

Measuring What Matters: Valuing Investments in Grid Resilience

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ENERGY TECHNOLOGIES AREA | ENERGY ANALYSIS DIVISION | ENERGY MARKETS & PLANNING

Selected economic and social valuation methods

Method	Key Planning Indicators	Examples	Comments
Least-cost, best-fit	Spend efficiency: non-monetary value divided by $	X dollars invested in grid to reduce SAIDI by Y minutes	• Presumes that an investment is needed and helps prioritize options to achieve objectives • Does not require monetization of any or all benefits of project
Benefit-cost analysis (BCA)	Benefit-cost ratio: $ divided by $	X dollars invested in grid leads to Y dollars in benefits	• Does not presume that an investment is needed • Allows for an apples-to-apples comparison of options • Can be challenging to put a dollar value on some benefits

Adapted from: Woolf et al. (2021) and Collins et al. (2025)

Examples of information needed to value an investment in the grid

Cost	Benefits: Non-monetized	Benefits: Monetized	Other
• Capital/installation • Annual operations and maintenance	• Avoided pollution • Avoided health/safety risk • Avoided damage to utility infrastructure • Reduction in frequency and/or duration of power interruptions • Avoided impacts to national security	• Avoided morbidity and mortality costs • Avoided capital and O&M costs to utility • **Avoided interruption costs to customers**  • **Avoided "spillover" effects to regional economy**  • Avoided aesthetic costs (if applicable)	• Real discount rate (or weighted average cost of capital) • Lifespan of strategy • Local, state, and federal incentives and rebates • Frequency and duration of power interruptions before and after investment • Detailed information about customers impacted

- Costs of past or proposed investments are generally easy to estimate
- However, the benefits of these investments are often difficult to quantify and monetize

Complementary tools to estimate benefits of avoided power interruptions



Used by stakeholders to estimate the costs of shorter duration (< 24 hours), localized power interruptions



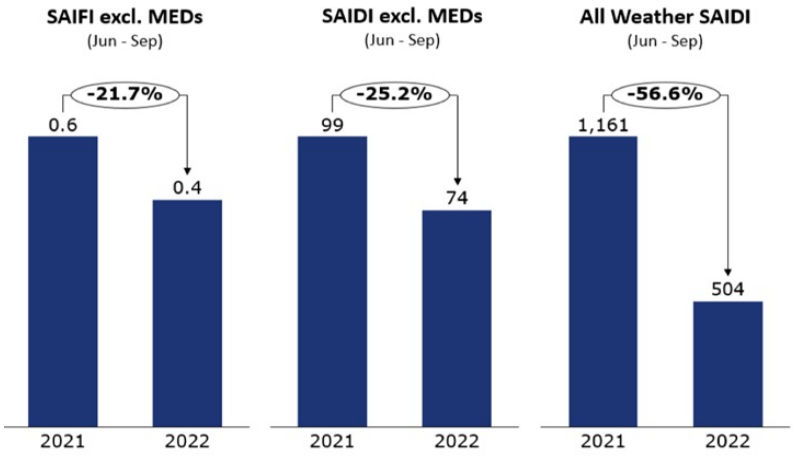
Used by stakeholders to estimate the costs of longer duration (> 24 hours), widespread power interruptions



Simple online tool that will allow users to calculate the benefits and costs of investments to enhance power system resilience

Resilience impacts can be analyzed ex-post or ex-ante

- Ex-post analyses
  - Compare performance of the electric grid before and after implementing resilience measures
  - Helpful for assessing the effectiveness of deployed measures
- Ex-ante analyses
  - Estimate the effect that resilience measures will have on performance metrics
  - Often leverage information learned in ex post studies about statistical associations between hazard events, resilience measures, and negative outcomes to the grid



DTE Electric: Performance Improvements from Short Cycle Preventative Maintenance Programs

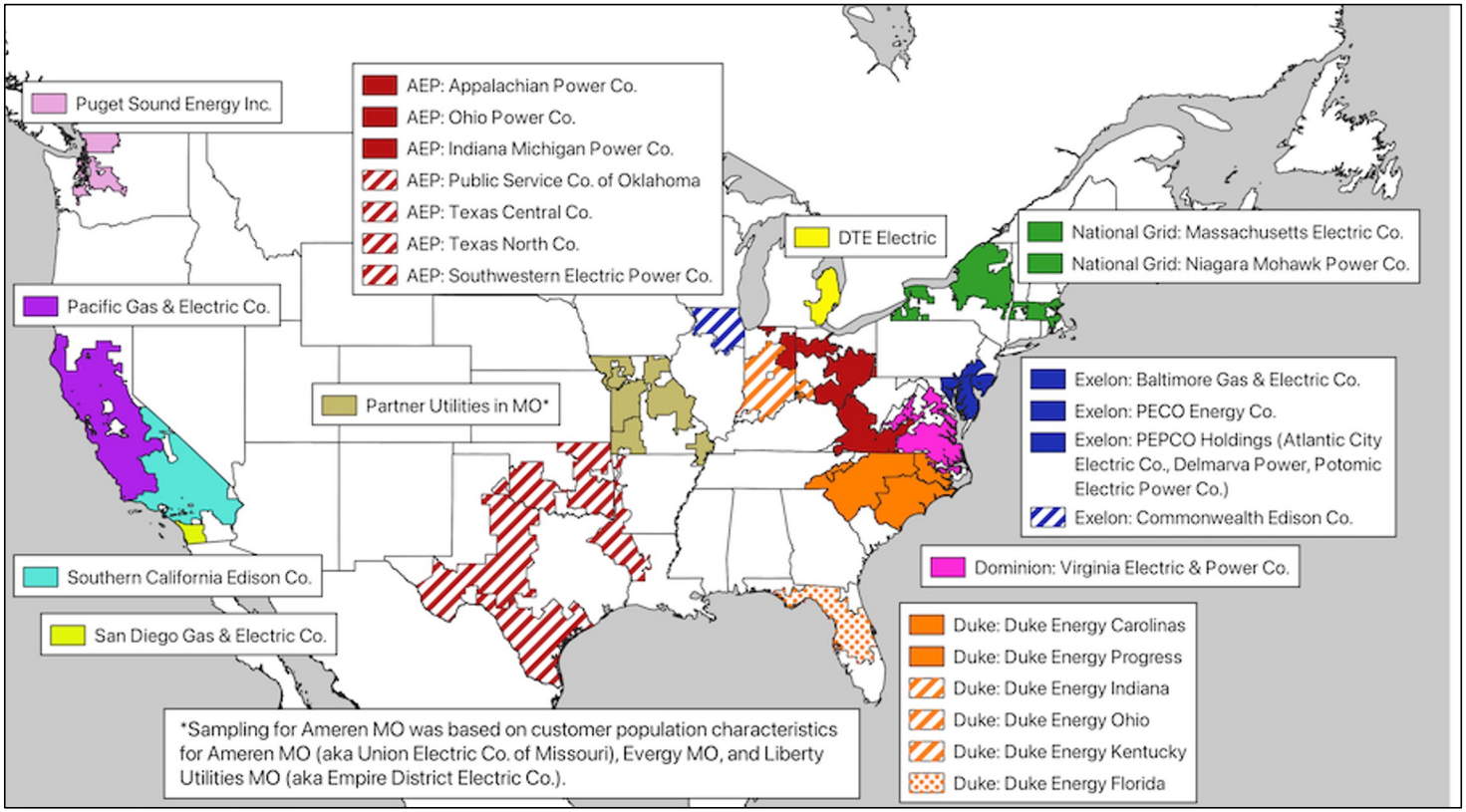
Examples of emerging performance metrics

Researchers and industry groups are exploring other new metrics for measuring and tracking resilience.

- Dual-metric framework consisting of a “resistance” and a “recovery” component (Levy et al., 2025)
  - Multi-Year SAIFI (MY SAIFI) and Major Event Restoration Time (MERT)
- IEEE Distribution Resiliency Working Group metrics to assess resilience investment performance and recovery effectiveness (IEEE, 2020; IEEE, forthcoming)
  - Sustained Interruption Reduction Index (SIRI) and Restoration Effectiveness + Area Index Resiliency (REPAIR)
  - The Michigan Public Service Commission directed Consumers Energy, DTE Electric, and Indiana & Michigan Power to work with Commission staff “to identify and define the data points that would support and serve as inputs to the SIRI and REPAIR metrics”—and, once identified and defined, to report them to the Commission annually.
- System Average Large Event Duration Index (SALEDI) (Ahmad and Dobson, 2026)


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Extra Slides

Participating utilities: Phase 1 and 2

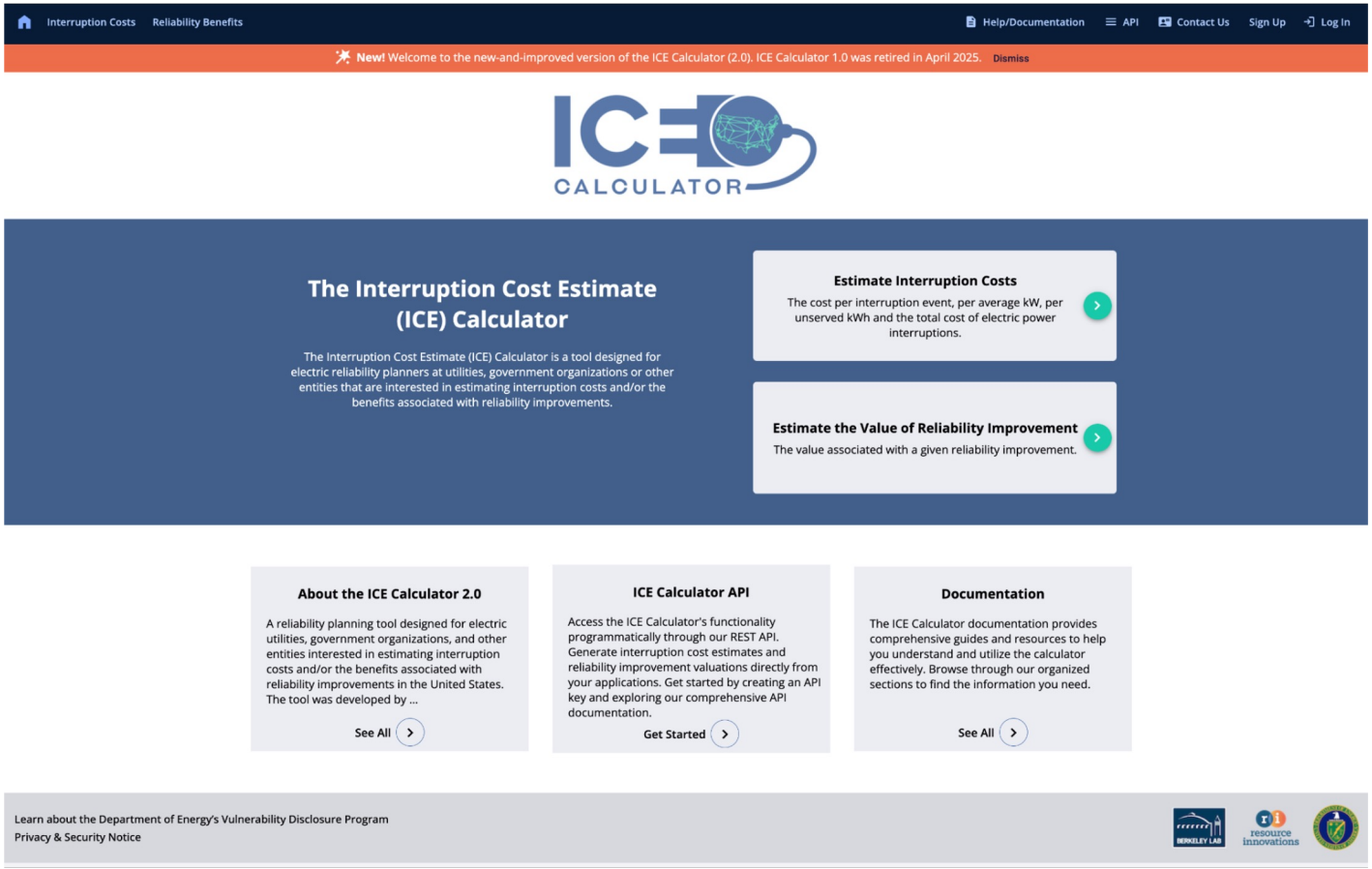


- 12 sponsors
- 15 distinct survey activities
- 30 investor-owned utility distribution service territories represented

Phase 3

- We received support from DOE to partner with NRECA to survey select rural cooperatives across the U.S.
- One utility in the West
- Recruiting ongoing

ICE Calculator 2 website

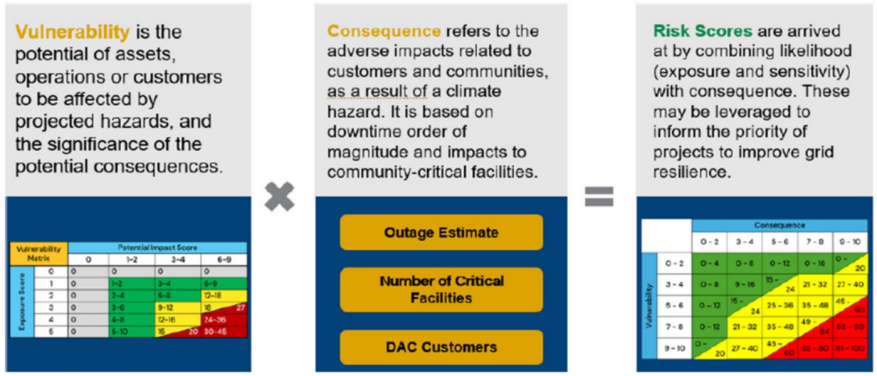


ICE Calculator Website

Asset Risk - Circuit-level Risk Scores - Public Service Company of CO (PSCo)

- PSCo calculated risk scores at the asset level as the product of vulnerability and consequence, where vulnerability was assessed across five natural hazards.
- Risk scores can technically be considered attribute metrics because they describe a characteristic or condition of the system.
- Functionally, they can serve as a bridge between attribute and performance metrics, as the scores quantify the potential for failure based on specific traits.

PSCo Risk Scoring Process



PSCo Heat and Flood Risk Scores for Substation Transformers

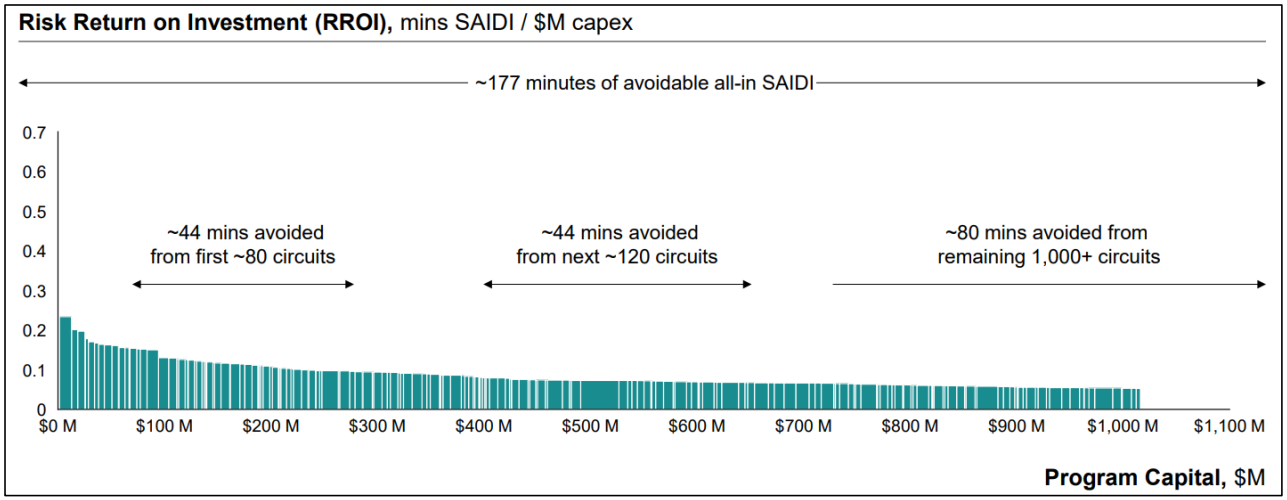
		Heat		Flood	
Substation	Consequence Score (out of 10)	Vulnerability Score (out of 10)	Risk Score (out of 100)	Vulnerability Score (out of 10)	Risk Score (out of 100)
G.J.	4.8	2.7	12.9	0	0
A.	4.1	2.1	8.8	0	0
S.	4.1	1.9	7.7	0	0
D.	4.1	1.6	6.6	0	0
R.	4.0	0.3	1.1	0	0
G.	1.5	2.1	3.2	0	0
A.	1.5	1.9	2.7	2.7	6.3
Av.	0.8	1.9	1.5	0	0
L.	0.8	1.9	1.5	0	0
S.	0.7	0.3	0.2	0	0

Source: PSCo (2024)

Solution Identification and Prioritization – Risk Return on Investment

Louisville Gas & Electric and Kentucky Utilities

- Solution portfolio developed by ordering solutions from highest to lowest risk return on investment and establishing resilience performance targets



Source: LG&E and KU (2025)

Metric for estimating asset risk - Consolidated Edison (ConEd)

- Network Resiliency Index (NRI) - “models the relative strength of each network by calculating the probability of failure of multiple associated feeders within a network over time, as caused by individual component failures" (ConEd, 2023)
  - Network ***Reliability*** Index typically calculated annually using ***actual*** system data
- Developed NRI in 2022 to evaluate future scenario that assumed networks in 2030 were designed with the same strength as in 2021, but with higher temperatures

Ranking	NWK ID	Network	What if 2030 @TV=87? (No Reliability Improvements)
1	5B	Ridgewood	1.708
2	7X	Southeast Bronx	1.561
3	6B	Williamsburg	1.420
4	4X	Central Bronx	1.382
5	9Q	Jackson Heights	1.279
6	3X	Fordham	1.151
7	2X	West Bronx	1.055
8	5X	Northeast Bronx	1.043
9	7B	Ocean Parkway	0.953
10	3M	Yorkville	0.889
11	9B	Richmond Hill	0.870
12	1B	Borough Hall	0.857
13	5Q	Jamaica	0.768
14	10B	Sheepshead Bay	0.761
15	2B	Park Slope	0.710
16	1X	Riverdale	0.652
17	7Q	Flushing	0.646
18	4B	Flatbush	0.614
18	8B	Bay Ridge	0.556
20	3Q	Rego Park	0.556
21	20M	Sutton	0.486
22	3B	Crown Heights	0.486
23	10M	Sheridan Square	0.486
23	11B	Brighton Beach	0.480
25	6Q	Maspeth	0.473

Source: ConEd (2025)



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For more information

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