TENNESSEE VALLEY AUTHORITY

Resiliency: Approaches, Technology and Funding to Get Your Community Prepared

Connected Communities Webinar Series
April 9, 2024

Welcome

- The Latest From Connected Communities
- New Resources from Connected Communities
  - Community Information Hub
  - The Natural Disaster Preparedness Guide: Planning and Technology Solutions
- Resiliency Overview
- Resiliency Perspectives
  - Jimmy Allen, TVA
  - Dean Bittner, RUNWITHIT Synthetics Pilot Project
  - Jared Green, The ARCHER Project
- Q&A Discussion

The Latest From Connected Communities

Connected Communities Initiative

Connected Communities are towns, main streets, neighborhoods and cities using tech- and data-related solutions to address community challenges while preparing for a modern energy system.

FOCUS AREAS

Broadband and Digital Literacy

Economic Empowerment

Energy and Environmental Justice

Enhanced Community Resiliency

RESOURCES

Off-the-Shelf Guides and Tools

Tailored Support and Success Coaching

Pilot Project Funding

Network and Partnership Building

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Upcoming Connected Communities Webinars

Workforce Development: Leveraging cleantech workforce opportunities

REGISTER NOW

Tuesday, May 14, 1:00 – 2:00 pm ET

Smart HVAC: A Connected Communities technology landscape deep dive

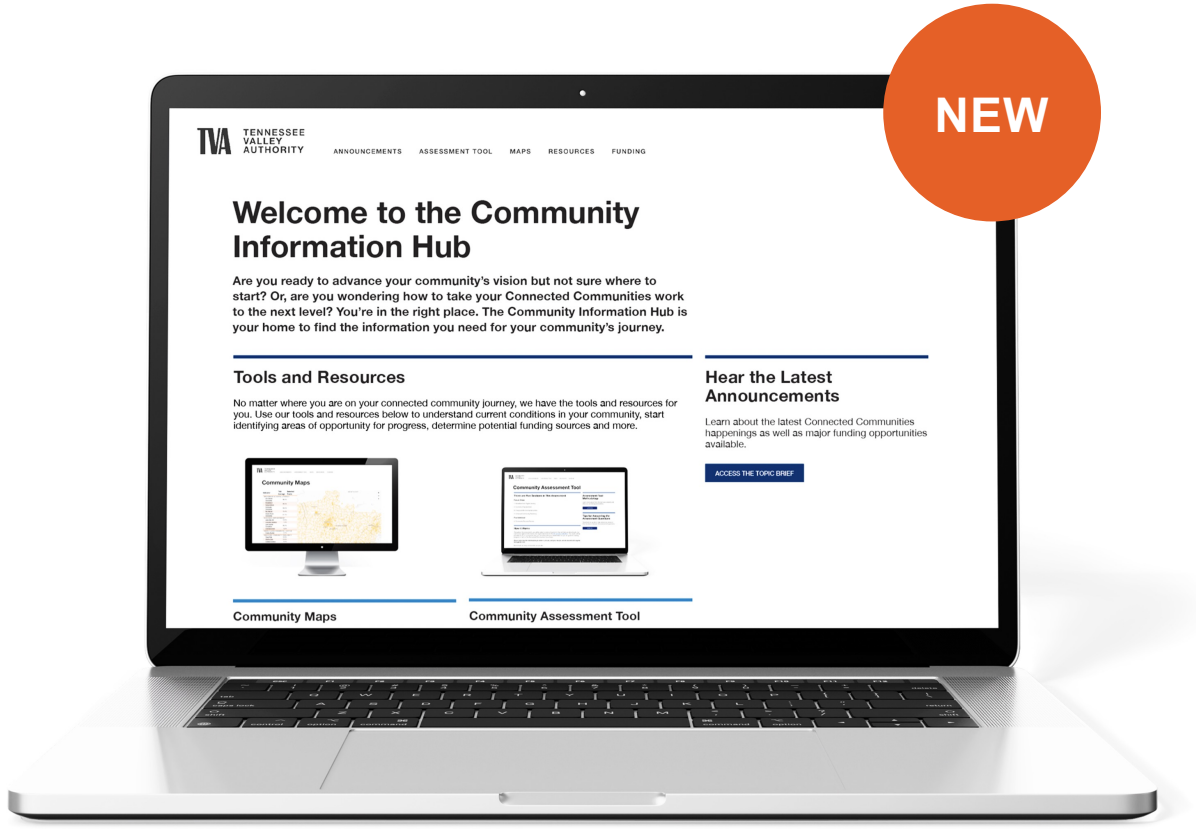
REGISTER NOW

Tuesday, June 11, 1:00 – 2:00 pm ET

New Resources from Connected Communities

Community Information Hub

A new, interactive tool is available to help **assess your community needs, prioritize solutions** and **identify funding opportunities.**



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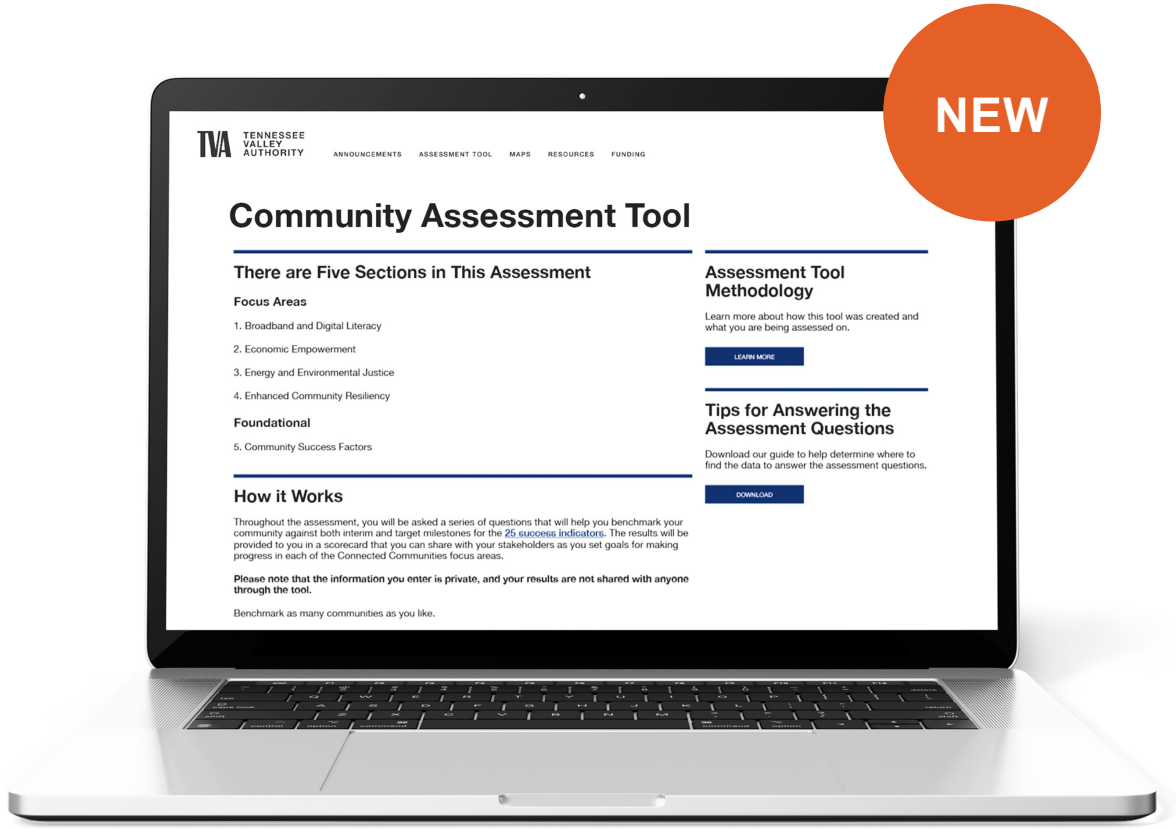
Community Assessment Tool

Use the CIH Community Assessment Tool to benchmark current conditions and resiliency gaps, enabling prioritization of critical actions to strengthen your community.



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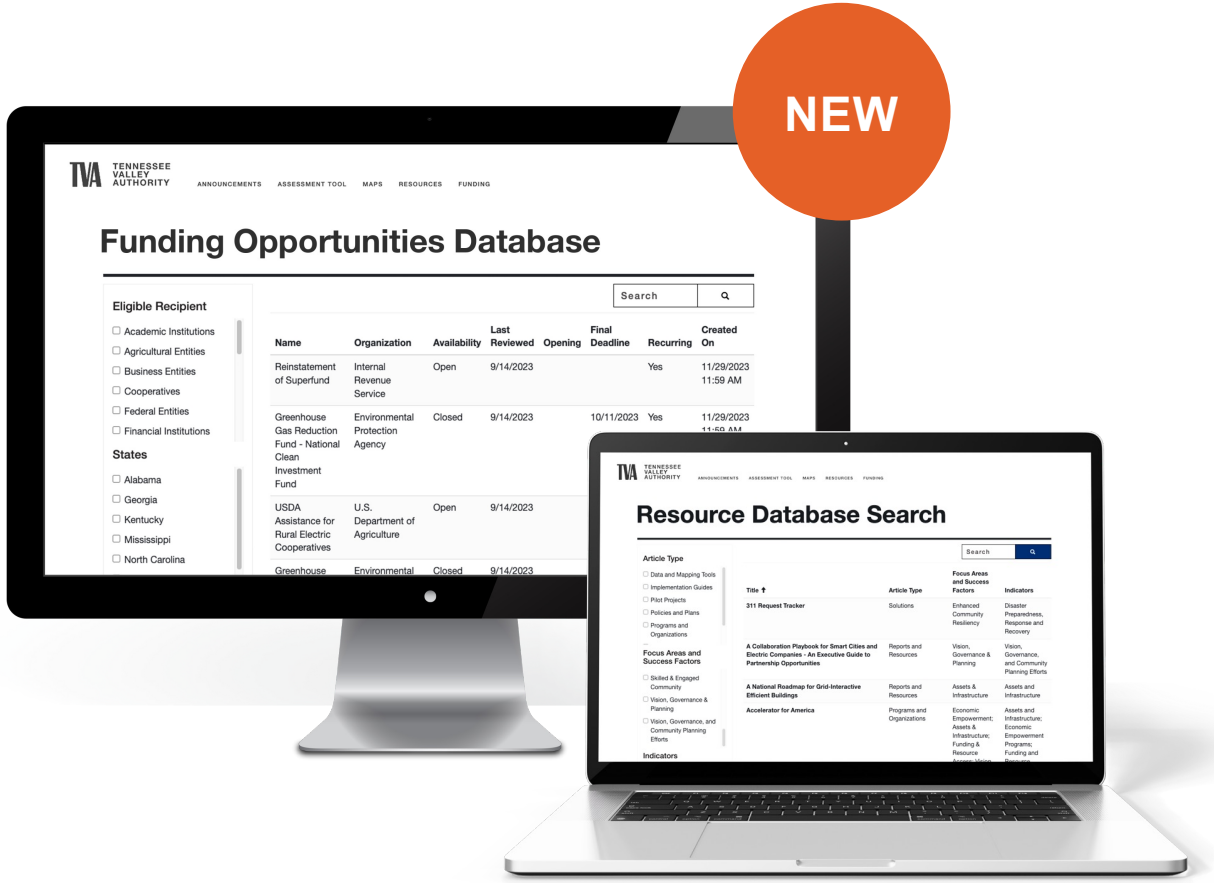
Resource Database and Funding Opportunities Database

Filter by resiliency-related indicators (e.g., Microgrids, Resilient Communications Systems, Disaster Preparedness, and more) to identify resiliency solutions and funding pathways fit to your community's needs.



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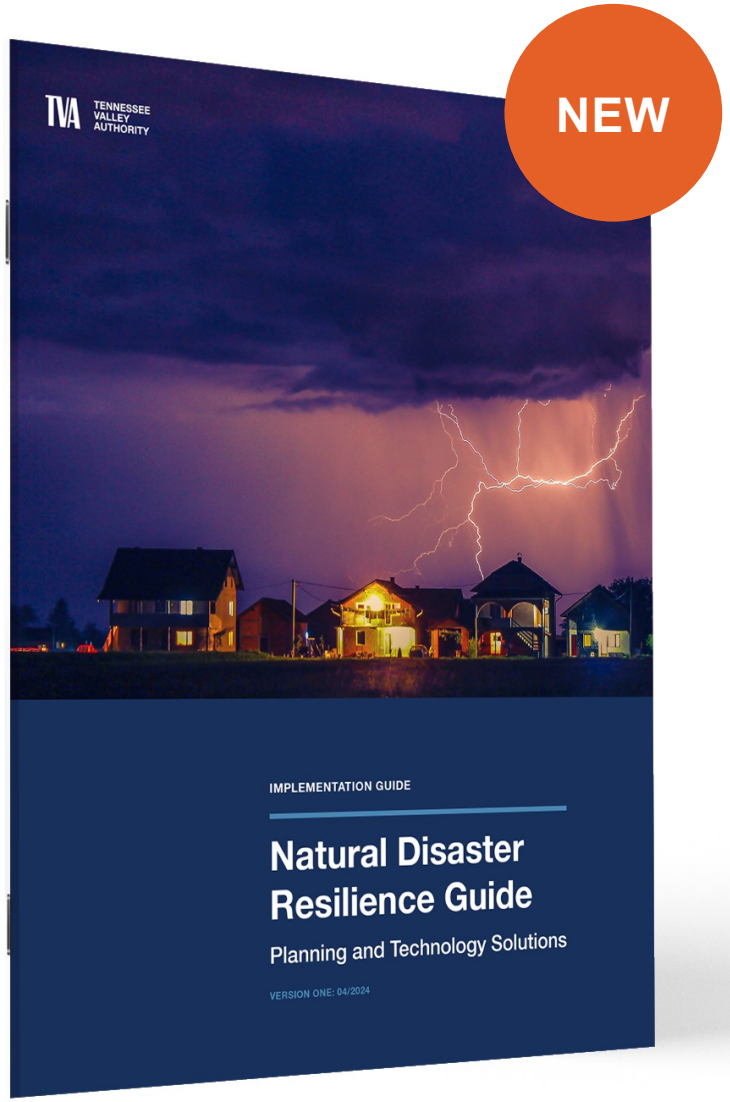
Natural Disaster Resilience Guide

This guide can help you identify key risks to your community while highlighting technology solutions to support resiliency strategies and detailing how other communities are using technology to prepare for and respond to natural disasters.



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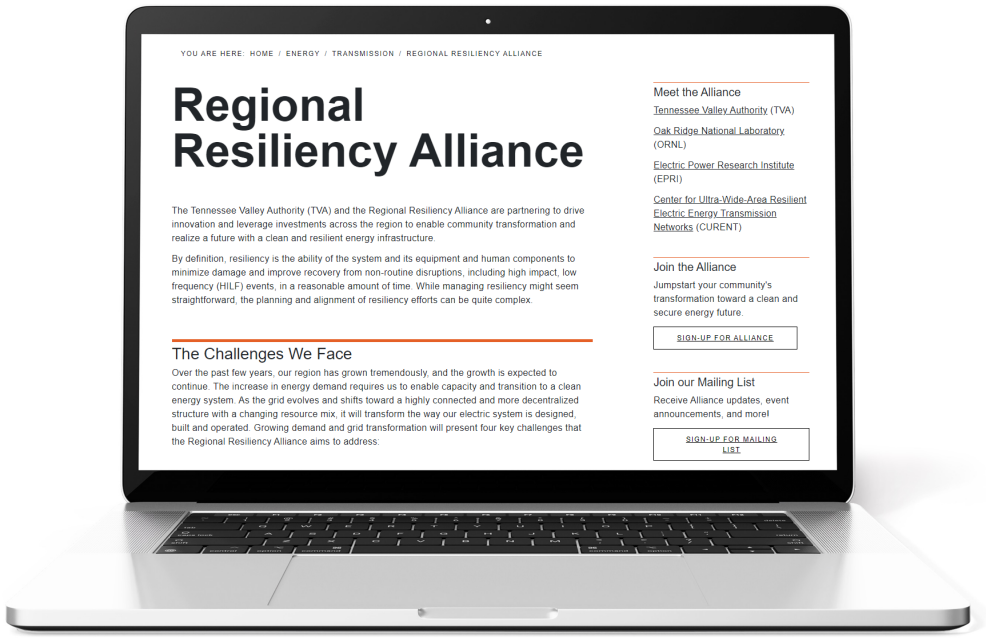
Resiliency Overview

Regional Resilience Alliance

The Tennessee Valley Authority (TVA) and the Regional Resiliency Alliance are partnering to drive innovation and leverage investments across the region to enable community transformation and realize a future with a clean and resilient energy infrastructure.



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Resiliency Perspectives

Meet Today's Speakers

Jimmy Allen

Senior Consultant, Business Development and Strategy, Origination and Renewables, TVA

Dean Bittner

CTO and co-founder, RUNWITHIT Synthetics

Jared Green

Technical Leader, Distribution Operations and Planning, EPRI

Resiliency 360°

TVA - Business Development and Strategy

Resilience 360° Principles*

1 Entry Qualifications	• Resources and host customers located in the Valley. • TVA will control the dispatch of the resources. • Available to host facilities during Qualifying Resiliency Events.
2 TVA Contribution	• Resiliency economic valuation under-development guided by valuing the assets to the TVA system and the evolving DER strategy. • Current system capacity needs coupled with primary dispatch of units to TVA may provide adjustments to value and pricing.
3 Customer Contribution	• Participants will provide space on, or connected to their operations, financially contribute to costs over value to the system, and allow access for O&M activities.
4 Generation Sources	• Initial focus aggregated natural gas and battery storage. • May include and not limited to an array of carbon-free, carbon-advantaged, and fossil fuel backup generation. Aggregators will provide resources that meet qualifications of TVA, and the resiliency needs of the customer.
5 Compliance Standards	• All aggregators will comply with TVA and/or LPC qualified resiliency standards as part of the enrollment and vetting process. • Local host sites will adhere to environmental assessment, transmission requirements, etc. on a case-by-case basis.

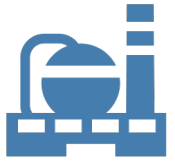
*Subject to programmatic, environmental, management reviews, and approvals

Target Customer Segments

Critical Infrastructure

Healthcare

Data Centers



Specialty Manufacturing

Food and Beverage / Distribution

RUNWITHIT SYNTHETICS

Synthetic Resiliency Modeling on Extended Power Outages

- Collaboration between RUNWITHIT Synthetics, the city of Nashville and Nashville Electric Service to model various scenarios of human impacts of power outages of varying lengths
- Examined the benefits of adding distributed energy resources around the city to minimize impacts

TOTAL TVA FUNDING

$80K

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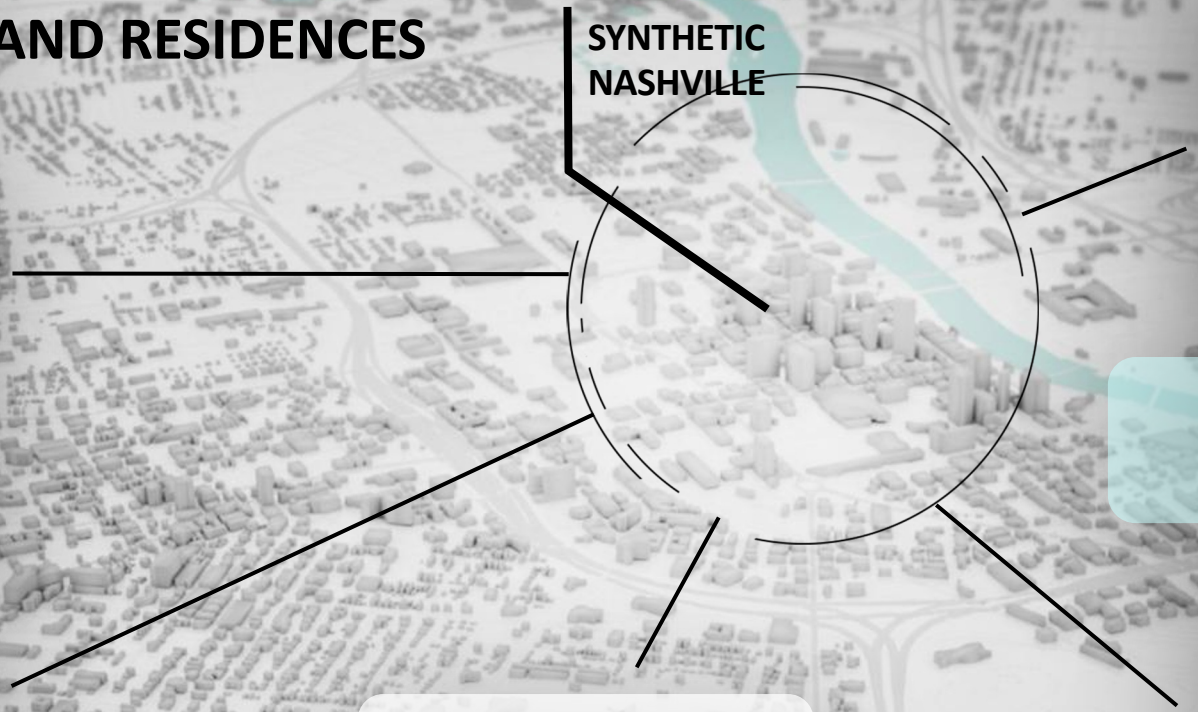
SYNTHETIC POPULATIONS: A COMPLETE BEHIND-THE-METER VIEW OF PEOPLE AND RESIDENCES



The current study area includes the US census area of Nashville-Davidson, including the area identified in US Census as **County 037** which consists of **159 census tracts**.

Using **US Census data and data available through the City of Nashville open data** portal, and other sources, RWI will synthesize approximately :

16,000 businesses
400,000 residences
and **755,000** residents

The data collection includes the EPA Environmental Justice dataset as available through the EJ Screen.

More information can be found at this link
https://www.epa.gov/ejscreen.

450 EPA/EJ regions

A synthesized grid from the DHS Homeland Infrastructure Foundation Level.

Data collection found here
https://gii.dhs.gov/hifld/content/about-hifld.

This dataset is anticipated to contain approximately :

157 substations
100 major transmission lines

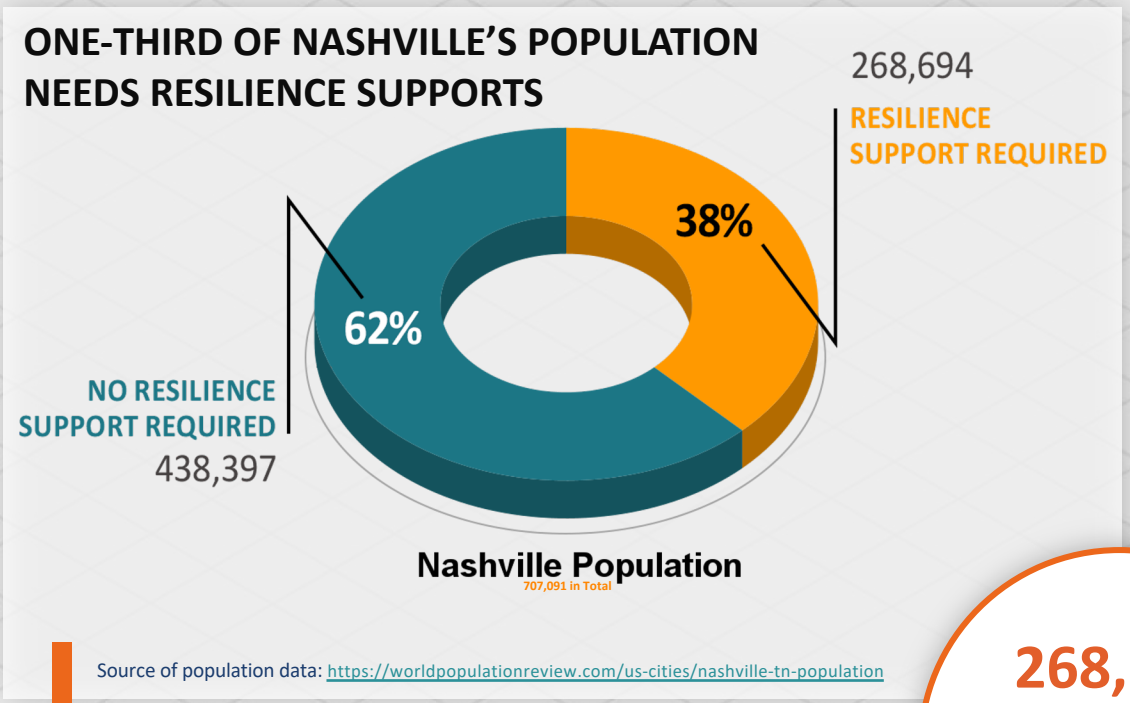
This dataset lacks business and residential transformers and lower-level feeder substations which will be synthesized by RWI based on a geographical aggregation of synthesized load and pole data derived from space imagery.

These synthesized grid resources may be augmented with utility-supplied data.

112,000 transformers
430 feeders

QUANTIFYING THE DEMOGRAPHICS, GEOGRAPHY AND BIG NUMBERS OF NASHVILLE'S COMMUNITY RESILIENCE NEEDS

HEALTH, ECONOMIC, AND MOBILITY CHALLENGES LEAD TO DISPROPORTIONATE IMPACTS DURING OUTAGES



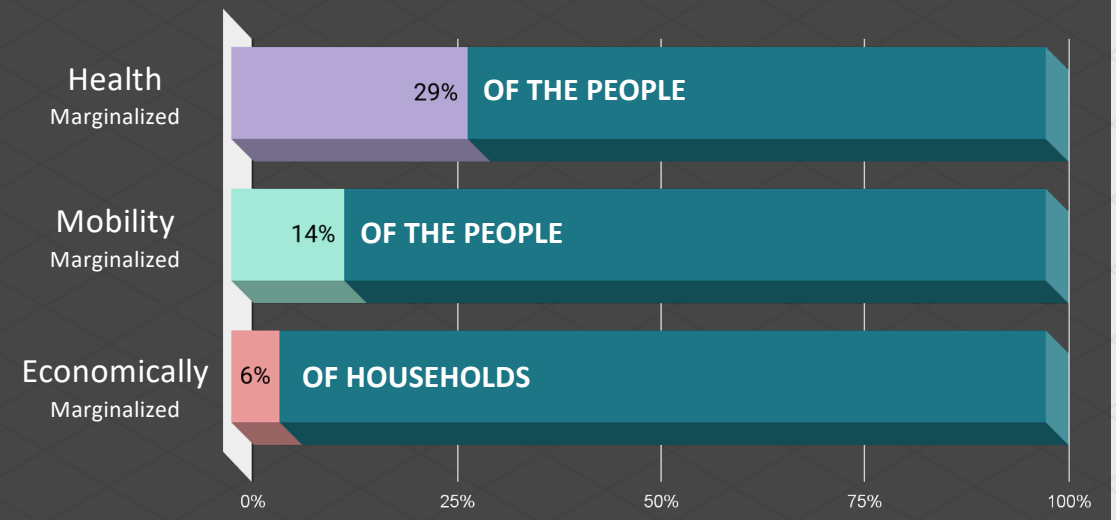
Source of population data: https://worldpopulationreview.com/us-cities/nashville-tn-population

Figure: Pie chart comparing the percentage of the Nashville population requiring resilience support.

268,694 vulnerable people

Resilience Demand

Figure: Breakdown of the vulnerabilities in the 38% who require resilience support.



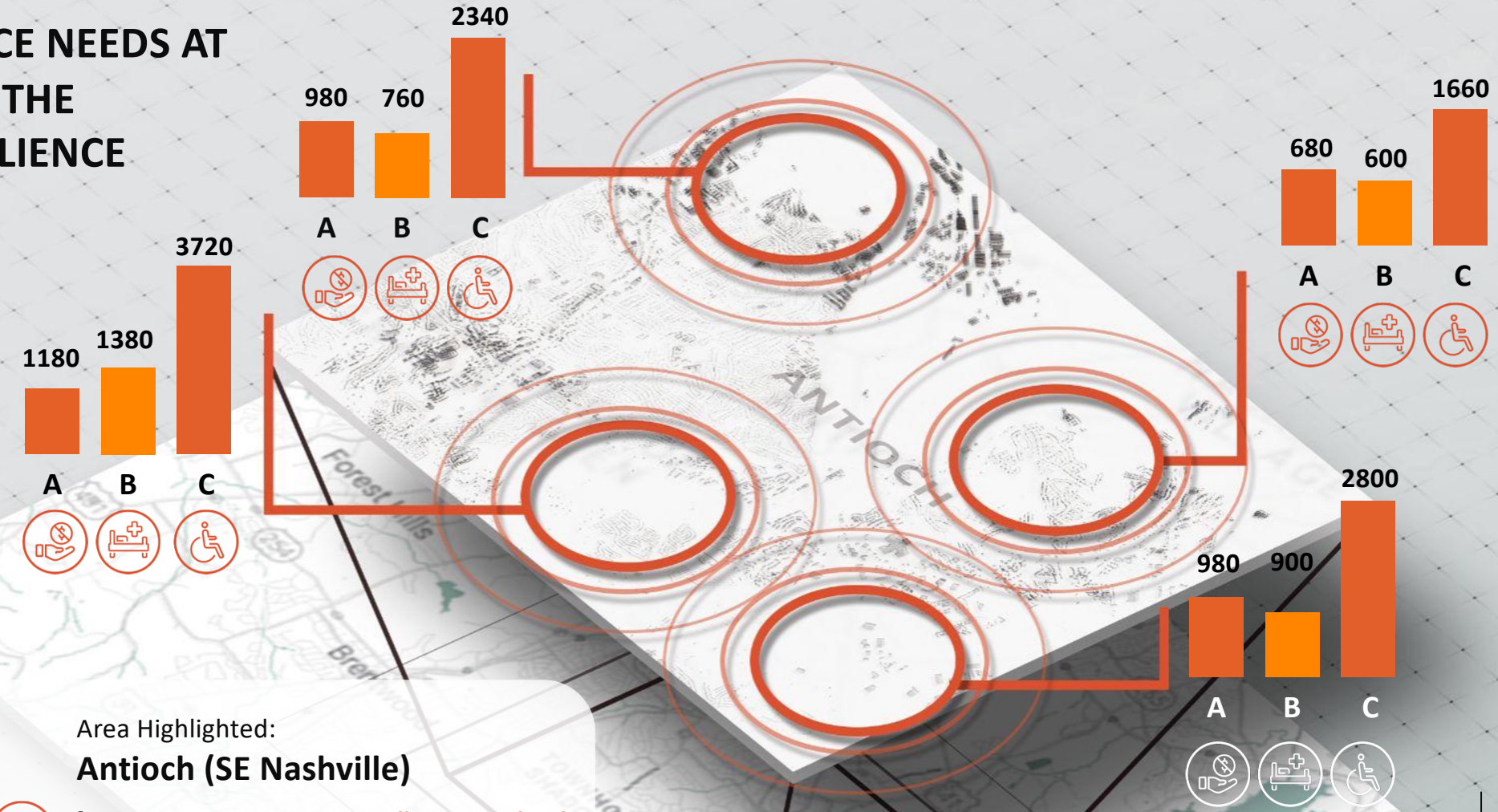
The chart above shows a breakdown by **marginality**. Some may have **intersectionalities** - multiple margins which count in multiple categories.

The delta, or difference, between the existing capacity and the required capacity informs the additional need for resilience.

INFORMING RESOURCE NEEDS AT FACILITIES BASED ON THE INDIVIDUALIZED RESILIENCE SUPPORT REQUIRED

Vulnerability heatmaps intersect and inform the distribution and nature of support needed.

Marginalization factors are interconnected, often creating overlapping demands for resources and requiring interdependent support systems.



Area Highlighted:

Antioch (SE Nashville)

A = Support required for **Economically Marginalized**
→ Basic needs (food, water, blankets, cots, etc.)

B = Support required for **Medically Marginalized**
→ Medical (medicine, equipment like DME's, nurses, etc.)

C = Support required for **Mobility Marginalized**
→ Mobility aid (eg. ramps, wheelchairs, etc.)

Figure: Highlighting four regions within the 25mi^2 area around Antioch with varying proportions of vulnerable populations, and therefore, resilience support requirements.

TEXAS-STYLE COLD SNAPS ARE UNPRECEDENTED

1.160 GW
Cold Snap Peak Residential Load

393,140 Residences
2.95 kW
per Residence on Average

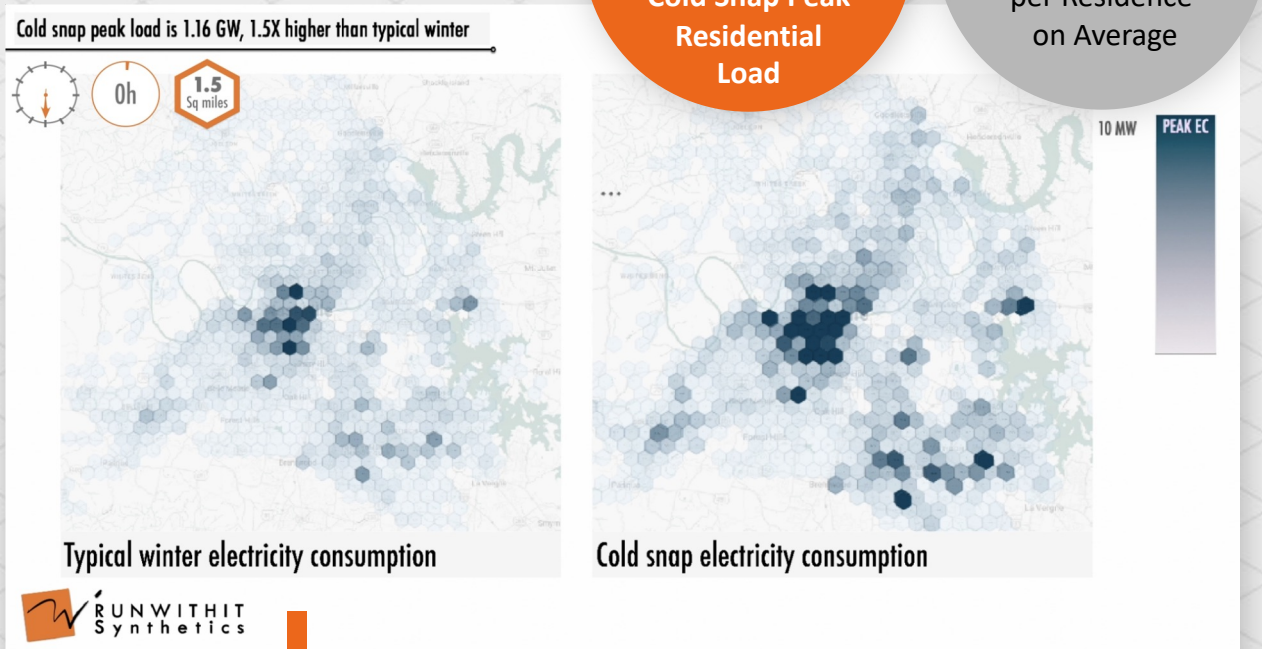


Figure: Difference between record breaking demand in a cold snap and a typical winter.

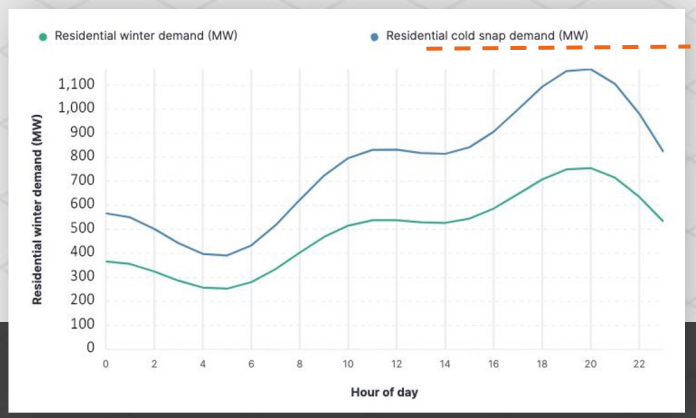


Figure: Peak **residential** demand in Nashville during a typical winter and during a cold snap.

We characterized peak load without adapting to an extreme event.
These curves would change shape from the fairly typical curve, due to changed patterns of life during a cold snap with many staying home.

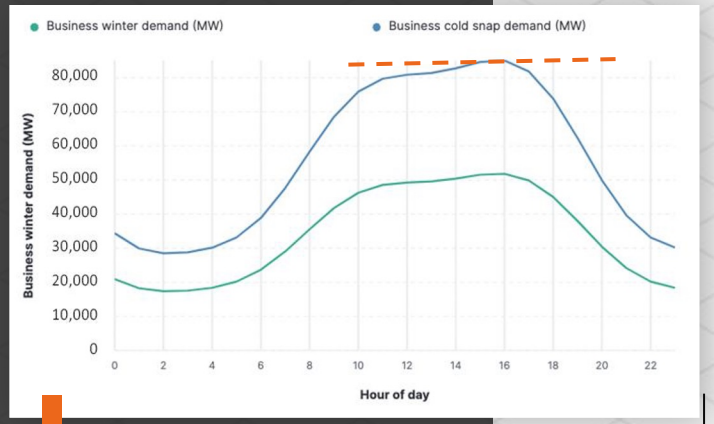
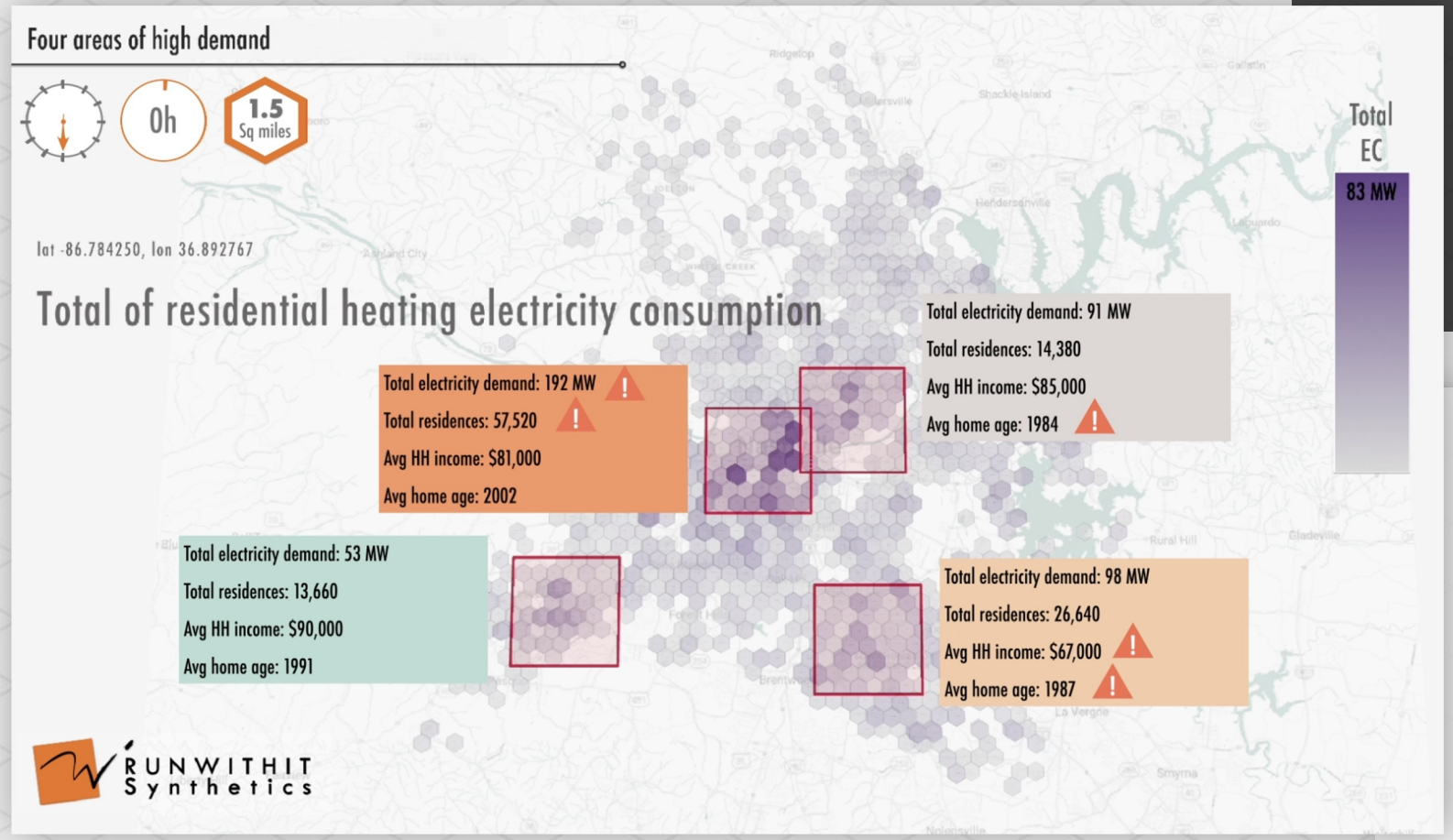


Figure: Peak **businesses** demand during a typical winter and a cold snap.

MODELLING BEHIND THE METER, UNPRECEDENTED COLD SNAP DEMAND SIDE LOAD

ELECTRICITY DEMAND FROM PRIMARY AND SECONDARY HEATING SOURCES SHOWS WHICH AREAS ARE CANDIDATES FOR GRID MODERNIZATION AND DER



These areas are good candidates for grid modernization, restoration and the location of distributed energy resources:

Southeast Nashville:

- Older and low energy-efficient homes.
- Lower income families.
- Predominantly single-family homes.

Central Nashville:

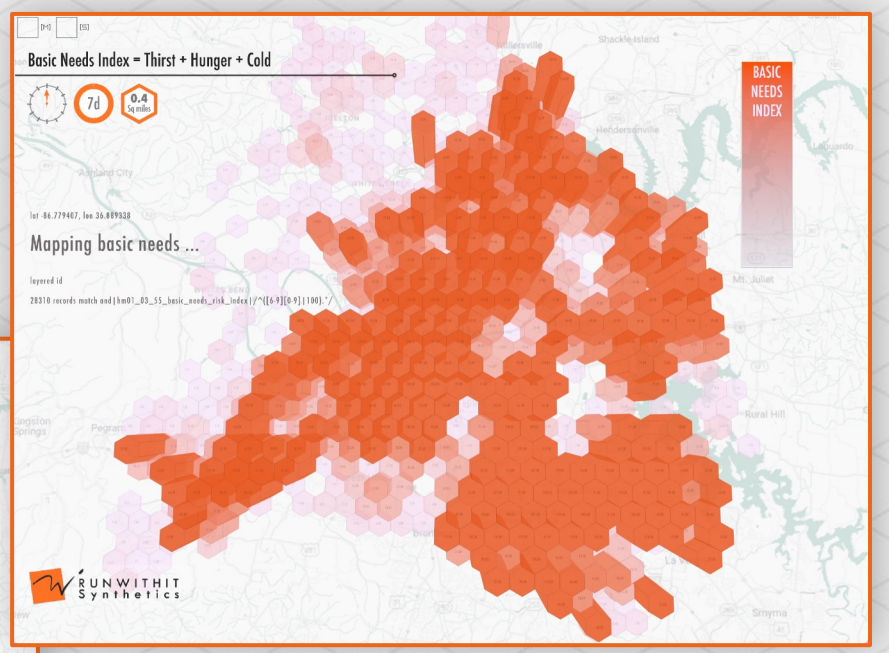
- High population and housing density.
- Predominantly multi-family buildings.

- In the city of Nashville **64,260**, or **41%** of single-family residences, were built before the 1990s and are without electric heat pumps.
- **156,020** - total number of single-family residences in Nashville.

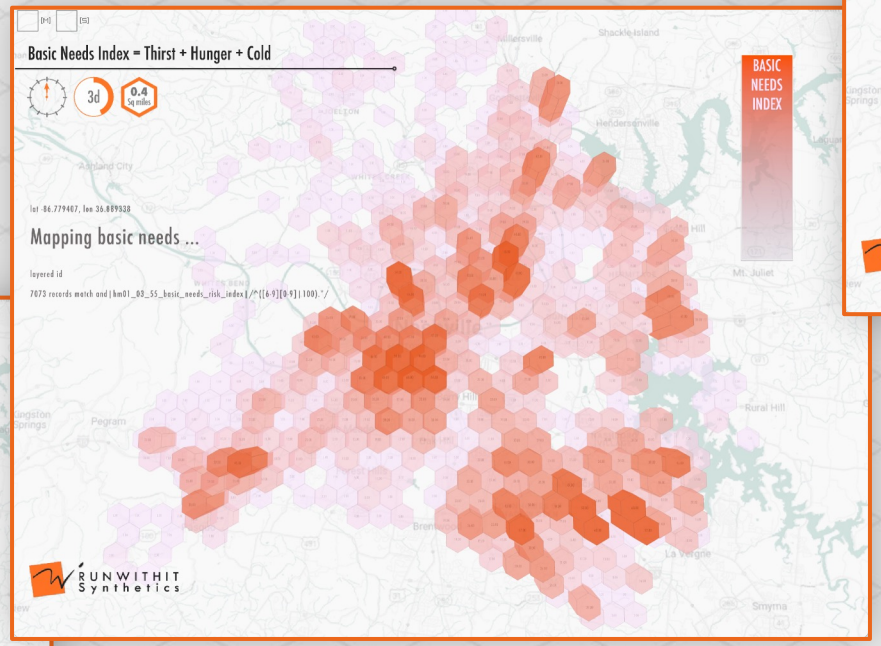
REAL, UNCHECKED, CRITICAL MORTALITY RISK FROM THIRST + HUNGER + COLD

HEATMAP SHOWS THE AREAS WHERE PEOPLE REACH CRITICAL MORTALITY RISK FROM LACK OF THESE BASIC NEEDS BEING MET OVER TIME.

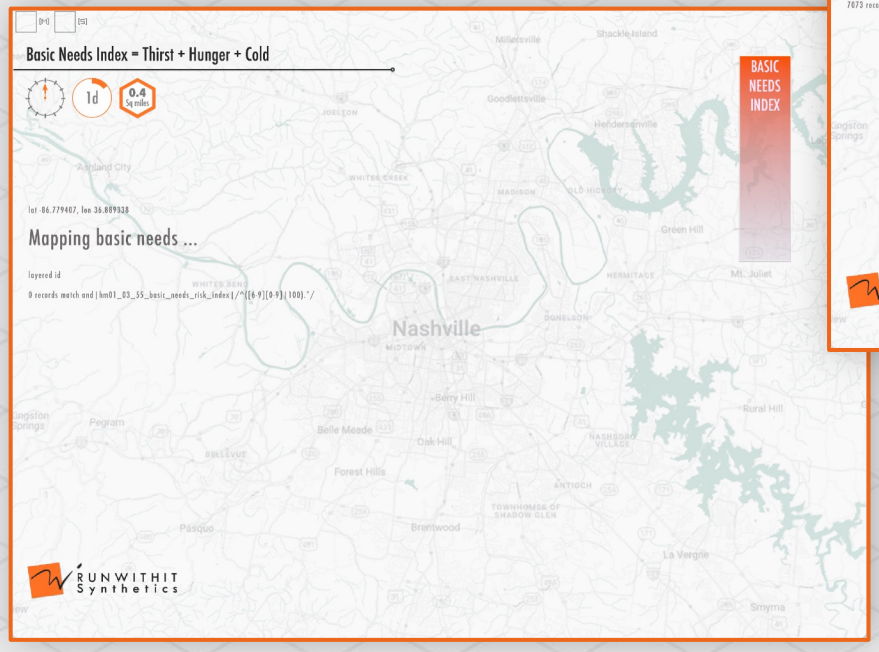
Basic Needs after 1 week

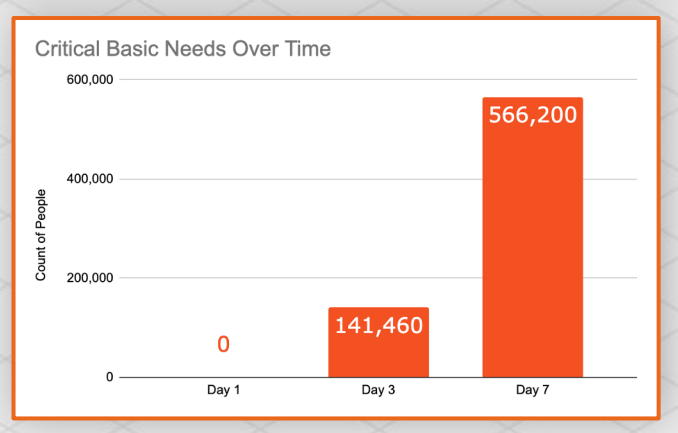


Basic Needs after 72 hours

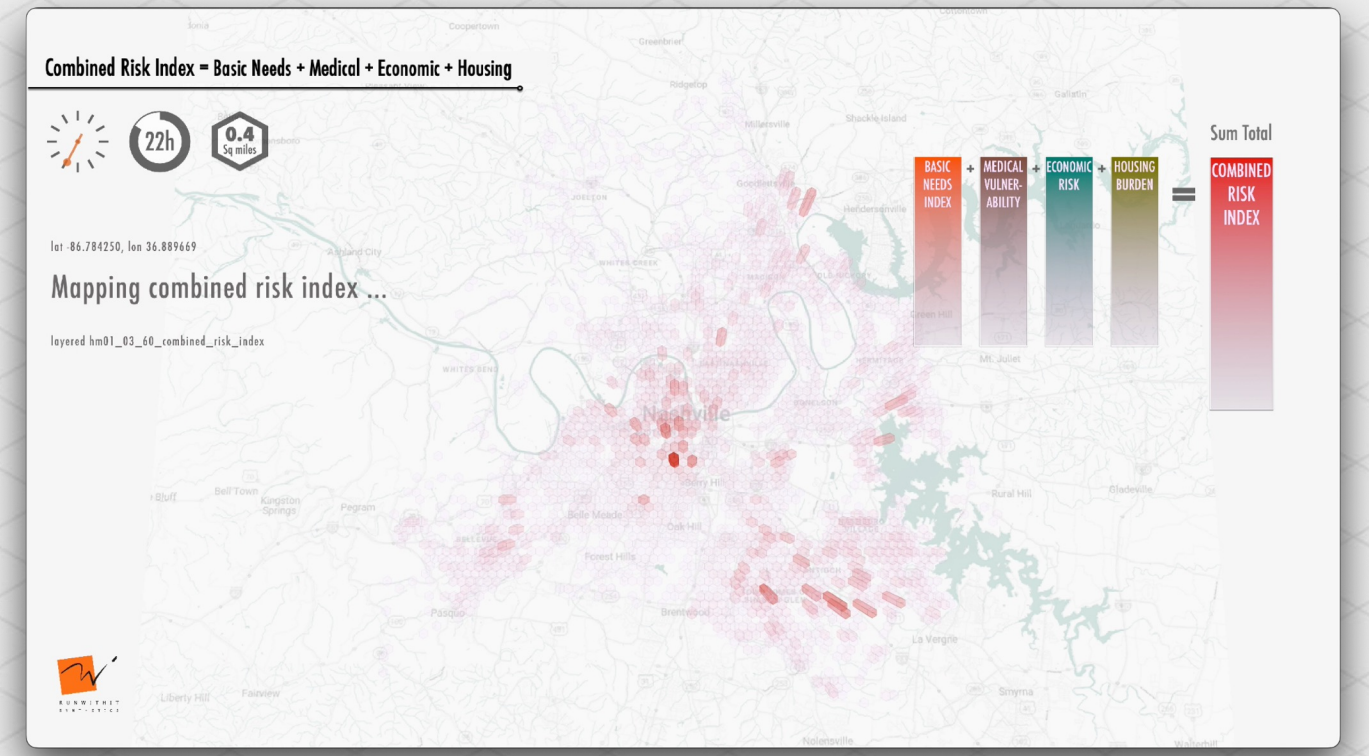


Basic Needs after 24 hours





ALL OF THE INDICES ARE WEIGHTED AND COMBINED INTO ONE CENTRAL RISK INDEX



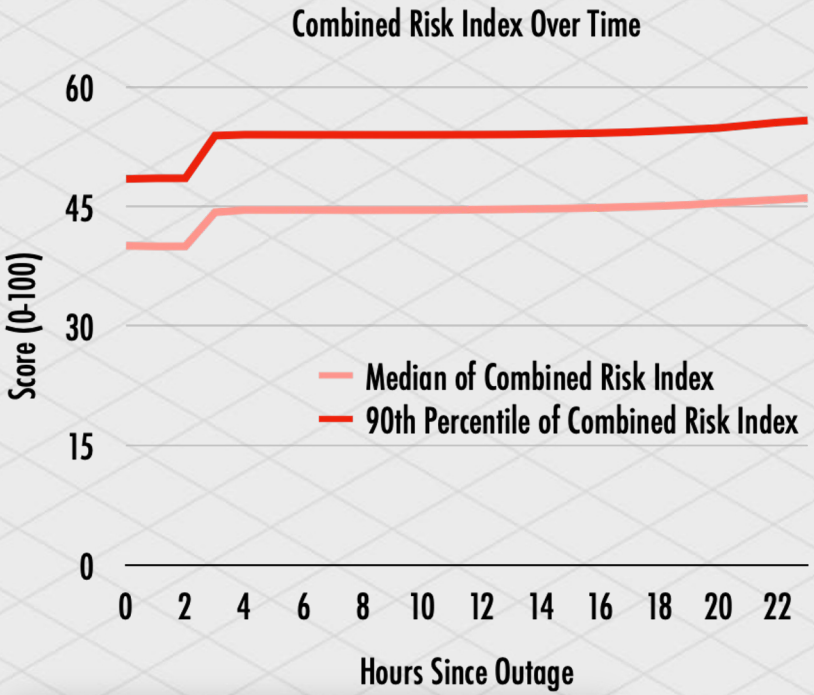


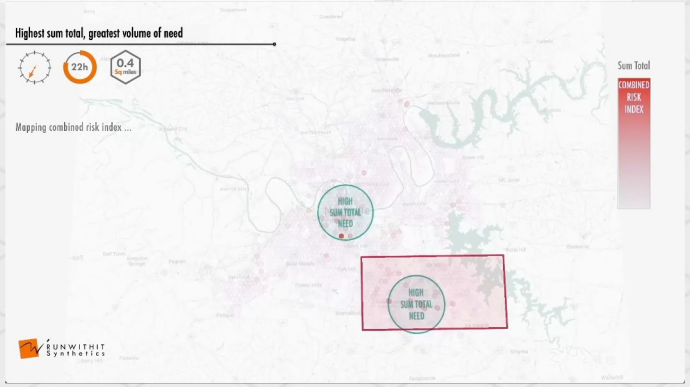
Figure:
Shows a heatmap of combined risk across all indices. A combined index is useful in isolating and looking at specific areas where multiple needs intersect.

TRENDS WITH ACUTE NEED CAN BE EXPLORED BY IDENTIFYING THE HIGHEST 90th PERCENTILE

Figures:

Left The 90th Percentile shows those in the population with the most acute needs.

Bottom: highest average and sum total needs both highlight different areas, but there is an area of overlap which shows the greatest overall need.



SYNTHETIC REGIONAL ADVANCED LAB (REAL): ENABLING CROSS-INDUSTRY ENGAGEMENT THROUGH CONVERGENCE

SYNTHETIC REGIONAL ADVANCED LAB ENGAGEMENTS SO FAR:

- **Ports and Airports** – decarbonization
- **Investment and Funding Support**
- **Growth Planning** – cost of shared services, land use, density
- **Energy Transition** – project phasing, impact and workforce
- **Post Secondary Expansion** – affordable housing, security and mobility
- **Critical Resource Requirements** – water, energy and power
- **Youth, Health and Community Futures**
- **High-risk Climate, Natural and Human-made Events**
- **Decentralized Energy** – generation, storage, resilience
- **Electrification Planning** – EV's, HVAC, DER
- **Equity and Sustainability** – vulnerable populations, access, risk indices, programs and services
- **Transportation** – public, active, micro, autonomous, policy & accessibility

ARCHER PROJECT

The ARCHER Project, Resiliency Planning Framework

- Creation of a community-focused planning framework that uses distributed energy resources to provide more energy resilience
- Aimed at solutions to limit outages and rapidly restore power when it does go out

TOTAL TVA FUNDING

In-Kind

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Funded by:
SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

ARCHER Framework Overview and Objectives

ARCHER Planning Framework:

- Merges community with electric system resilience planning.
- Accounts for community and electric system vulnerabilities.
- Adaptable, repeatable, and scalable.
- Prioritize resilience investments down to the individual neighborhood.
- Develops open-source, data-exchange platform to carry framework into operational planning during extreme events.
- Test, validate, and refine using real-world data.

Identify Community Needs and Resources

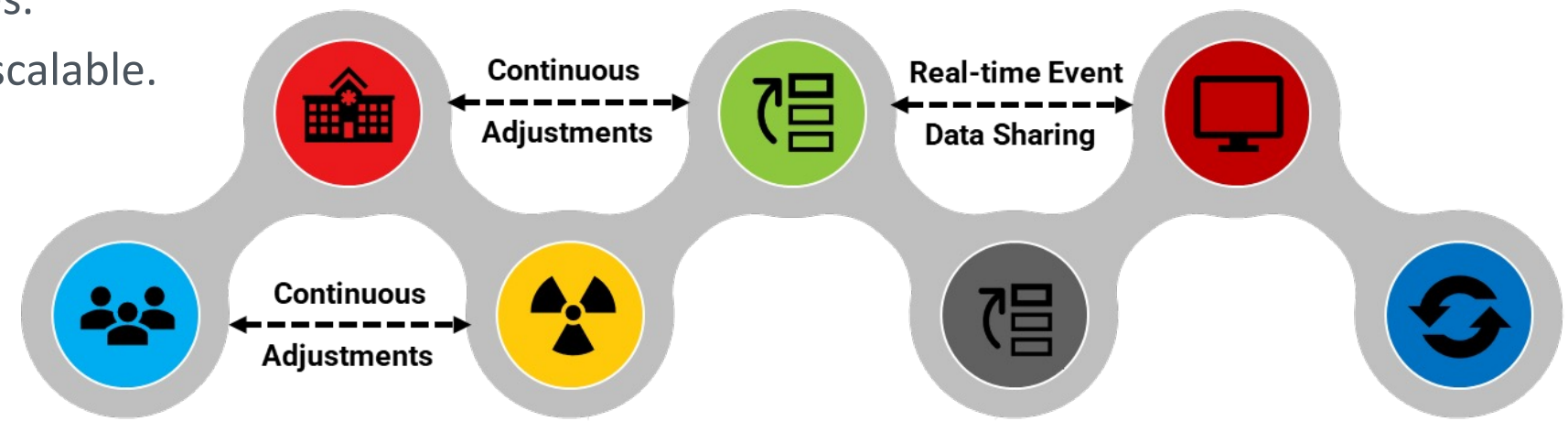
Community identifies unique services & resources (solar) for energy resilience.

Identify Resilience Improvements for Range of Events

Resilience improvements linked to extreme weather hazard and need of community.

Community Data Exchange Platform

Data model and platform equips communities and utilities to exchange data in during all event stages.



Community Engagement

Community informs utility through a structured, holistic, engagement process.

Develop Metric and Identify Risks

Analysis to understand socioeconomic, energy, environmental, & electric system risk.

Prioritize Resilience Investments

Community, energy, and electric system vulnerabilities drive resilience decisions.

Framework Testing, Validation & Adjustment

Framework tested with real- world examples to validate and refine the framework.

Funded by:
SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

Motivation of Project

- Key gaps for community energy resilience
  - Siloed energy resilience planning – Grid and the Community.
  - Voice of community not present.
- Key expected outcomes of proposed project
  - Methods to give a voice to the community
  - Framework for combined energy resilience planning
    - Templates for community engagement.
    - Optimal location of DER and supporting grid improvements
    - Existing and new metrics
    - Utilization of new datasets
    - New decision support tools

Q&A Discussion

Let’s Stay Connected

Continue the Conversation

Contact Georgia Caruthers to learn more:

gmcaruthers@tva.gov

Join Our Connected Communities Network

Visit the Connected Communities website and sign up to be part of the Connected Communities Network:

tva.com/connectedcommunities

Access Our Resources

Access the Community Information Hub and the Community Housing Needs and Solutions guide:

- Community Information Hub
- Resilience Guide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