

Exceptional service in the national interest

Integration of equitable resilience metrics into electric utility planning processes

A collaboration between the California Public Utilities Commission, Sandia National Laboratories, and Southern California Edison

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Climate Adaptation Proceeding (R.18-04-019) Climate Adaptation Equity Metrics Workshop





CALIFORNIA

Public Utilities Commission

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Project Motivation: Developing an Equity Metric for Energy Resilience Planning in California

- Sandia National Laboratories (Sandia), Southern California Edison (SCE), and the California Public Utilities Commission (CPUC) investigating how utilities could consider resilience needs within current infrastructure investment planning
- Sandia, SCE, and CPUC are investigating the use of Sandia's Social Burden metric in California as a pilot metric reflecting equity considerations for energy resilience planning

Expected outcomes:

- ✓ Identifying **use cases** for the metric
- ✓ Documenting benefits and drawbacks
- ✓ Understanding use case **applications**

Potential use cases:

- ✓ **Informing IOUs** during the grid planning process
- ✓ **Informing stakeholders** about project prioritization
- Allowing the CPUC to assess regulatory considerations that include Environmental & Social Justice (ESJ) Action Plan items

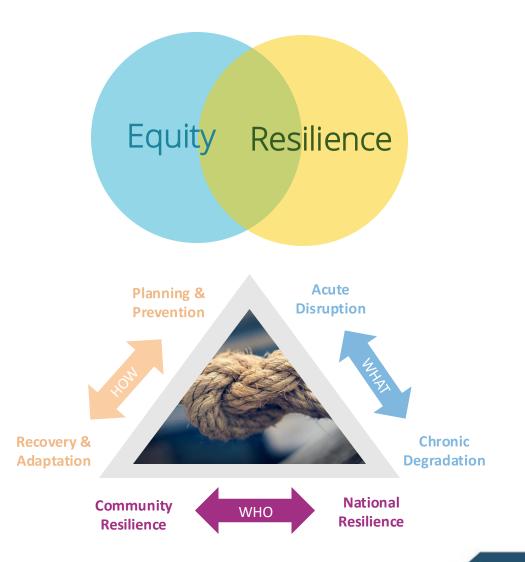
Equity and resilience are interdependent

Resilience is a component of equity

• Cannot have a truly equitable energy system if some communities are more resilient than others

However, equity is also a component of resilience

- Energy system is embedded in communities (social) and within other (physical) infrastructures
 - Embedded social inequalities independent of the energy system also impact equity
- Inequities are vulnerabilities
- Vulnerabilities reduce resilience
- Can escalate events from local concern to national security priority
 - e.g., New Orleans, Puerto Rico



Introduction to Social Burden

Social Burden measures the ability of the built environment to provide people with the critical services they need for health and wellbeing, relative to people's differing abilities to obtain those services.

In a grid resilience context, Social Burden can help prioritize resilience investments to mitigate disproportionate harm from outages. It is a quantitative metric to measure *both* resilience & equity.

Burden to acquire a service:

- Increases with distance to facilities
- Decreases with additional facilities (diminishing returns, non-linear)
- Decreases with ability (a study-specific combination of socioeconomic and other indicators: *SCE's Community Resilience Metric)



Social Burden = $Effort/Ability \cong$

 $\frac{Effort \ to \ Obtain \ Service_{people, services}}{Service \ Levels_{facilities, services} \times \ Baseline \ Capacity_{people}}$

Calculating Social Burden

Relating Infrastructure to Critical Services:

 $E_{n,m} = \frac{1}{\sum_{l} \frac{S_{l,m}}{I_{n,l}}}$

- S_{l,m} = Infrastructure to Service relationship, a matrix of over infrastructure points (l) and infrastructure services (m)
- I_{n,l} = Individual pairwise efforts between spatial elements (**n**) and infrastructure points (**l**).

Burden aggregation:

- Per-service burden calculated for each population block
- Burden summed across blocks
- Total burden summed across services

Relating Ability and Service Availability:

$$B_{n,m} = \frac{E_{n,m}}{A_n}$$

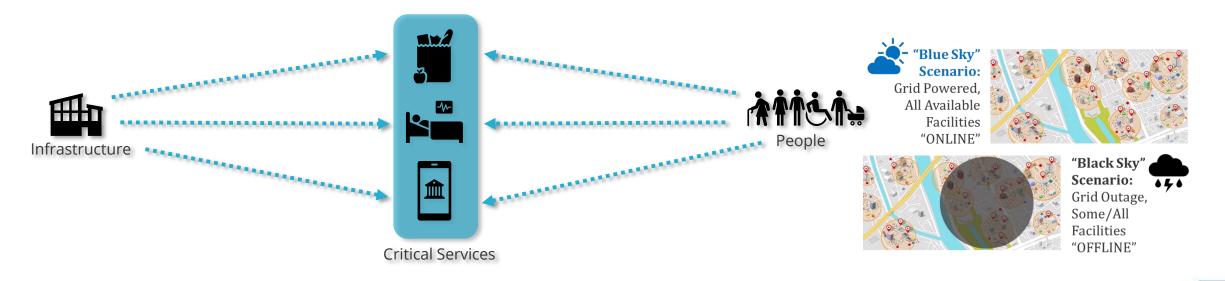
- B_{n,m} = Societal Burden, a matrix over discrete space (**n**) and infrastructure services (**m**)
- $E_{n,m}$ = Attainment Effort, or how hard people have to work to attain their infrastructure service needs, also an **n x m** matrix
- A_n = Attainment Ability, or the resource people have at their disposal for attaining their infrastructure service needs, not dependent on the type of service, a vector length **n**

Aggregating Resilience from the Facility to the Community Scale

Social Burden provides the framework to link resilience at individual buildings or facilities, to community resilience:

• People rely on infrastructure to provide them with critical services ("lifelines").

- When facilities lose power, their ability to provide critical services is diminished.
- The resilience of facilities to grid power outages can decrease loss of access to critical services.
- Facility-level resilience can *enhance* community resilience to grid power outages by decreasing service loss during outages.



Benchmarking the Relationship between Services and Facilities

The relationship between facilities and services is many-to-many:

 A single facility can provide multiple types of critical services;

- The same critical service can be provided at multiple types of facilities.
- Service levels can differ by facility type and by service.

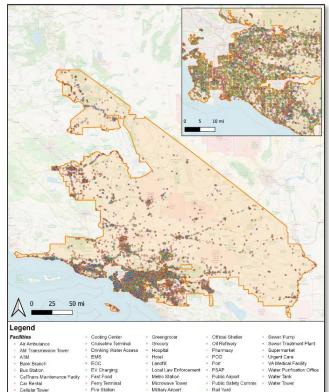
A GIS database was created for the SCE service area to represent this relationship between facilities and services:

- 54 types of facilities,
- Providing 15 different types of critical services,
- Representing over 33,000 individual facility locations.

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| Port, Public Airport, Military Airport, Metro Station, Bus Station, Car Rental, Cruiseline Terminal, EV Charging Point, Ferry | Landfill, Sew | er Pump, Wastewater Treatment Plant | VA Medical Facilities |
| Car Rental, Cruiseline Terminal, EV Charging Point, Ferry | Port, Public A | Airport, Military Airport, Metro Station, Bus Station | Water Purification Ma |
| | , | | Water Storage Tank |
| | | | Water Tower |
| Oil Refinery, Gas Station, Natural Gas Facility | | | |

| | Parameters | | | | | | Chucal Services | | | | | | | | | | |
|---------------------------------|----------------------|-----------------|------------|------|-------|------------------|-----------------|-----------------|-------------|----------|--------|-------------|------|---------|---------------------|----------------|----------------|
| | Zero Distance Effort | Effort Per Foot | Evacuation | Food | Water | Waste Management | Shelter | Medical Service | Medications | Security | Safety | Restoration | Fuel | Finance | Emergency Logistics | Communications | Transportation |
| Facility Type | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 0.005 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 3 | | |
| AM TransmissionTower ATM | 0.005 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bank Branch | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| Bus Station | 0.4 | 0.05 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 |
| CalTrans Maintenance Facilities | 0.01 | 0.01 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Car Rental | 0.01 | 0.01 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Cellular Tower | 0.01 | 0.005 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 4 | 0 |
| Clinic | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Convenience Store | 0.4 | 0.05 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cooling Center | 0.4 | 0.05 | 0 | 2 | 2 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Cruiseline Terminal | 0.4 | 0.05 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Drinking Water Access Points | 0.4 | 0.05 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EMS | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| EOC | 0.4 | 0.05 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| EV Charging | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| FastFood | 0.4 | 0.05 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ferry Terminal | 0.4 | 0.05 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Fire Station | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| FM Transmission Tower | 0.005 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Food Bank | 0.005 | 0.05 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gas Stations | 0.4 | 0.05 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| Greengrocer | 0.4 | 0.05 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Grocery | 0.4 | 0.05 | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hospital | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hotel | 0.4 | 0.05 | 0 | 1 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Landfill | 0.01 | 0.01 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Local Law Enforcement | 0.4 | 0.05 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Metro Station | 0.4 | 0.05 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| MicrowaveTower | 0.005 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Military Airport | 0.4 | 0.05 | 4 | 4 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| Money Transfer | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Motel | 0.4 | 0.05 | 0 | 1 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural Gas Facility | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 |
| Official Shelter | 0.4 | 0.05 | 0 | 2 | 2 | 1 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Oil Refinery | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 |
| Pharmacy | 0.4 | 0.05 | 0 | 1 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| POD | 0.4 | 0.05 | 0 | 4 | 4 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Port | 0.4 | 0.05 | 4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| PSAP | 0.01 | 0.005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Public Airport | 0.4 | 0.05 | 4 | 4 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| Public Safety Comms Sites | 0.01 | 0.005 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| Rail OM Yard | 0.2 | 0.01 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| RailStation | 0.4 | 0.05 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| Retail Superstore | 0.4 | 0.05 | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Service Center | 0.01 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| Sewer Pump | 0.01 | 0.01 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sewer Treatment Plant | 0.01 | 0.01 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Supermarket | 0.4 | 0.05 | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Urgent Care | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| VA Medical Facilities | 0.4 | 0.05 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Water Purification Main Office | 0.01 | 0.01 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Water Storage Tank | 0.01 | 0.01 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Water Tower | 0.01 | 0.01 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Critical Servi



Money Transfe

Natural Gas Facilit

Moto

Rail Statio

Retail Superstor

Service Cente

FM Transmi

Food Bani

Gas Statio

Clinic

Convenience Stor

Evaluating Community Resilience to Climate Scenarios

- A "black-sky" scenario in Social Burden analysis can represent any partial or total outage on the grid.
- The outages can be hypothetical or based on real (historic or projected) events.
- In this study, the outage scenarios were hypothetical and based on SCE's prior analysis of potential climate impacts in its service area as documented in the 2022 CAVA.

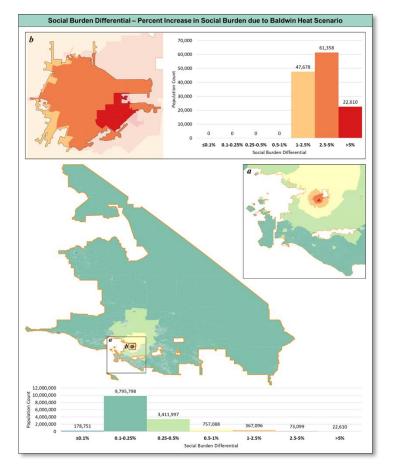
| Hazard | Scenario Name | County | CRM | Rural | Customer Count | IWM S Risk |
|--------|------------------|----------------|--------|--------|-------------------|---------------|
| Temp | Hemet | Riverside | High | Low | Medium | Medium |
| Temp | Chino | San Bernardino | High | Low | Medium | Medium |
| Temp | Baldwin | Los Angeles | Low | Low | High | Low |
| Temp | Jurupa | San Bernardino | Low | Low | Low | Low |
| Flood | Laguna | Orange | High | Low | Medium | High |
| Flood | Oxnard | Ventura | Low | Low | High | Low |
| Flood | Fillmore | Ventura | Medium | Medium | Low | High |
| Flood | Westminster | Orange | Medium | Low | Medium | Low |



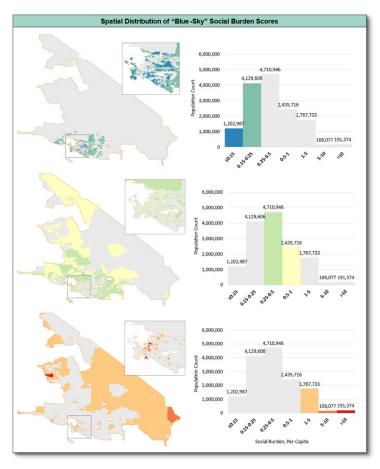
Hart, O., Wachtel, A., Sorge, M., McCombs, A., Brockway, A., and Chwierut, A. (2024) Integration of Equitable Resilience Metrics into Climate-Informed Electric Utility Planning Processes: Phase One Results (No. SAND2024-15090). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States).

Helping Quantify Impacts, Explore Root Causes

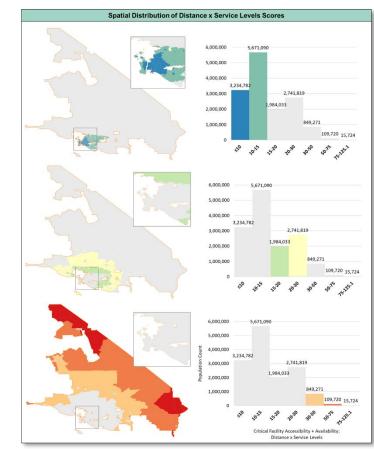
Q: How do outage impacts propagate and how sensitive are people within particular hypothetical outage extents?



Q: Which parts of the service area start off more burdened, before any outages add increased burden?



Q: Where would community resilience be enhanced by additional investment in critical services?



Hart, O., Wachtel, A., Sorge, M., McCombs, A., Brockway, A., and Chwierut, A. (2024) Integration of Equitable Resilience Metrics into Climate-Informed Electric Utility Planning Processes: Phase One Results (No. SAND2024-15090). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States).

Implications for Planning and Alternatives Evaluation

| | | Social Burden Differential | | | | | | | |
|--------------------------|------|----------------------------|-----|------|--|--|--|--|--|
| | | Low | Med | High | | | | | |
| Burden | Low | | | | | | | | |
| "Blue-Sky" Social Burden | Med | | | | | | | | |
| "Blue-Sk | High | | | | | | | | |

| "Black-Sky" Social Burden | | | | | | | | | |
|--|---|--|--|--|--|--|--|--|--|
| | Extremely High | Extremely low community resilience to power outage | | | | | | | |
| | Very High | Very low community resilience to power outage | | | | | | | |
| | High Low community resilience to power outage | | | | | | | | |
| | Medium Moderate community resilience to power outag | | | | | | | | |
| | Low | High community resilience to power outage | | | | | | | |
| | | | | | | | | | |
| Bold outline at left denotes recommended focus for grid-based interventions, where electric utilities can make impactful improvements to communities' resilience to power outages. | | | | | | | | | |

| Inte | Will Reduce High Black-Sky Social Burden by Driving Down: | | | |
|--|---|----------------------------------|-------------------------------|--|
| and Re | presentative Examples | <i>Blue-Sky</i> Social Burden | Social Burden Differential | |
| Electric Infrastructure Owners & Operators | Microgrids, line hardening, undergrounding, prioritized restoration | | \checkmark | |
| Non-Electric Infrastructure Owners & Operators | Expansion of services and construction of new facilities | \checkmark | | |
| Non-Electric Infrastructure Owners & Operators | Installation of backup generators | | \checkmark | |
| Local Jurisdictional Authorities | Rezoning, economic development initiatives, public health supports | \checkmark | | |
| Local Jurisdictional Authorities | Expansion of Community Resilience Hubs, Cooling Centers | | \checkmark | |

Principal Findings and Future R&D Needs

Social Burden integrates into and extends existing utility equity planning processes within climate adaptation

Continue working towards formal integration of Social Burden into utility planning

- Apply Social Burden to evaluate specific <u>outage and climate</u> interventions; test Social Burden's ability to represent "intersectional" benefits of non-resilience investments
- **Develop** <u>variable-duration</u> Social Burden metric; apply to different duration outage scenarios to understand impacts of climate-related outages intersected with extreme weather
- Develop <u>coupled socio-economic framework</u> for (e)valuation of variableduration outages and intervention prioritization
- Develop and operationalize a framework for the integration of Sandia's Social Burden metric into the SCE Climate Adaptation investment planning process.

- Community engagement to inform metric and ground-truth results
- Analytic support for outage extent prediction
- User-friendly GUIs for utility adoption

A growing ecosystem of user-friendly tools

In addition to the ReNCAT desktop application, the *ReNCAT ecosystem* now includes several **new** user-friendly, open-source tools that enable users – from communities to energy planners – to collect their own critical infrastructure data and perform Social Burden analyses and to visualize and overlay results in a GIS application.

ReNCAT, and the QGIS Social Burden and GeoCricket plugins can be downloaded online from:

https://energy.sandia.gov/resilientnode-cluster-analysis-tool/ Software Downloads







ReNCAT Desktop Application

Sandia's Resilient Node Cluster Analysis Tool (ReNCAT) analyzes geographical areas for optimal placement of microgrids and other grid resilience investments, ensuring critical services remain available and are equitably distributed during grid outages. The tool uses distribution system topology, critical infrastructure locations, demographic information, and anticipated threat impacts to prioritize the areas that can maximize access to critical services while benefitting the greatest number of impacted people.

> Download ReNCAT Desktop Application

QGIS Social Burden Plugin

The QGIS Social Burden Calculator Plugin calculates total, per-service, and per-population group Social Burden scores and provides the outputs in shapefile and tabular formats for visualizing, mapping, analyzing, and postprocessing. The Social Burden metric quantifies the burden a population experiences when attaining services needed from critical infrastructure.

Download QGIS Social Burden Plugin

GeoCricket

Sandia's Geospatial Critical Infrastructure and Census Data Stockpile Tool (GeoCricket) is a collection of functions that collect critical infrastructure and Census data for use in equitable resilience tools to inform place-based work.

Download GeoCricket

Additional Resources

Project report:

Hart, O., Wachtel, A., Sorge, M., McCombs, A., Brockway, A., and Chwierut, A. (2024) *Integration of Equitable Resilience Metrics into Climate-Informed Electric Utility Planning Processes: Phase One Results* (No. SAND2024-15090). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States). <u>https://www.osti.gov/servlets/purl/2477038</u>

Public webinar recordings:

- Hart, O., Wachtel, A., Melander, D., and Bresloff, C. (July 2022) Resilience Node Cluster Analysis Tool (ReNCAT). CPUC Microgrid Proceeding Track 5 Value of Resiliency: Economic and Equity Impacts of Large Disruptions – Social Burden Index. <u>https://www.youtube.com/watch?v=QKM_L9YcHmg</u>
- Hart, O., Wachtel, A., Melander, D., Brockway, A., and Blagaich, M. (July 2023). Sandia's Social Burden and Southern California Edison's Community Resilience Metric. CPUC Microgrid Proceeding – Track 5 Value of Resiliency: Economic and Equity Impacts of Large Disruptions – Social Burden Index. <u>https://www.youtube.com/watch?v=6eD-dUGaWXk&t=588s</u>
- Hart, O., Wachtel, A., Melander, D., Brockway, A., and Torres, S. (November 2023). Evaluating Social Burden in California: Final Results. CPUC Microgrid Proceeding – Track 5 Value of Resiliency: Economic and Equity Impacts of Large Disruptions – Social Burden Index. <u>https://www.youtube.com/watch?v=e0ZXqXuCLyg</u>

Further Reading on Social Burden and ReNCAT theory and applications:

- Wachtel, A., Melander, D., & Jeffers, R. (2022). *Measuring Societal Infrastructure Service Burden* (No. SAND2022-2029R). Sandia National Lab.(SNL-NM), Albuquerque, NM (United States).
- Wachtel, A., Melander, D., & Hart, O. (2022). *ReNCAT: The Resilient Node Cluster Analysis Tool* (No. SAND2022-10888R). Sandia National Lab.(SNL-NM), Albuquerque, NM (United States).
- Gunda, T., Wachtel, A., Khadka Mishra, S., & Moog, E. (2023). Quantitative approaches for including equity in risk and resilience infrastructure planning analyses. *Risk Analysis*.
- Hart, O., Wachtel, A., Jones, K., Jimenez, T., Lucas, H., Gregory, P., and Tam, D. (In Revision) Moving towards a more comprehensive valuation of resilience investments: case study in a tribal context. *Energy Research and Social Justice*.



Download ReNCAT:

https://energy.sandia.gov/news/download-sandias-resilient-node-cluster-analysis-tool-rencat/

Path Forward: SCE Perspective