NARUC Summer Policy Summit

Committee on Energy Resources and the Environment

Grid Hardening or DERs? How to Pick Your Resilience Entrée

2:00 p.m. – 3:00 p.m.

RHIZOME

Leveraging AI for a More Resilient Electric Grid

Mishal Thadani | Co-Founder & CEO, Rhizome

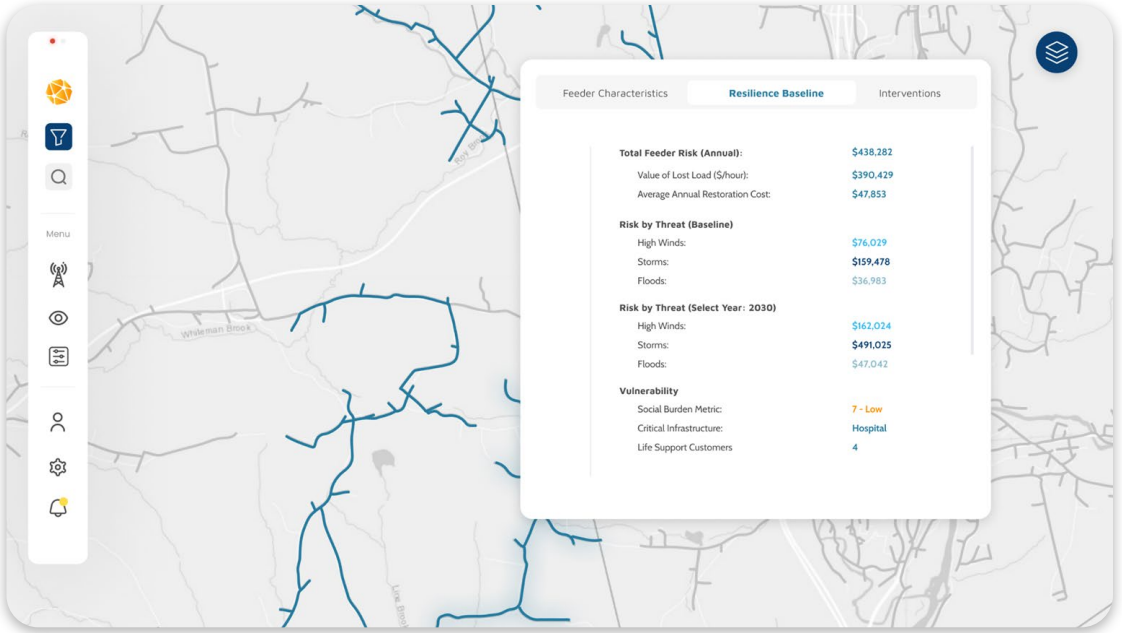
7.16.2024

Rhizome has built the only comprehensive resilience planning platform in the world.

Assess → Vulnerabilities and climate risks on a digital twin of T&D assets

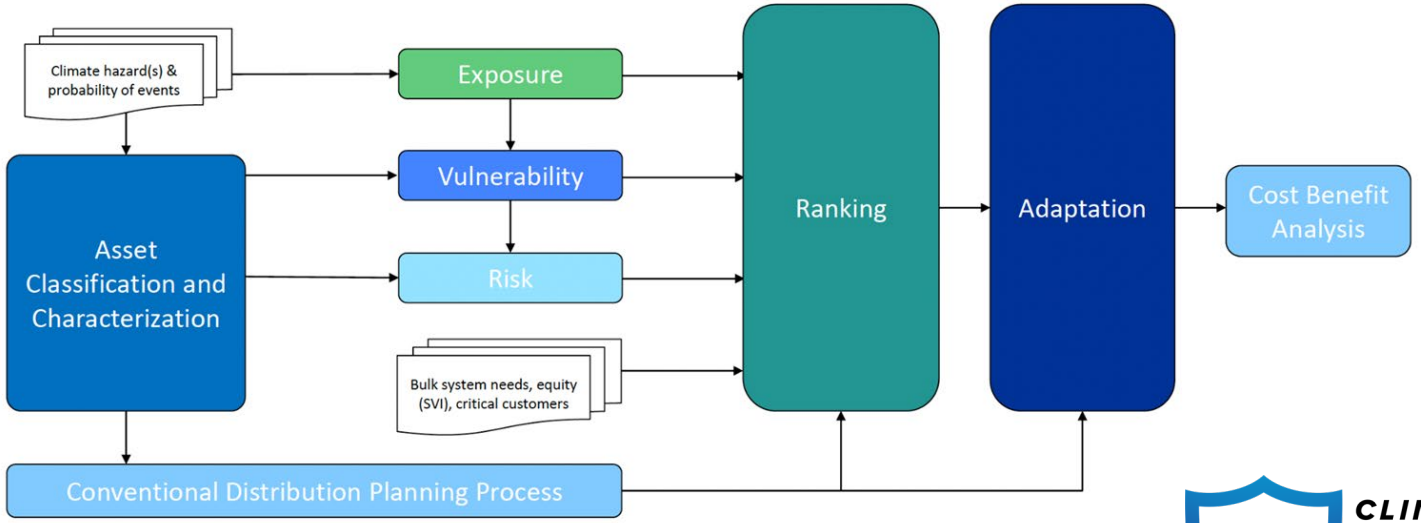
Optimize → Plan infinite scenarios to optimize risk reduction and social parameters

Justify → Capital investments to regulators through fully-defensible cost-benefit analyses



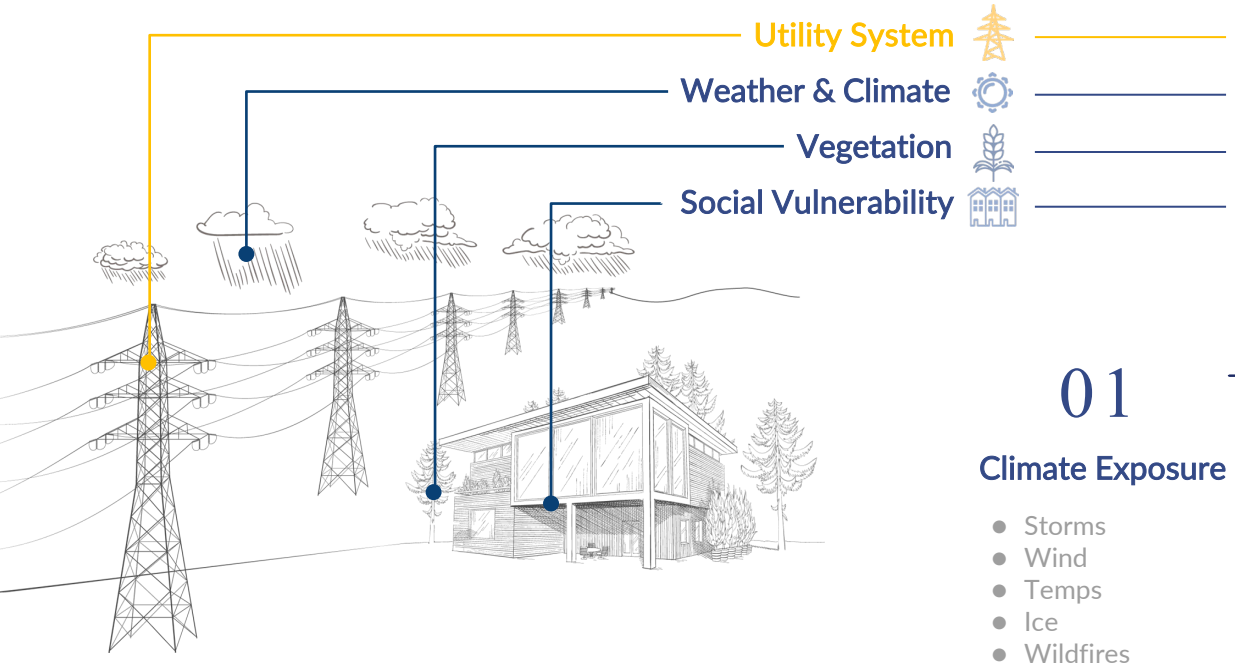
CenterPoint Energy · Portland General Electric · Seattle City Light · Vermont Co Electric Co-op · Joules Accelerator · NREL National Renewable Energy Laboratory · EPRI · Climate READi: Power

The platform aligns with frameworks designed to optimize distribution plans for future resilience

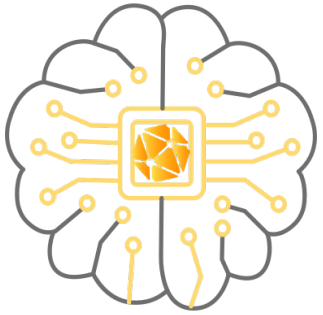


CLIMATE READi
RESILIENCE AND ADAPTATION INITIATIVE

Rhizome's platform is built to evaluate future resilience challenges for any geography



Rhizome Machine Learning Algorithms



01 Climate Exposure

- Storms
- Wind
- Temps
- Ice
- Wildfires

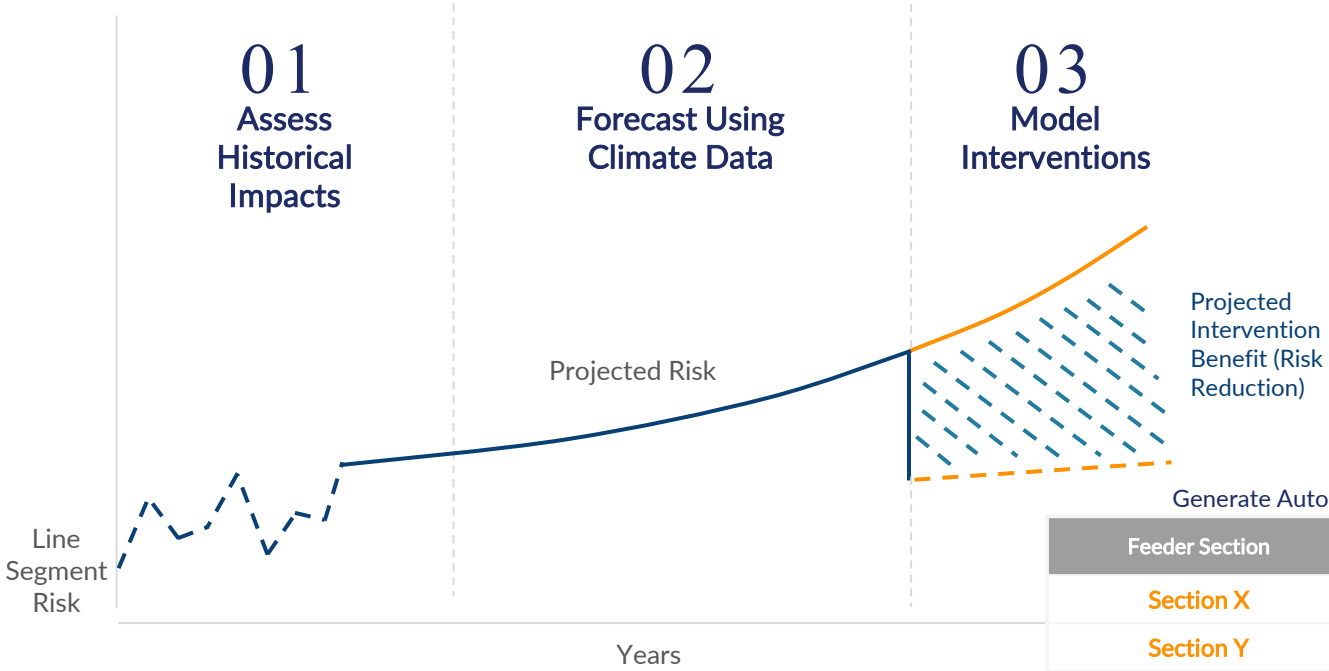
02 Asset Vulnerability

- Circuits
- Poles
- Transformers
- Conductors
- Elbows

03 Consequence

- Outages
- Restoration Costs
- Critical Facilities
- Vulnerable Communities

Quantify climate risks and investment benefits at high resolutions, forecast reliability and risk metrics



Interventions Evaluated

- Pole upgrades
- Vegetation management
- Undergrounding
- Line hardening
- Distribution automation
- Battery storage
- Microgrids

Generate Automated Cost-Benefit Analyses

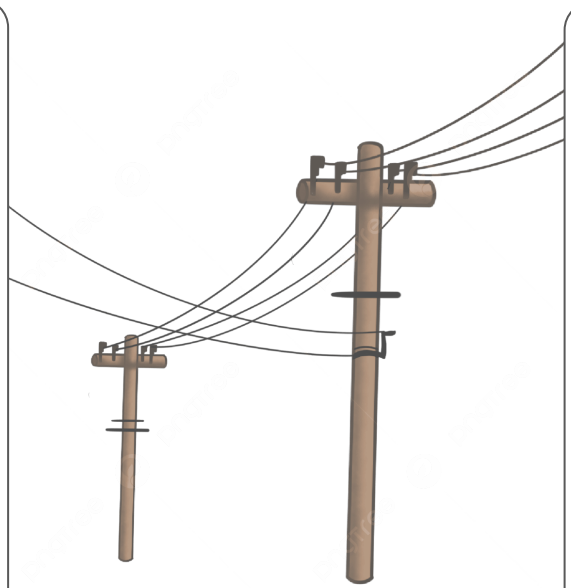
Feeder Section	Cost	Year 1	NPV
Section X	$800k	-$20k	**$1.9M**
Section Y	$425k	-$17k	**$3.3M**
Section Z	$1.33M	-$8k	**-$1.6M**

→ The platform aligns with frameworks designed to optimize distribution plans for future resilience

Circuit Needs

Capacity:
- Electrification
- DERs hosting
- Extreme temperatures

Asset:
- Asset degradation
- Extreme events
- Higher reliability expectations



Circuit Solutions

- Demand Response
- Energy Efficiency
- Battery/Microgrid
- Undergrounding
- Distribution Automation
- Vegetation Management

Value Stream

	Capacity	Asset
Demand Response	✓	
Energy Efficiency	✓	
Battery/Microgrid	✓	✓
Undergrounding		✓
Distribution Automation		✓
Vegetation Management		✓

Thank you!

RHIZOME

Mishal Thadani
Co-Founder and CEO
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NARUC Summer Policy Summit

Grid Hardening or DERs? How to Pick Your Resilience Entrée

Moderator - Hon. Angie Hatton, Kentucky

Hala N. Ballouz, P.E., President & CEO, Electric Power Engineers, LLC
Thad Culley, Director of Public Policy, Sunrun
Jennifer Kallay, Principal Associate, Synapse Energy
Mishal Thadani, CEO, Rhizome

Grid Hardening or DERs?
How to Pick Your Resilience Entrée

The biggest technical impediment to improving the resilience of the grid is understanding the threat to be mitigated and evaluating the effects of the solutions.

At EPE, we have a unique talent and skills to support the energy transition.

Hala Ballouz

President & CEO

ELECTRIC POWER ENGINEERS

DELIVERING ENERGY INTELLIGENCE

The Need for Resiliency

UNIVERSAL THREATS

- Cybersecurity
- Environment Threats
- Physical Threats

UNIQUE CHALLENGES

Grid Conditions Demographics Cost Weather

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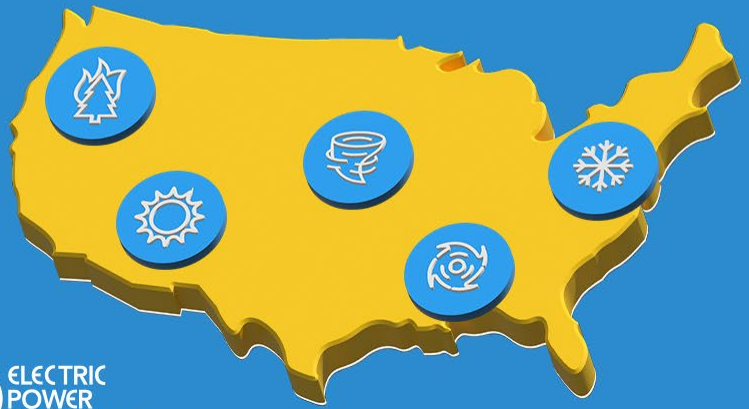
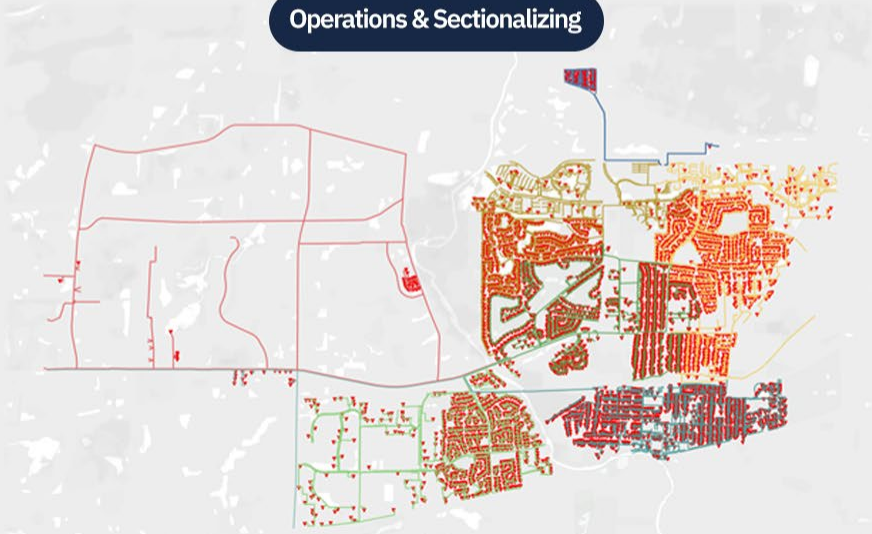
Resiliency Solutions Are Unique & Localized

- Wildfires
- Hurricanes
- Earthquakes
- Winter Storms
- Heat Waves



This Requires Circuit - by - Circuit Analysis

- Infrastructure Mitigations
- Vegetation Management
- Advanced Protection
- Operations & Sectionalizing



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Comprehensive Framework

Challenges & Threats
- Wildfires vs. hurricanes

Impact
- Equity
- Environmental impacts
- Consumer as a stakeholder

Evaluate Risk Areas
- Geographic + demographic
- Grid condition and future needs

Location Specific Solutions
- Grid hardening + DER

Determine Funding
- Traditional rate recovery
- Federal funding

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Grid Resilience

1 Universal + Unique

Universal threats to the grid require unique solutions.

2 Hardening + DER

We must understand the grid edge behavior and DER potential.

3 Develop a Framework

Manage complexity and acheive resiliency with a personalized framework.

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Thank You!

Contact Us

Our Contact Information

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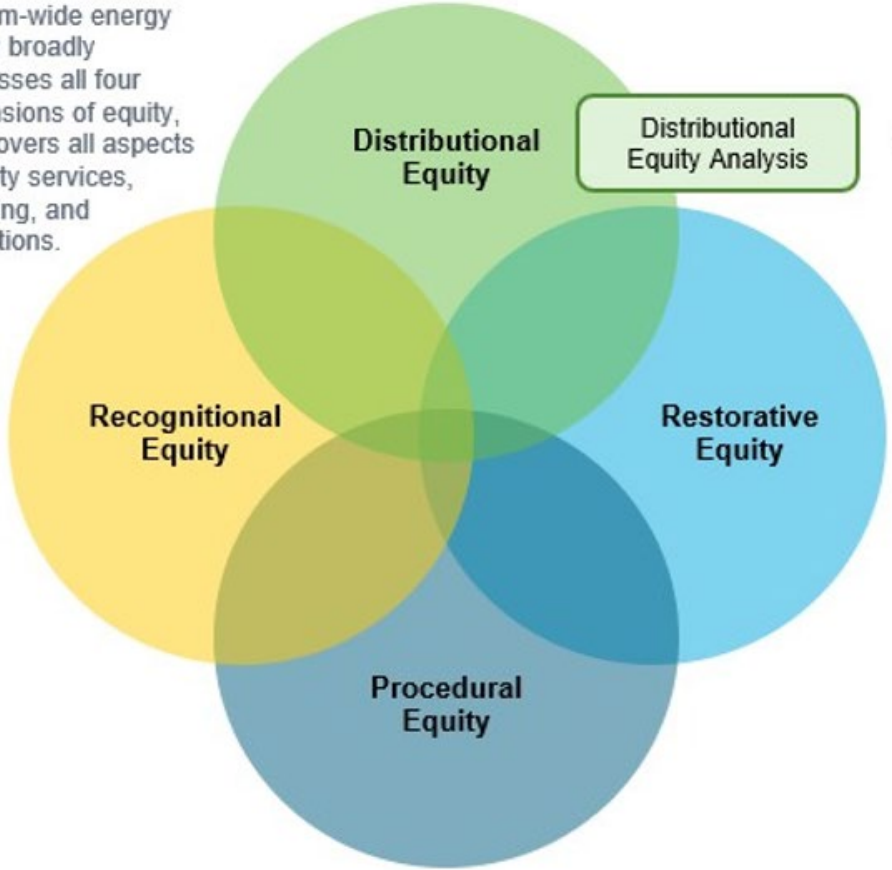
DELIVERING ENERGY INTELLIGENCE

Distributional Equity is a subset of system-wide energy equity

System-wide energy equity broadly addresses all four dimensions of equity, and covers all aspects of utility services, planning, and operations.



Distributional Equity Analysis + Benefit Cost Analysis

DEA addresses one aspect of distributional equity:

What are the distributional equity impacts of utility resource investments in the context of cost-effectiveness evaluation?

Source: *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources*. June 25, 2024 webinar slides. Presented by Lawrence Berkeley National Laboratory, U.S. Department of Energy, E4TheFuture and Synapse Energy Economics. Available at: https://emp.lbl.gov/publications/distributional-equity-analysis

Distributional Equity Analysis (DEA) Can Be Used with BCA to Address Distributional Equity

DEA can be conducted alongside BCA

- Provides information on equity that BCAs cannot provide
- DEA uses many of the same inputs, methods, and assumptions as BCA

Key differences between DEA and BCA

- DEA separates customers into priority populations and other customers.
- DEA includes additional metrics to provide energy equity data

Together the two analyses can inform decisions about whether and to what extent utility investments meet articulated energy and equity goals

Source: *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources*. June 25, 2024 webinar slides. Presented by Lawrence Berkeley National Laboratory, U.S. Department of Energy, E4TheFuture and Synapse Energy Economics. Available at: https://emp.lbl.gov/publications/distributional-equity-analysis

Priority Populations – Key Concepts

- The DEA Guide uses the term “priority populations” to indicate those customers and communities that will be evaluated separately to assess equity impacts.
- Many terms are used to represent the concept of priority populations:
- Priority populations should be identified using each jurisdiction’s equity policy goals along with stakeholder input.
- A variety of indicators can be used to determine which customers and communities should be included in a priority population. These fall into several categories:
  - Income, population health, poor environmental conditions, access to services, existing inequities.

- disadvantaged
- overburdened
- marginalized
- underserved
- vulnerable
- environmental justice communities
- frontline communities
- highly impacted communities
- target populations

Source: *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources*. June 25, 2024 webinar slides. Presented by Lawrence Berkeley National Laboratory, U.S. Department of Energy, E4TheFuture and Synapse Energy Economics. Available at: https://emp.lbl.gov/publications/distributional-equity-analysis

DEA Metrics: Examples

Proposed Metrics	For Grid Hardening	For DERs
Participation		
# of installations (for EJ and non-EJ communities)	✓	✓
#/% customers the installations serve (for EJ and non-EJ communities)	✓	✓
cost (in dollars) of installations (for EJ and non-EJ communities)	✓	✓
MMBtu/kW saved/generated by installations (for EJ and non-EJ communities)		✓
Resilience		
CMI for customers served by the installations, including resilience event days (for EJ and non-EJ communities)	✓	✓
CAIDI for customers served by the installations, including resilience event days (for EJ and non-EJ communities)	✓	✓
CAIFI for customers served by the installations, including resilience event days (for EJ and non-EJ communities)	✓	✓
SAIDI	✓	✓
SAIFI	✓	✓

DEA Metrics: Examples (cont'd)

Proposed Metrics	For Grid Hardening	For DERs
Cost Effectiveness/Affordability		
Benefit cost ratio	✓	✓
Cost per customer served by the installations	✓	✓
Change in rates (for LI and non-LI customers)	✓	✓
Change in bills (for LI and non-LI customers)	✓	✓
Energy burden (for LI and non-LI customers)	✓	✓
Shutoffs (for LI and non-LI customers)	✓	✓
Public Health		
GHG Emissions produced/avoided by installations (for EJ and non-EJ communities)		✓
Other Environmental Pollutants produced/avoided by installations (for EJ and non-EJ communities)		✓
Hospitalizations related to grid outages (for EJ and non-EJ communities)	✓	✓
Deaths related to grid outages (for EJ and non-EJ communities)	✓	✓
Economy		
Jobs related to installations (for EJ and non-EJ communities)	✓	✓

Resources

- The Distributed Equity Analysis (DEA) guidebook, available at: https://emp.lbl.gov/publications/distributional-equity-analysis

- Virtual Live Training on ***How to Conduct a Distributional Equity Analysis*** July 30 – Aug 2, 2024: https://aesp.org/event/how-to-conduct-a-distributional-equity-analysis-dea-to-inform-der-investment-decisions/ (focus is on application to DERs, but applicable to traditional utility investments in resilience as well)

- National Resources on Priority Populations:
  - Justice40: https://www.whitehouse.gov/environmentaljustice/justice40/
  - Climate and Economic Justice Screening Tool (CEJST): https://screeningtool.geoplatform.gov
  - U.S. Climate Vulnerability Index (CVI): https://climatevulnerabilityindex.org/about/

- Benefit cost analysis (BCA) guidebook titled *National Standard Practice Manual for Conducting Benefit-Cost Analysis of DERs* (NSPM), available at: https://www.nationalenergyscreeningproject.org/national-standard-practice-manual/

Contact Information

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NARUC Shark Tank

General Session
will start at
3:30 p.m.