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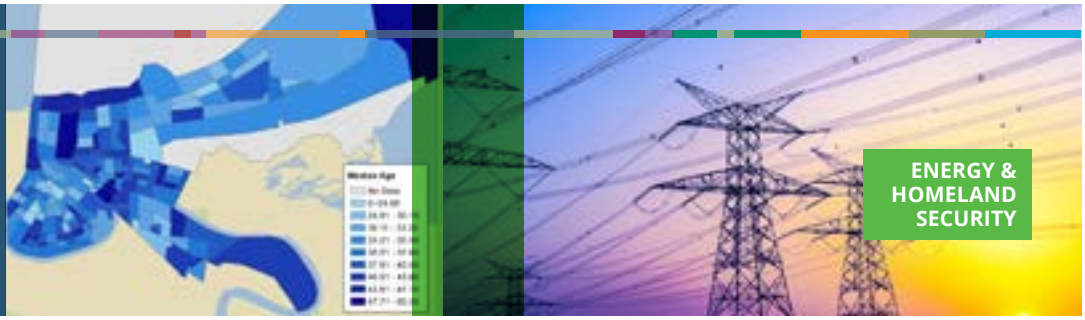
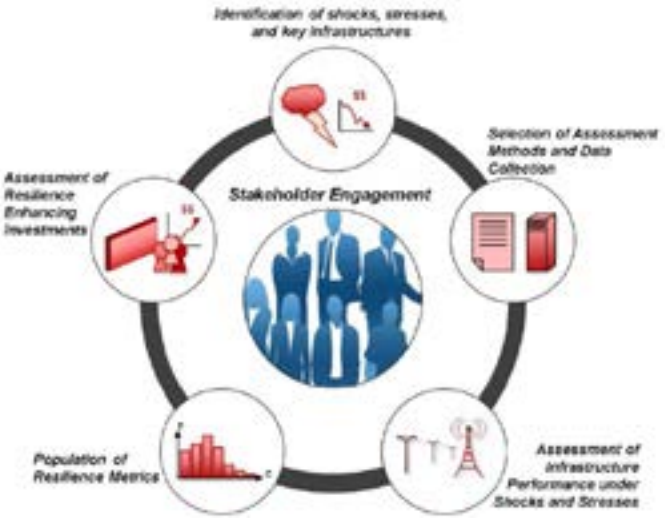


ASSESSING SOCIAL NEEDS WHEN DESIGNING GRID SOLUTIONS FOR COMMUNITY RESILIENCE

Sandia supports the health and welfare of communities by applying leading edge science and technology integrated with an understanding of policy and stakeholder needs to local infrastructure investment problems.

Incorporating Social Welfare in the Urban Resilience Planning Process

As evidenced by the social hardship experienced during the major hurricanes Harvey, Maria, and Irma in 2017, a primary aspect of providing resilience to communities is understanding what their specific needs will be during extreme disruptions. A better understanding of these needs will lead to better designed resilience solutions, and better investment in research and development of new technologies.



Urban Resilience Planning Process

In observation of this need, Sandia's **Urban Resilience Planning Process** incorporates social welfare factors. This process was first developed for Norfolk, VA in partnership with their Office of Resilience, and has since been applied to New Orleans, LA through the Grid Modernization Laboratory Consortium.

The two core tenants of the Urban Resilience Planning Process are that community stakeholders are at the core and resilience is measured by consequence to the community following extreme events. The concentration on stakeholders leads to community-specific insights into how resilience and social welfare are interdependent. For instance, New Orleans has identified access to fresh, wholesome food as a concern for their more vulnerable communities; therefore, the team prioritized grocery stores near these areas when designing a system of resilience nodes for the city. Furthermore, incorporating consequence to communities into an infrastructure planning process means that social welfare can be directly internalized instead of being a soft variable or loose consideration.

Tools for Addressing Social Needs

Sandia uses several tools and datasets for addressing social needs within the Urban Resilience Planning Process. First, the **FASTMap** tool allows various spatial data at nearly any spatial resolution to be quickly viewed by a wide range of stakeholders. For example, Entergy New Orleans and the City of New Orleans could quickly visualize

new information about potential microgrid locations, leading to faster and more direct feedback on the social considerations of different neighborhoods. Datasets that Sandia has used for community resilience analysis include:

- Demographic information from the 2010 Census – population, age, income, education attainment, etc.
- Household information from the American Community Survey – commuter status, employment, health insurance, poverty status, veteran status, etc.
- The Homeland Security Infrastructure Program's (HSIP) Gold dataset – Banks, roads and bridges, rail, hospitals, airports, natural gas, power transmission, dams, drinking and waste water, etc.
- Individual datasets supplied by the stakeholders themselves – net metering customers, community shelters, emergency operations assets, historic power outage data, etc.
- Custom datasets generated by Sandia – Grocery stores, gas stations, pharmacies, detailed medical facilities

Once the need for certain types of services in different locations throughout the city is understood, the team employs the **Resilience Node Clustering Analysis Tool (ReNCAT)** to identify clusters of infrastructure (buildings and other point assets) that could feasibly and cost-effectively be supported by local distributed energy resources such as battery storage and advanced microgrids.

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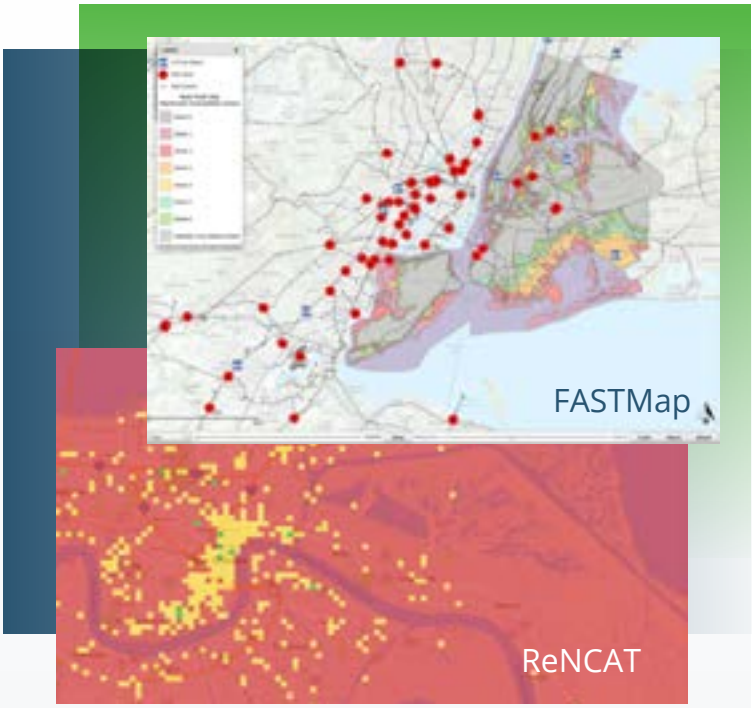

Social needs are incorporated by applying higher algorithmic weight to buildings that are especially important to their local communities.

Future Challenges

There is a strong need for better answers to the question, "Where will people be and what will they need?" Tools to answer this question in a general sense need to be further developed. For example, the Urban Resilience Planning Process coupled with the **RtePM** evacuation model can generate additional insights into this problem. Even with this tool, however, gaps in our understanding exist. For instance, RtePM does not account for the demographics of a region. Additionally, research into the predictors of who will evacuate and when they will evacuate has not been incorporated into these types of tools. Information about infrastructure utilization will enable quantitative decisions to drive which buildings are considered important for ReNCAT analysis instead of the qualitative process currently used based on stakeholder intuition.

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