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Navigating the Storm: Strategies for Enhancing Grid Resiliency

Jennifer Potter | December 8th, 2023

Agenda

- Introduction
- Why Resiliency?
- Resilience Hubs and Microgrids
  - Lahaina Wildfire
  - Mississippi Tornados
- Valuing Resilience
  - Resilience Analysis and Planning Tool (RAPT)
  - Measurement options
  - Interruption Cost Estimate (ICE)
- Policy Impacts and Key Takeways

The Social Imperative of Resiliency

+ Resilience in the electric infrastructure and the establishment of resiliency hubs offer profound community benefits, particularly in the face of natural disasters and emergencies.
+ A resilient electric infrastructure ensures continuous access to power during adverse conditions, serving as a linchpin for critical services.
+ Hospitals, emergency response centers, and essential facilities that can maintain operations, guaranteeing uninterrupted medical care, communication, and emergency services for residents.
+ Reliability is fundamental in safeguarding public safety and mitigating the potential impact of disasters, showcasing the vital role a resilient electric infrastructure plays in community resilience.

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Preparing for and recovering from disasters, storms, & outages requires investments

+ Resilience planning, investment, and implementation play a transformative role in enhancing the well-being of individuals and communities by identifying and providing resources for navigating challenges, adapting to change, and fostering a sense of collective strength.

Resilience Hubs

Proactive developments are not only logical, but critical

Devastating wildfires in Lahaina, Maui

What are resilient options?

Microgrids and Resilience Hubs for Maui

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Footprint Project in Mississippi. https://www.footprintproject.org/news/2023/7/26/lighting-the-way-to-recovery-in-mississippi

California's 100% Renewable Microgrid

- A front-of-meter microgrid combining 2.2MW of solar PV with a 9MWh battery in Humboldt County, northeast California
- Redwood Coast Airport Microgrid (RCAM) is the first 100% renewable energy, front-of-meter, multi-customer microgrid to go online in the state
- Significant because roads into Humboldt County are often closed by fires and mudslides, meaning air services are particularly critical in emergency response.
- The airport handles 50,000 flights a year while the Air Station provides search and rescue services for 250 miles of coastline

Image: PG&E

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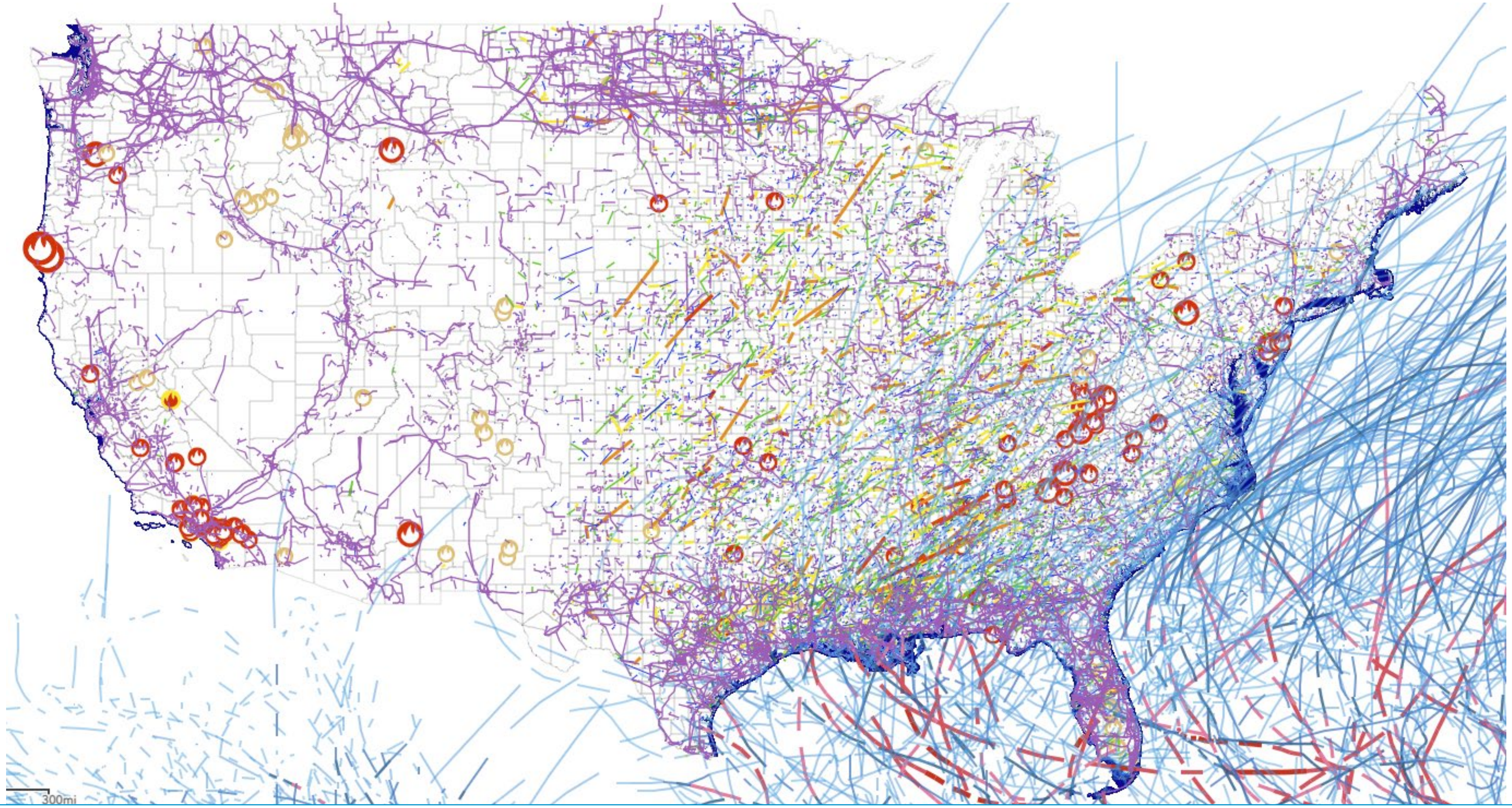
Valuing Resiliency

To justify critical investments

Determining Optimal Resiliency Investments

- How do we optimize grid investments while integrating resiliency?
  - How can we ensure that the appropriate amount of resiliency investment is being made in the right places that will benefit all of the population?
- We can’t know the answer to this question without quantifying through measuring, assessing, and evaluating resiliency, so we know where best to put enough money and effort to optimize resiliency efforts.
- Difference between Quantification and Valuation of resiliency:
  - Quantifying resiliency is to put numbers to the amount of risk reduction a given measure (or bundle of measures) achieves and the cost of that risk reduction, i.e. projects, events, and outcomes.
  - Valuing resiliency is to understand these numbers in terms of human impact – how much is the risk reduction worth relative to other solutions

Transmission Lines, Tornados, Hurricanes, Wildfires, & Sea Level Rise(4 ft)
Resilience Analysis and Planning Tool (RAPT)



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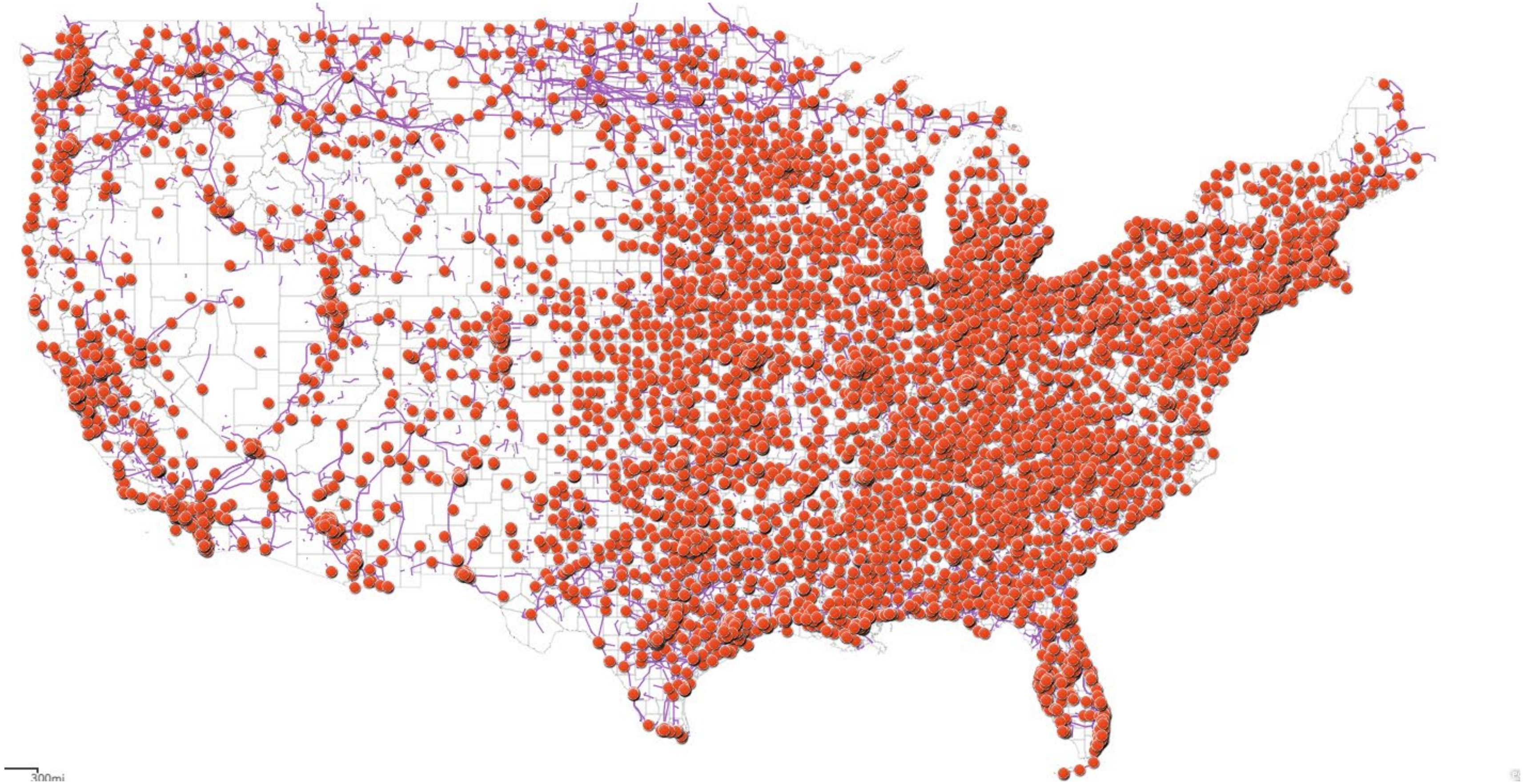
Transmission Lines & Hospitals- RAPT



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Options for Measuring & Valuing Resilience

Value of Lost Load

- Value of Lost Load (VoLL) is a concept used in energy economics and power system planning to quantify the economic value associated with the loss of electric power supply, often in terms of dollars per unit of electricity not delivered.
- The costs associated with business interruptions, productivity losses, damage to equipment, and potential health and safety risks are all factors that contribute to the overall economic value of a lost load.

Customer Damage Function

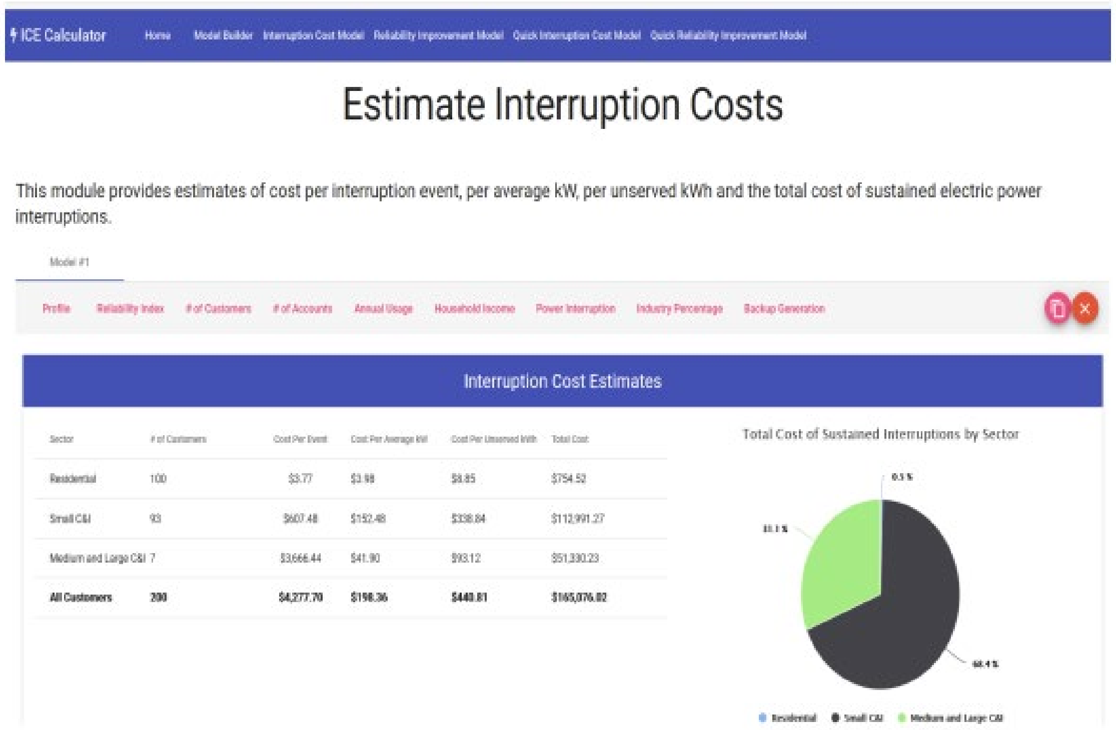
- Customer damage functions help estimate the direct and indirect economic losses associated with power disruptions.
- Provide an approach to quantify costs incurred by different customer segments, considering factors such as downtime, lost revenue, spoiled goods, and productivity losses.

Willingness to Pay

- Willingness to Pay (WTP) is a concept used in economics to quantify the value that individuals and society place on various goods, services, or attributes, including resiliency.
- Measures how much people are willing to spend or invest to achieve a particular outcome or gain a specific benefit.

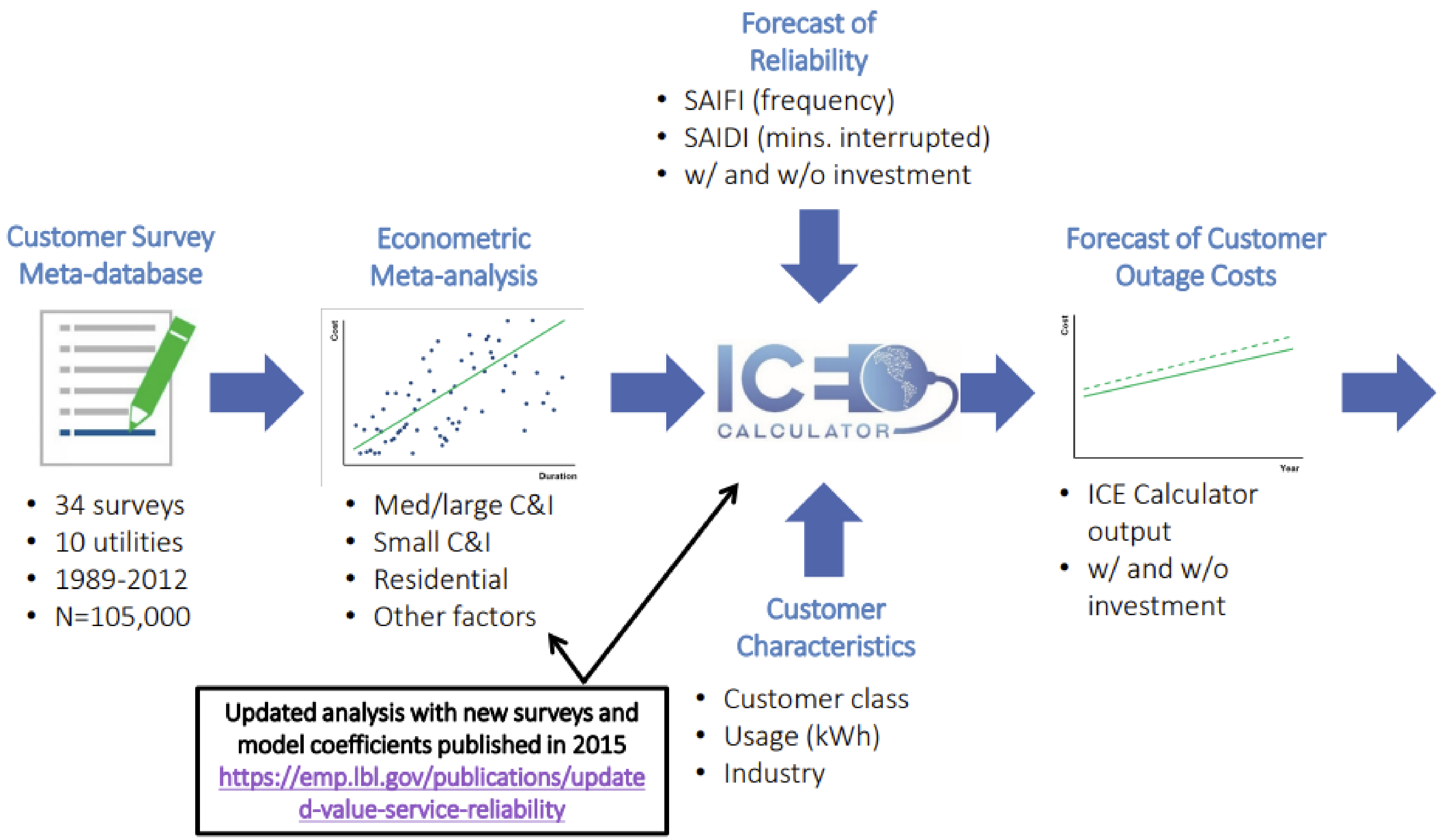
Valuing Resiliency

- Customer costs of power interruptions are of increasing importance for identifying and prioritizing cost-effective utility investments to improve reliability/resilience
- Berkeley Lab’s Interruption Cost Estimate (ICE) Calculator is the leading and only publicly-available tool for estimating the customer cost impacts of power interruptions
- The ICE Calculator is being used to:
  - Support internal utility reliability planning activities
  - Provide a basis for discussing utility reliability investments with regulators
  - Assess the economic impact of past power outages



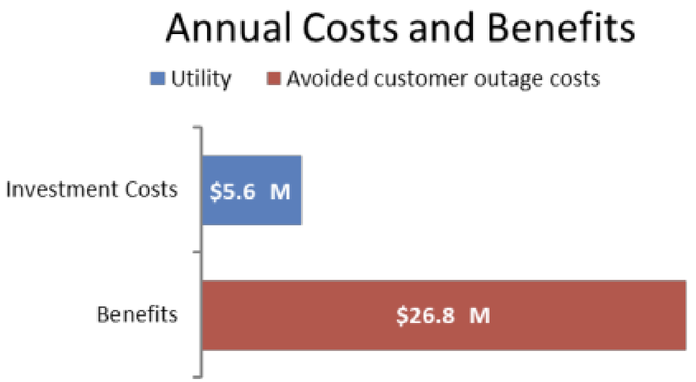
http://www.icecalculator.com/

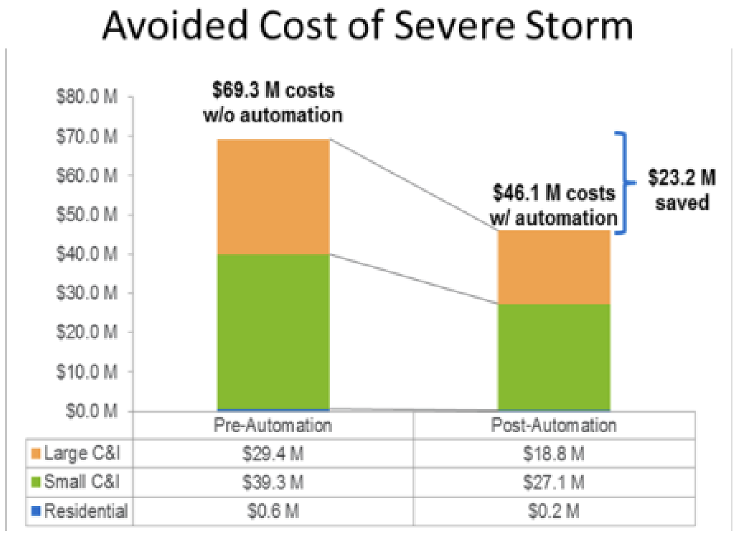
Parameters, Inputs, & Assumptions



Reliability Value-Based Planning Example

- Utility: EPB of Chattanooga
- Customers Impacted: 174,000 customers (entire territory)
- Investment: 1,200 automated circuit switches and sensors on 171 circuits
- Reliability Improvement:
  - SAIDI ↓45% (from 112 to 61.8 minutes/year)
  - SAIFI ↓51% (from 1.42 to 0.69 interruptions/year) (between 2010 and 2015)





Policy Impacts and Key Takeaways

Research and Policy Development

- Research serves as the cornerstone for evidence-based policymaking in resiliency planning.
- Rigorous studies contribute valuable insights into the vulnerabilities of energy systems, the potential consequences of disruptions, and the efficacy of different resilience measures.
- Research informs policymakers about emerging threats, technological innovations, and best practices in the field of energy resilience.
- Together, this knowledge guides the formulation of policies that are responsive to current challenges and forward-looking, anticipating future risks and opportunities.
- **Policy development and impacts are informed by quantitative research and help assign value to ensure prudent investment in resilient infrastructure.**

Key Takeaways

- Different contexts, whether urban or rural, coastal or inland, present unique challenges and vulnerabilities that must be considered in developing and maintaining energy systems.
- The significance of resilience valuation lies in its ability to provide tailored insights into the specific risks and potential impacts that different contexts may face.
  - For instance, coastal areas may be more susceptible to extreme weather events, necessitating resilience strategies that account for sea-level rise and storm surges.
- Valuing resilience in different contexts ensures that energy infrastructure is reliable and adaptable to the specific challenges posed by geography, climate, and societal needs.
- Resilience valuation is essential for justifying infrastructure investments and promoting equity and inclusivity in energy access.
  - Resilient infrastructure planning requires quantitative analysis to demonstrate viability for policymakers, regulators, and stakeholders.
  - Different demographic groups and regions may experience energy disruptions disproportionately.
  - Valuing resilience in diverse contexts allows policymakers to identify and address disparities in access to reliable energy, ensuring that resilience strategies are inclusive and promote social equity.

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