



INCUBATENERGY LABS 2022 DEMO DAY

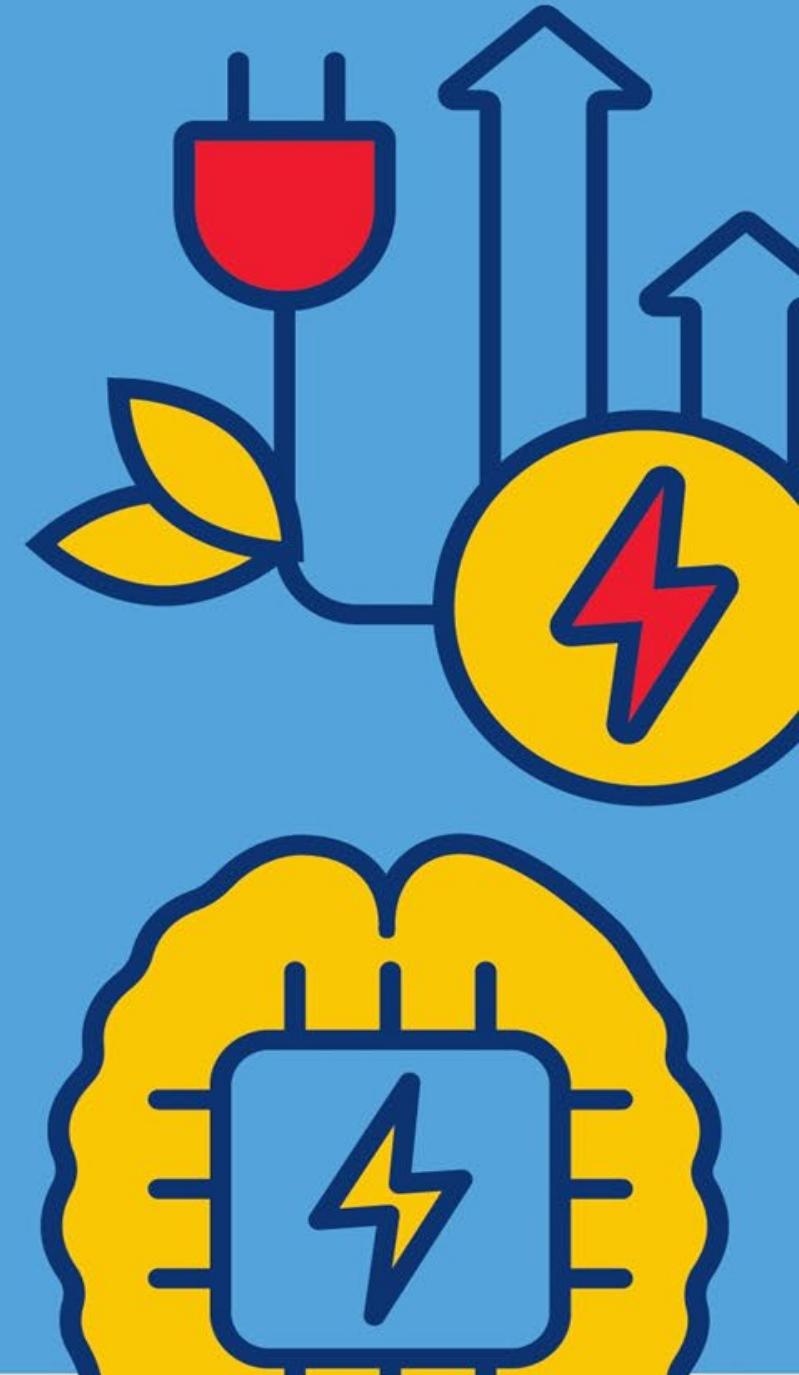
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October 26
Minneapolis
Minnesota



OVERVIEW





Using Advanced Simulation to Explore and Optimize Community Resilience and DER

Supported/Hosted by: Tennessee Valley Authority, Nashville Electric Service, City of Nashville

EPRI Subject Matter Expert: Jared Green

Model the City of Nashville during a prolonged outage. Focus at 24 hours, 3 days, 1 week outage duration timelines.

- **Measure impacts on the population, particularly the vulnerable and those who are economically disadvantaged**
- **Model various options for DER to manage and mitigate outages and measure the benefits**
- **Present data, results and insight in a series of data and media assets to inform and engage collaboration with stakeholders.**

SCOPE



Including People, Built Environment, Infrastructure and Impact



15,743 businesses
400,620 residences
and **774,100** residents

A grid will be synthesized 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 :

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**.

The data collection will include 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

7000 transformers
250 feeders

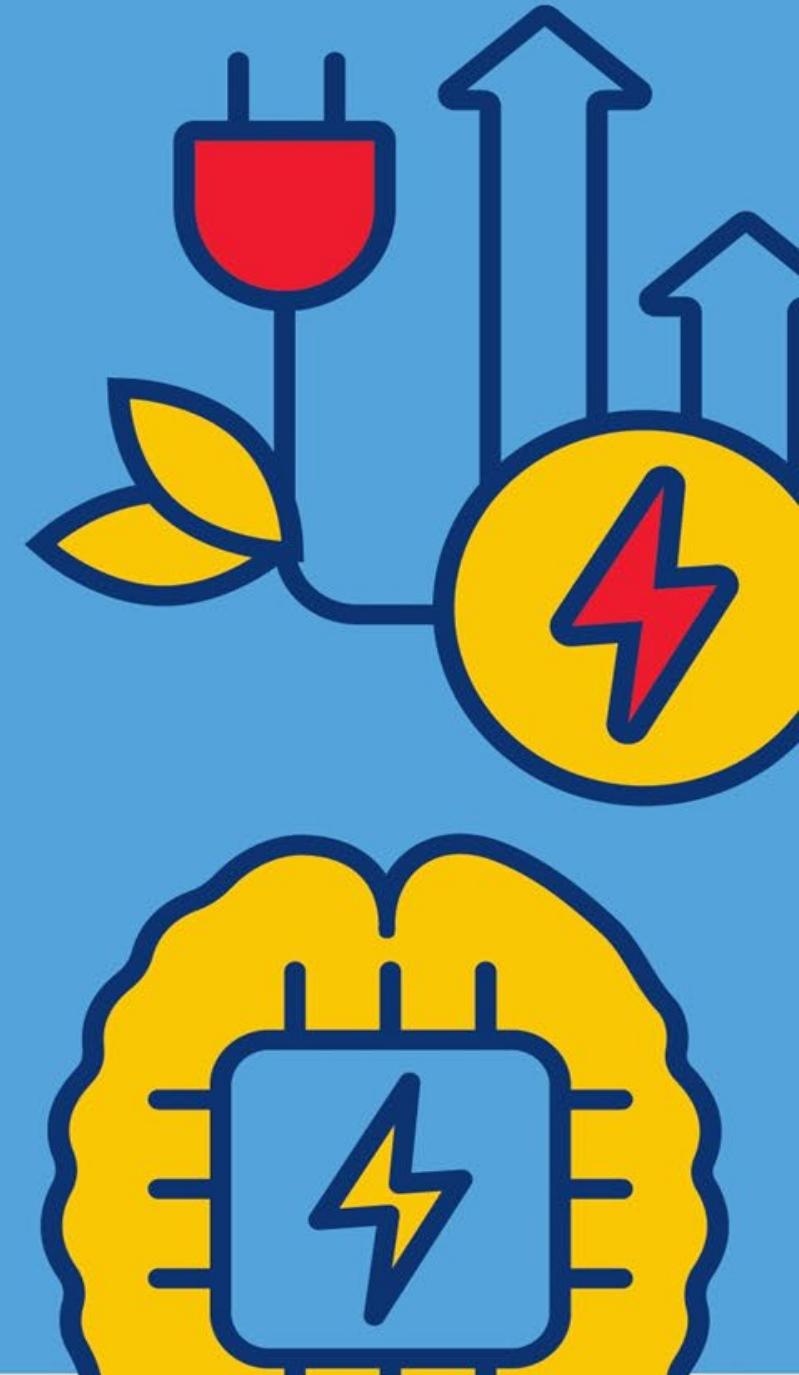
70 substations
100 major transmission lines

Cold peak load, outage, mitigate, manage, measure, share

- DER
- Heat pumps
- Business impacts
- Critical infrastructure, responders, communications
- Cascades into other utility failures
- Vulnerable and disadvantaged individuals and communities
- Community resilience hubs
- Restoration plans and priorities
- Grid vulnerability intersection with disadvantaged communities
- Potential to make a difference with public education and communication
- Mitigation with cold heat pump
- Building envelopes

TIMELINE

(in progress)



Project Timeline



SEPT. 29, 2022

Generated Synthetic
Nashville

NOV. 1, 2022

First 4 hours of outage

DEC. 15, 2022

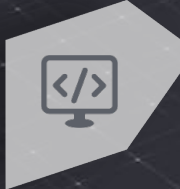
DER generated

DEC. 23, 2022
(First 24 Hours)

First 24 hours modelled,
data verified, asset
candidates

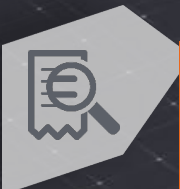
Synthesize

- People
- Business
- Community
- Grid
- Community



Research

- Human behavior
- Community resources
- Grid assets
- Supporting research



Model

- Human impacts
- Business costs
- Grid assets
- Community resources
- Risk and priority scoring
- DER optimization



Simulate

- Design experiments
- Set and run
- Analyze and review
- Deep dives



Analyze

- Analyze for key insights
- Qualify high value
- Prepare assets for sharing



Engage

- Identify use cases for sharing
- Share
- Discuss next steps



FEB. 1, 2023

DER optimized, visualized assets

MARCH 1, 2023
(First Week of Outage)

Finalized
assets for
sharing

METHOD



A vertical decorative banner on the right side of the page. It features a solid yellow background. Scattered across the banner are stylized sun icons. There are four suns in total: two in blue, two in white, and two in red. Each sun consists of a central circle with multiple straight lines radiating outwards. The suns are arranged in a vertical sequence, with some partially cut off by the edges of the page.

Based on publicly available data, behavioural research, consumer surveys, and domain experts.



Inflect scenarios with manipulatable inputs



RWI uses diverse sources of **research, expertise** and **publicly available data** to set initial conditions in an environment.

We **dial forward scenarios** to measure configurations and impacts under different conditions with synthetic data.

To explore scenarios, we sandbox or **manipulate different factors** and analyze impacts including emergent and cascading consequences in energy and adjacent sectors.

Dial-forward the cold-weather outage, and measure

core Camera

24 hours, 3 days, 1 week - run different outage lengths and assess impacts from generated data from the community

renting or owning

value of the house

household composition

- age
- income
- gender
- education
- working from home

health condition

- COVID-19 risk
- caregiver status
- pre-existing conditions
- oxygen dependent
- stress level

power consumption

- has PV
- has generator
- potential for PV adoption

TRUST in utility companies

- willingness to pay
- poor/good communication

ability to pay

motivation

VULNERABLE population

Analyze the data for impactful outcomes



Compare outcomes over time and between populations

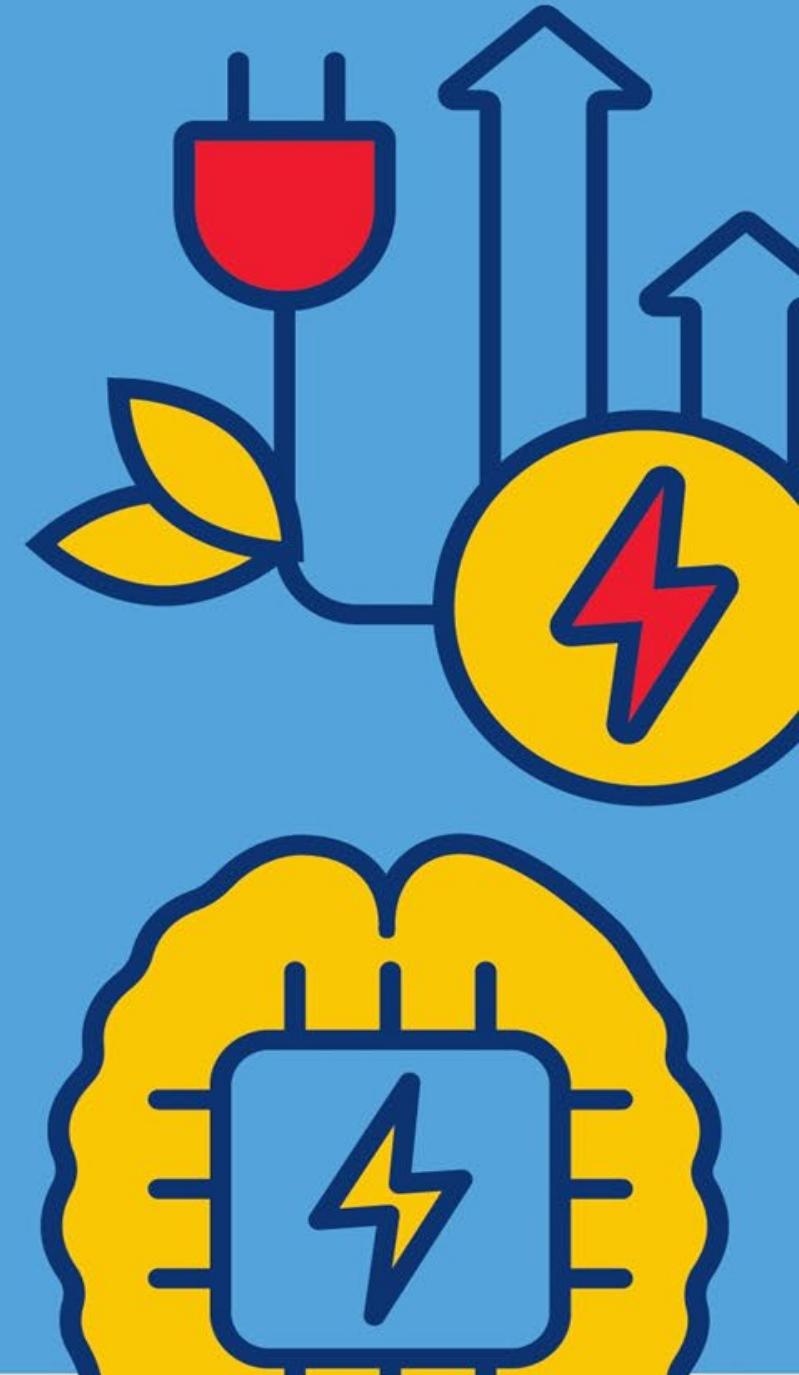
Inflect and measure DER options

**SYNTHETIC
NASHVILLE**

Engage community stakeholders and Incorporate community resilience plans

Explore optimization

OUTCOMES



Share insight and outcomes for positive impact with stakeholders

Engage the community for resilience

FOR -> Those who are socializing, organizing and planning Community Resilience Centers at the City of Nashville as well as, perhaps, others more generally engaged in economically disadvantaged communities, in understanding and sharing an understanding of the unique challenges faced.

Priorities grid modernization and restoration

FOR -> Those responsible for understanding grid outage and considering expanded definitions of risks and impacts considered in decision-making and prioritization around modernization and restoration with respect to economically disadvantaged communities.

DER roll-out

FOR -> Those responsible for planning and locating distributed energy resources, including resources for the home that will be partially or fully utility owned or managed.

THANK YOU!

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