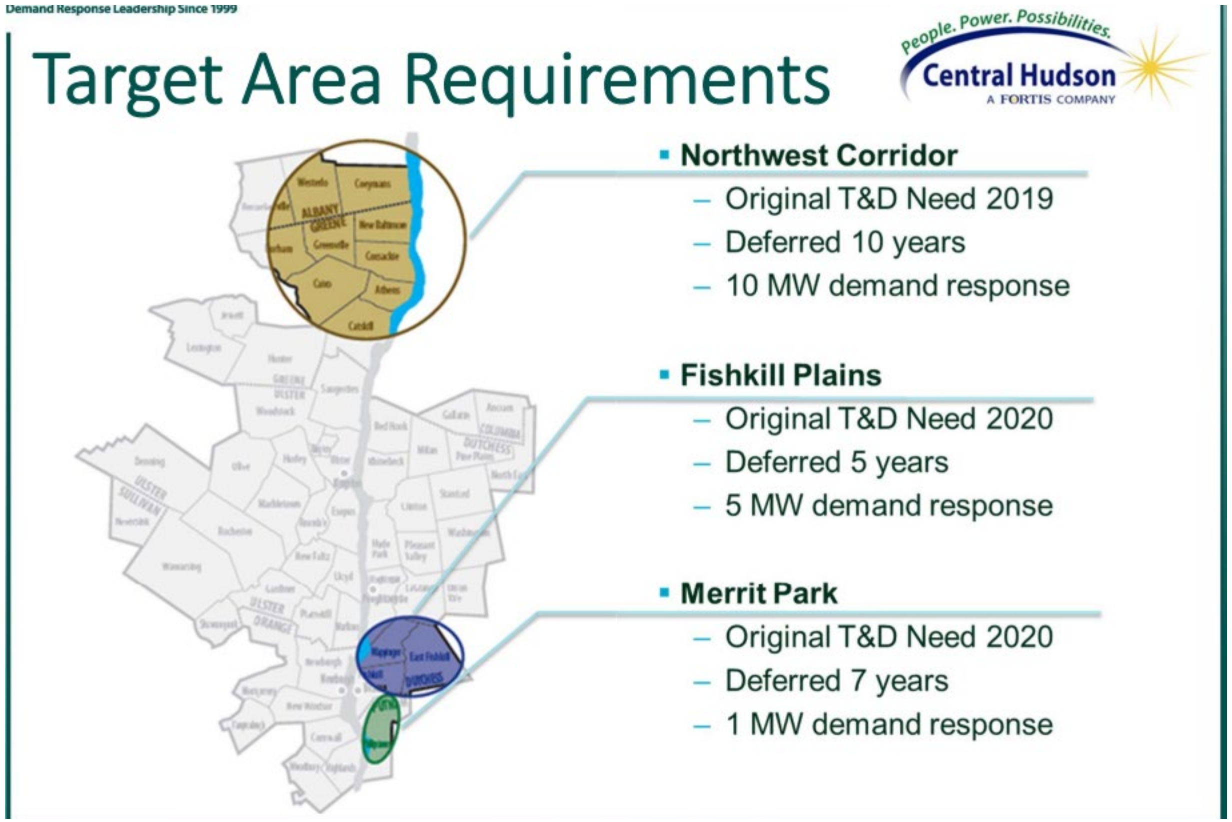
Source: Con Edison BQDM Report Q2 2023, NY PSC Order Establishing Brooklyn/Queens Demand Management Program

Example – Central Hudson Peak Perks Program

Background

- Central Hudson, serving parts of New York State, faced challenges with peak load management, especially during the summer months when energy usage spikes due to air conditioning and other cooling needs.

- The utility was looking for a way to manage these peaks more effectively without resorting to costly infrastructure upgrades in three targeted zones for 5 to 10 years.



Source: PLMA Demand Response Program [Link]

Example – Central Hudson Peak Perks Program

Overview

- Peak Perks was designed as a voluntary program that incentivizes residential and commercial customers to allow Central Hudson to install devices that can remotely cycle off air conditioning systems or adjust thermostat setpoints for brief periods during peak demand times.
- Participants receive an initial enrollment bonus and annual participation incentives.

Estimated Cost of Traditional T&D Solutions

– Actual Cost of DR Solution

+ Actual Capacity Savings

= Program Financial Benefits

70% of benefits go to rate payers by reducing future bill pressure

30% of benefits are provided to utility as incentive to achieve the program targets

Source: PLMA Award Wining DR Initiatives

Example – Central Hudson Peak Perks Program

Strategy

- The program 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.

Outcomes

- The program exceeded the total first year MW target of all three locations, achieving **5.9 MW** of load reduction compared to 5.3 MW target.
- Overall, Central Hudson's Peak Perks program successfully curbed peak energy demand, contributing to more stable and efficient grid operation.
- Program participants contributed to a collective effort that helps to maintain reliable service and keep energy costs down for all customers.

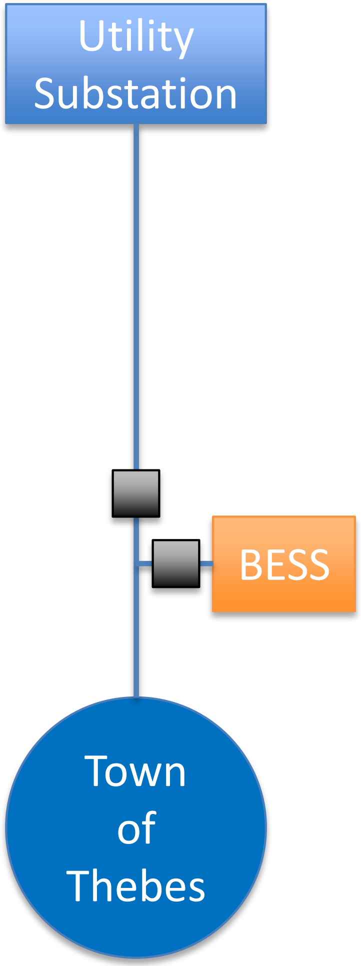
Specific Grid Needs Example – Ameren Illinois Thebes BESS

- Ameren Illinois installed a battery energy storage system to provide backup power for the town of Thebes.
  - Approximately 300 residents
  - Historically worst performing circuit for reliability
  - Served via radial supply through dense Mark Twain National Forest
  - Traditional alternate source construction not viable due to distance and trees

- **1 MW battery** installed and used as an automatic transfer voltage source for the community during an outage situation

- Estimated Cost: **$1.4M**

- This project resulted in **fewer and shorter outages with positive community feedback**.

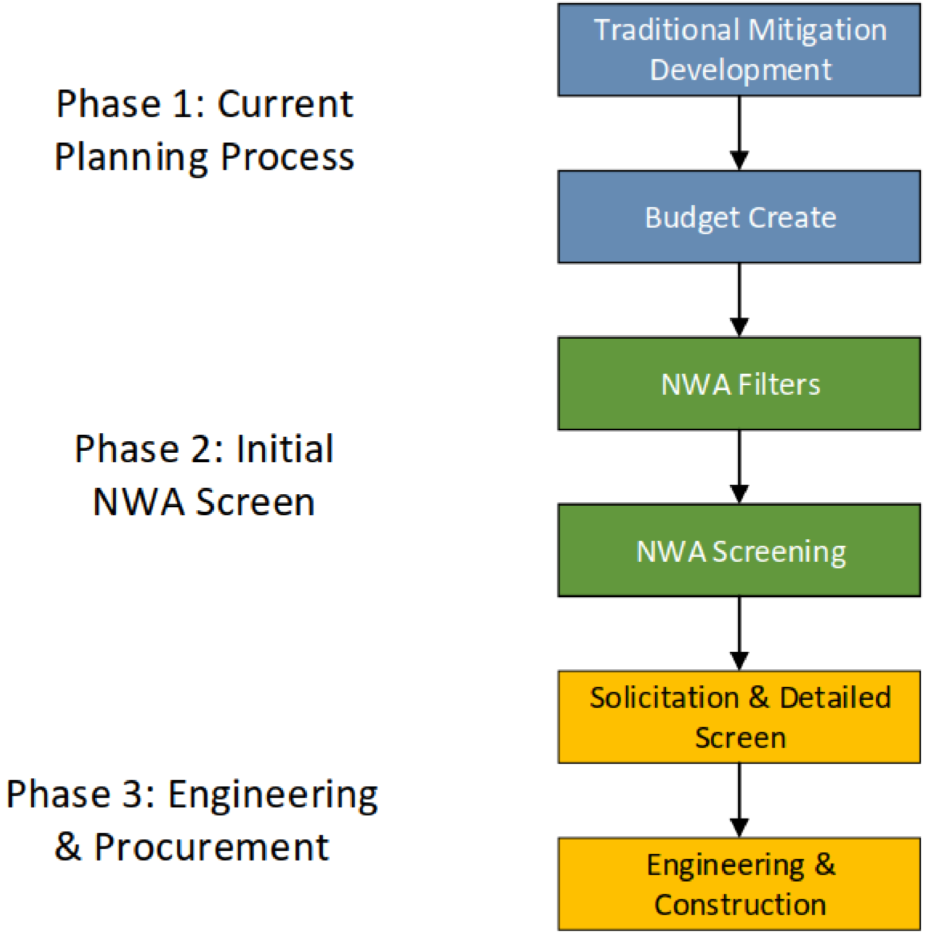


Ameren Illinois Thebes Battery [Link]

NWA Evaluation Framework – Comparison with Alternatives

Evaluating Non-Wires Alternatives requires comparing them to traditional infrastructure solutions to understand benefits and limitations of NWAs in addressing specific grid needs. This comparison is a multi-faceted comparison including, but limited to, the following factors :

- Capital and operational costs
- Time to implement
- Scalability and flexibility
- Environmental impacts
- Reliability and resiliency measures
- Regulatory and policy compliance
- Public/community impact
- Maintenance and long-term use
- Finance and business models
- Risks



Source: Xcel Minnesota 2023 Integrated Distribution Plan

NWA Evaluation Framework – Cost Benefit Evaluation

Cost-benefit analysis for NWAs scrutinizes a variety of factors to ascertain NWA economic viability compared to traditional grid upgrades, such as:

- Initial capital expenditure
- Operational expenditures
- Economic lifespan and depreciation
- Benefits and savings
- Scalability costs
- Avoided energy benefits
- Avoided capacity benefits
- Avoided non-energy benefits
- Benefit to cost ratio

Individual Cost and Benefit Calculations for an Example Project, Used to Calculate the Net Impact

Cost and Benefits Summary	
Energy Generation	$1,544,526
Generation Capacity + MISO Reserves	$473,600
Transmission Capacity	$20,332
Deferral Benefit	$800,717
GHG Emissions + Other Environmental	$2,112,750
Solar Cost	$(2,177,637)
Battery Cost	$(438,363)
Interconnection Fees	$(204,000)
Total Benefit	**$4,951,924**
Total Cost	**$(2,819,999)**
Net Impact	**$2,131,925**

Source: Xcel Minnesota 2023 Integrated Distribution Plan – NWA Appendix F, Pg 24

NWA Evaluation Framework – Resource Overcommitment Evaluation

Resource overcommitment occurs when a **single asset** is expected to **serve multiple functions simultaneously**, which might **not be feasible** due to operational constraints. This is especially relevant in the context of value stacking for NWAs, where assets like energy storage systems are expected to provide a range of services, such as demand response, load shifting, and voltage support.

To mitigate the risk of overcommitment, it is crucial to assess the following:

- **Capability Assessment -** Ensuring that each asset can handle the demands of each service it's tasked with, both individually and in combination.
- **Coordinating Scheduling and Dispatch -** This involves using advanced control systems to schedule the asset's responsibilities in a way that avoids conflicts, such as providing ancillary services during one period and reserving capacity for peak load support in another period.
- **Contractual Obligations -** When engaging resources for multiple services, the terms should reflect the physical and operational limits of the asset.
- **Robust Monitoring and Management Systems –** These systems continuously track the performance and availability of the resource, ensuring that it can meet its various functionality commitments when needed.
- **Fallback Options -** In case a resource can't fulfill all roles due to simultaneous demand, backup systems or strategies can be in place to maintain service levels.

NWA Procurement Mechanisms

Specific Grid Need
Direct Procurement

- Utility-initiated acquisition of resources to meet identified grid needs.
- Utility-owned/leased and directly controlled, offering a streamlined approach.
- The approach simplifies access to the value stack, mitigating contractual or control complexities associated with third-party operations.
- Suitable for vertically integrated utilities. More challenging for deregulated distribution utilities (ownership, market revenue, and dispatch coordination challenges).

Specific Grid Need
Distribution Services Approach

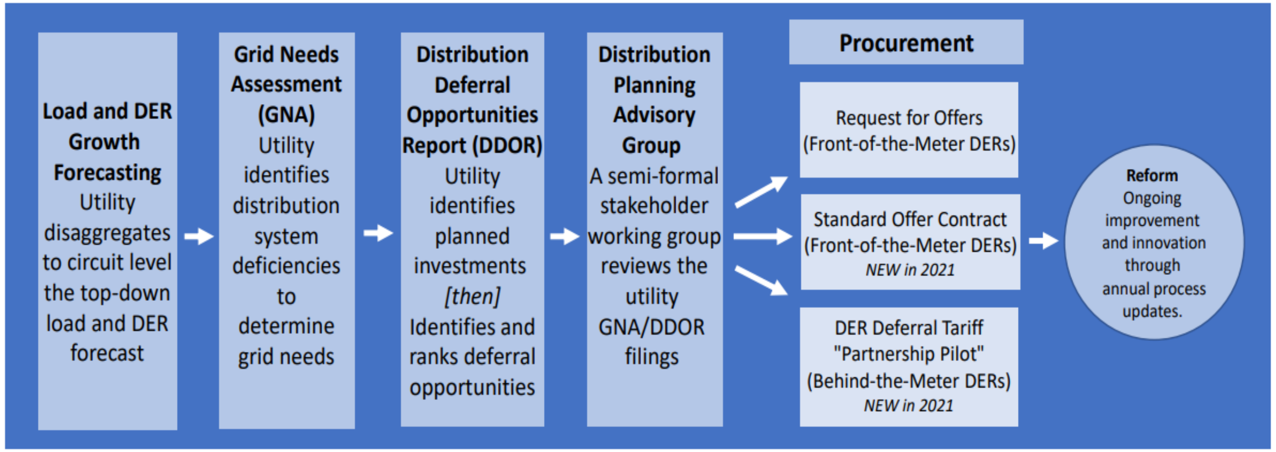
- Utility issues a call for proposals from third parties or customers for NWAs to address specific grid needs.
- Such solicitations enable the integration of customer or third-party-owned resources, which are then compensated for their services to the grid.
- These resources can be directed by the utility for distribution system needs as necessary, while otherwise participating freely in other market opportunities.

Geotargeting or System Level
Programmatic Approach

- Employ systematic studies to discern the locational value of DERs, aiming to direct them to where they're most beneficial on the grid.
- Adjust incentive levels to promote DERs in locations which can offer the greatest value/relief to the system.
- The goal is to prevent as many specific grid needs as possible by managing load growth in targeted areas, thereby reducing reliance on traditional infrastructure upgrades.

Specific Grid Needs - Distribution Services Approach - California

In 2018 the CPUC issued decision D. 18-02-004, which adopted the **Distribution Investment Deferral Framework**, creating opportunities for DERs to serve as **NWAs in lieu of traditional grid investments**.



*The California Energy Commission prepares the top-down load forecast used by the IOUs. The same top-down load forecast is used as the basis for the CPUC's Integrated Resources Plan process and California Independent System Operator's Transmission Planning Process.

Candidate Deferral	GNA Facility Name	In-Service Date
WILLOW PASS BANK 1	WILLOW PASS BANK 1	2023
	WILLOW PASS BANK 3	2023
SAN MIGUEL BANK 2	SAN MIGUEL BANK 1	2023
	SAN MIGUEL 1104	2023
	PASO ROBLES 1107	2023
CALISTOGA BANK 1	CALISTOGA BANK 1	2023
	CALISTOGA 1102	2023
RIPON 1705	VIERRA 1707	2024
ZAMORA BANK 1	ZAMORA BANK 1	2023
GREENBRAE BANK 2*	GREENBRAE BANK 2	2023
BLACKWELL BANK 1 *	BLACKWELL BANK 1	2023

* CUSTOMER CONFIDENTIAL due to their peak loads violating the 15-15 customer privacy rule

Source: PG&E presentation on 2021 RFO for more than 19.6 MW support of local distribution capacity relief in seven areas in central California

DIDF Framework - Demand-side Alternatives To Traditional Supply-side Investments: Updated And New Approaches In California

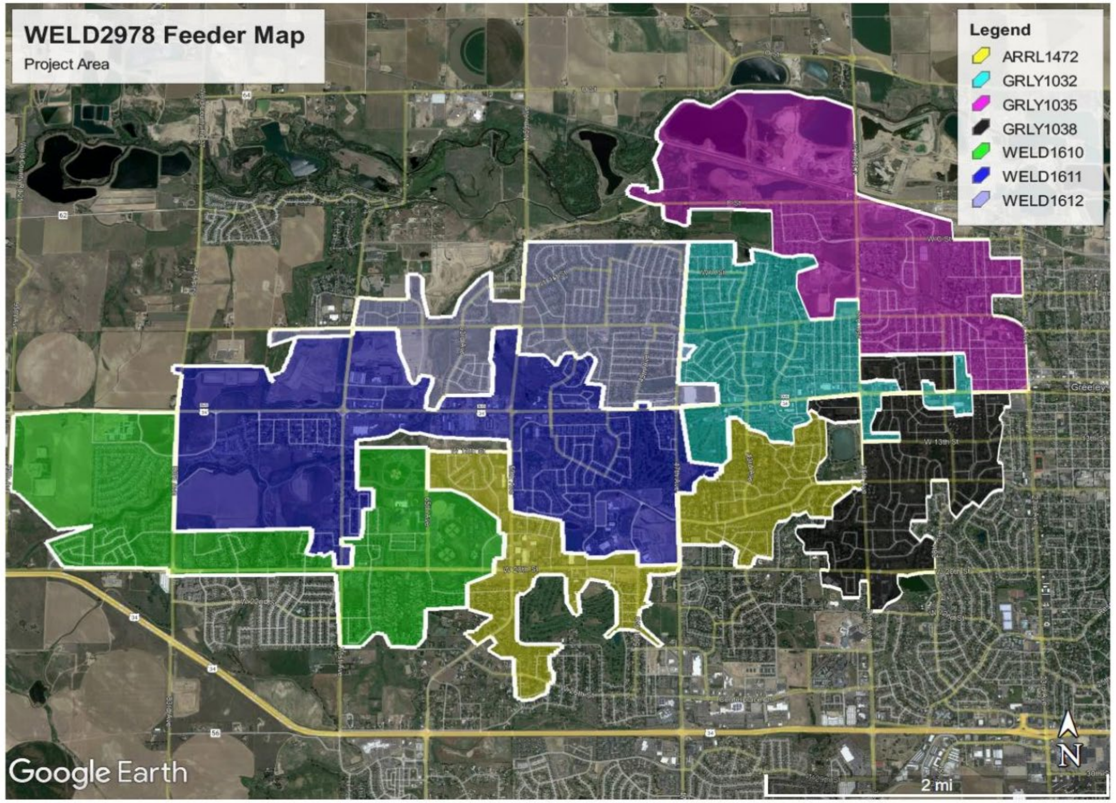
PG&E 2021 DIDF identified more then 19MW of Grid needs [Locational Value of DERs]

Specific Grid Needs - Distribution Services Approach - Colorado

In May of 2023, Xcel Energy (PSCo) issued an RFP to solicit NWA solutions 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

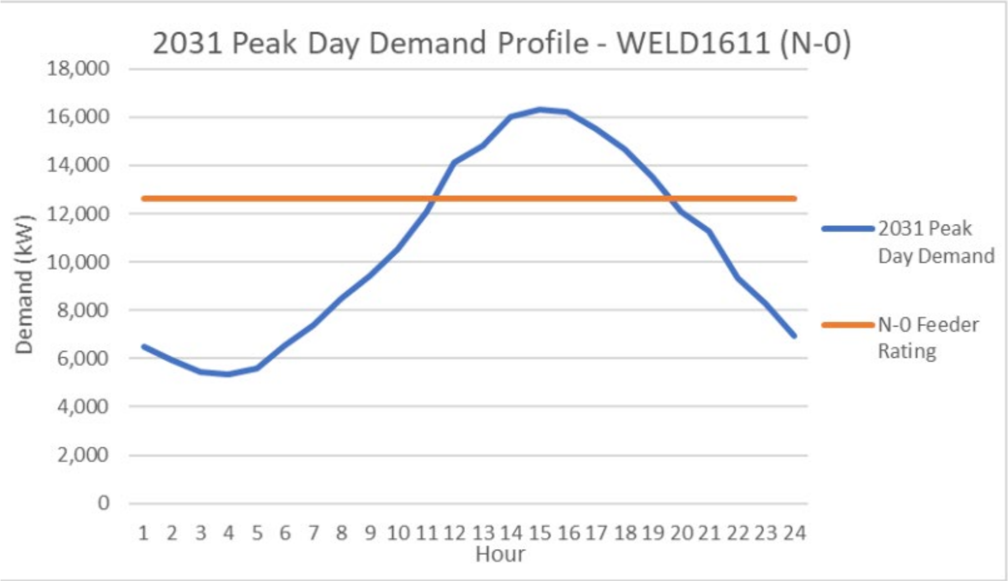
Area of Need



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



[Source]

Geotargeting and System Level – Value of DER

- **Customer-centric approach** where customers choose the size, location, and type of DER installations, such as solar panels or energy storage systems, and are **compensated based on the locational value their DERs** provide to the grid, **encouraging deployment in areas where can provide maximum benefits**.

Example: NY VDER
New York's Value of Distributed Energy Resources (VDER) program, which includes the **Locational System Relief Value**, **compensates** DER providers based on the **location-specific value** they bring. VDER also employs studies on the marginal cost of service to determine a general "**Demand Reduction Value**" applicable across **all locations**.

Ongoing Proceeding – Illinois Value of DER
Illinois is engaged in an ongoing proceeding to determine "base value" and "additive services" value of DER as a replacement for the distribution component of net metering compensation

- Driven by state legislation
- Framework to be proposed in 2024
- Workshop Materials: [Link]

Value Name	Description	Eligible DERs
Energy Value (LBMP)	LBMP is the day-ahead wholesale energy price as determined by NYISO. It changes hourly and is different according to geographic zone.	All technologies: PV, storage, CHP, digesters, wind, hydro, and fuel cells.
Capacity Value (ICAP)	ICAP is the value of how well a project reduces New York State's energy usage during the most energy-intensive days of the year. Developers can choose from three payout alternatives and most ICAP rates change monthly.*	All technologies receive ICAP. Dispatchable technologies (stand-alone storage, CHP, digesters, and fuel cells) will receive Alternative 3.
Environmental Value (E)	E is the value of how much environmental benefit a clean kilowatt-hour brings to the grid and society. The E value is locked in for 25 years.**	PV, wind, hydro, and storage charged exclusively from PV or wind energy. Stand-alone storage is not eligible at this time.
Demand Reduction Value (DRV)	DRV is determined by how much a project reduces the utility's future needs to make grid upgrades. DRV is locked in for 10 years.**	All technologies.
Locational System Relief Value (LSRV)	LSRV is available in utility-designated locations where DERs can provide additional benefits to the grid. Each location has a limited number of MW of LSRV capacity available. The LSRV is locked in for 10 years.**	All technologies. Project must be on a utility-specified substation.
Community Credit (CC)	CC is available on a limited basis to encourage the development of Community Distributed Generation (CDG) projects. CC is the successor to the Market Transition Credit (MTC) and is similar in structure. The CC is locked in for 25 years.** PV projects in utility territories that have fully expended their CC may be eligible for the Community Adder – an upfront incentive administered by NY-Sun.	Available for CDG projects including PV and digesters. Wind, hydro, and fuel cells receive CC at a derated value. Not available for stand-alone storage or CHP.

NY Value Stack Elements [Link]

Closing

Questions to Ask

- How are the impacts of DER factored into your planning and investment processes?
- How are you estimating the peak load impact of EV growth across your distribution system?
- How granular are your PV, EV, and other DER forecasts with regard to location?
- What constraints are you considering in your hosting capacity map?
- What information could be readily provided by your hosting capacity analysis that would provide value to the utility, DER developers and customers?
- What steps would be needed to incorporate hosting capacity results into the screening process for DER interconnection?
- How can geotargeting be applied to existing system-level DER programs to improve distribution benefits?
- How are Non-Wires Alternative opportunities being identified and screened?
- What challenges have you experienced or do you anticipate within the NWA adoption process?

Q&A

Questions?

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