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West Virginia Office of Energy Regional Microgrids for Resilience Study

Microgrids as a resilience tool in the energy toolbox

October 2022

Acknowledgements and Disclaimer

SEPA would like to thank the WVOE for the opportunity to conduct this study. The development of this study was financially assisted from a grant assisted by U.S. DoE. SEPA would also like to thank our key stakeholders that provided input on our site selection criteria and played an important role in highlighting key considerations.

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SEPA Overview

Mission and Vision

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Mission

To accelerate the transformation to a carbon-free energy system through actionable solutions

Vision

A carbon-free energy system that is safe, affordable, reliable, resilient and equitable

Microgrids

Economic Viability

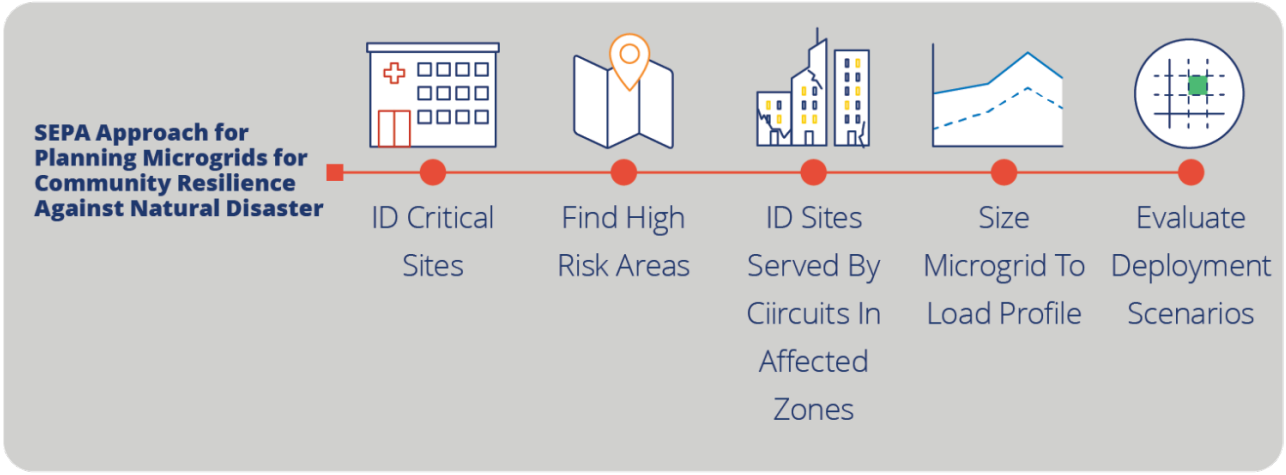
A solution to provide win-win customer and grid benefits through utility investments and public-private partnerships.

Sustainability

A mechanism to drive carbon-free resources onto the grid.

Resilience

An emergency preparedness and energy assurance mitigation measure for critical infrastructure and services.



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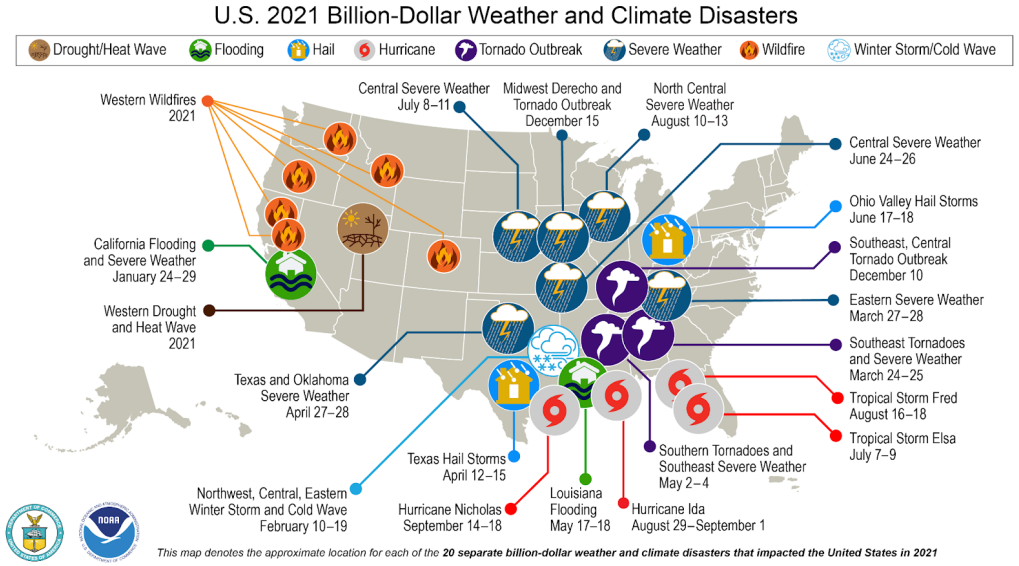
Microgrids for Resilience Study Overview

Objective

Microgrids as an economic, sustainable, and resilience solution

- Identify areas of the state and specific sites where WVOE can facilitate the deployment of microgrids and other solutions for resilience
- Understand how natural hazard risks, critical infrastructure, disadvantaged communities and community interest align with utility operations and planning to establish tiers of resilience need and microgrid suitability across the state
- Engage with key stakeholders to collect relevant datasets and input to conduct a comprehensive microgrid suitability and economic assessment
- Align with the White House's Justice40 Initiative, FEMA BRIC program, IIJA, and other federal and state funding opportunities for enhanced grid and community resilience



Source: U.S. National Oceanic and Atmospheric Administration, Billion-Dollar Weather and Climate Disasters (2022)

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Landscape Review

Landscape Review

Data Collection - Overview

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Analysis in this study was developed based on data collected by SEPA in three following:

Critical Infrastructure and Natural Hazard Risks

- Critical Facility Types
- Natural Hazard Risks
- Designated Emergency Shelters

Energy Equity and Environmental Justice

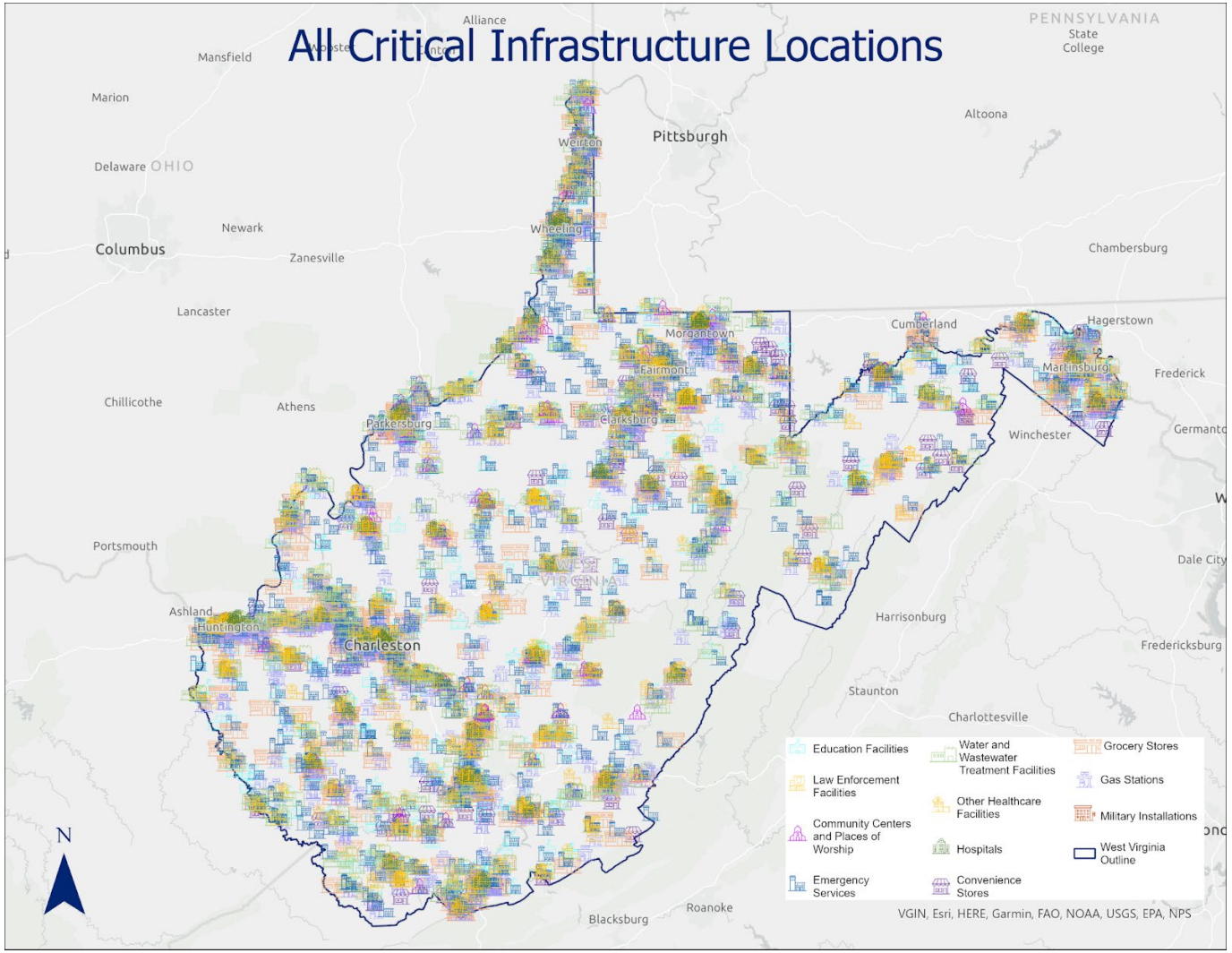
- Population Density & Urban Areas
- ARC Defined At-Risk and Distressed Areas
- Justice40, US DOE/DOT Defined DACs

Utility Planning and Operations

- Utility-Defined Essential Customers
- Distribution System Reliability
- Historical Transmission System Outages

Landscape Review

Data Collection – Critical Infrastructure and Natural Hazard Risk



Landscape Review

Data Collection

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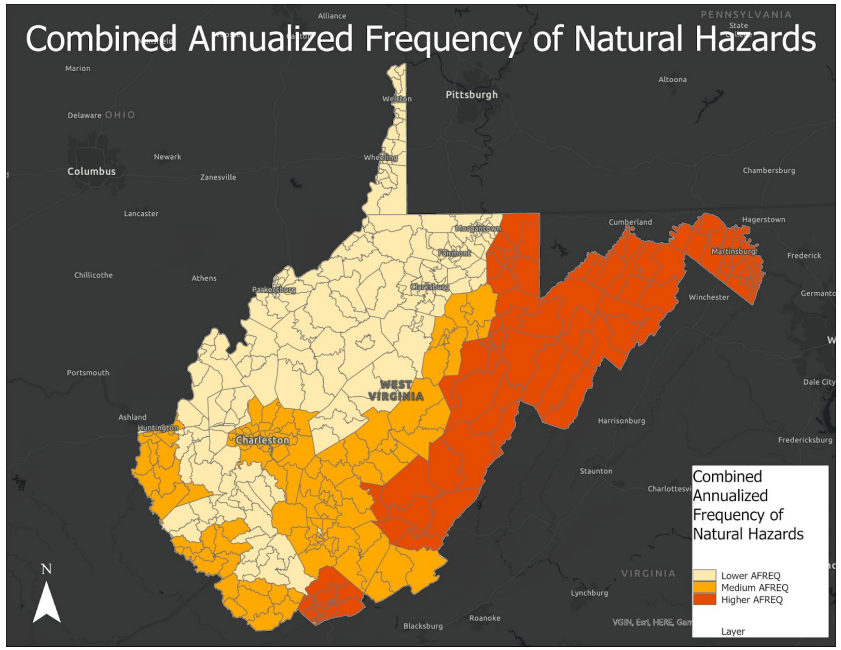
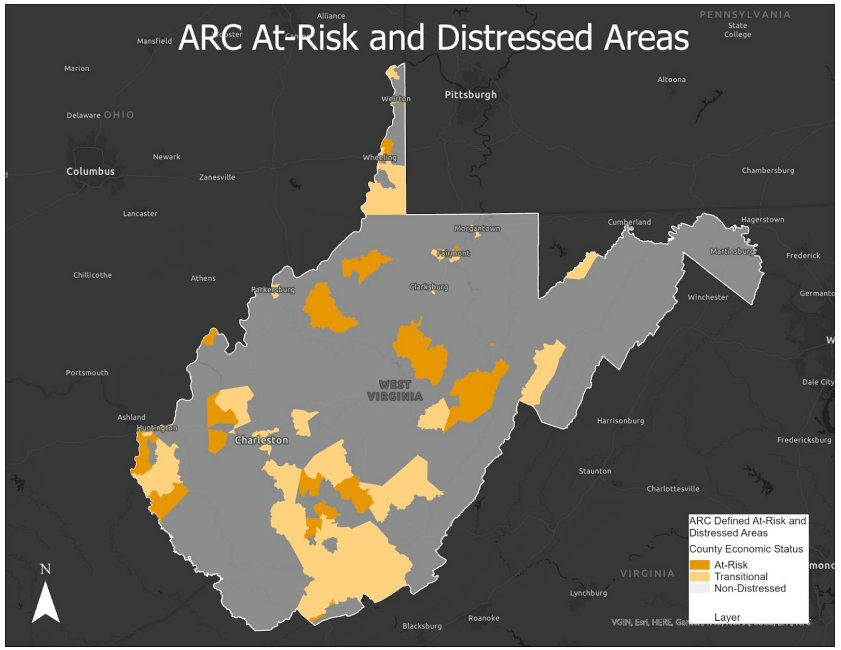
Natural Hazard Risk Data



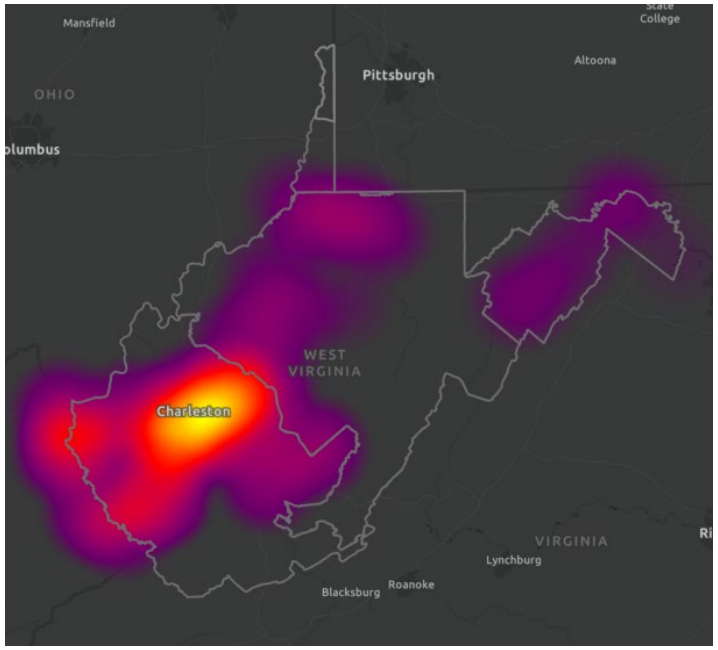
Source: Smart Electric Power Alliance (2022) based on data from FEMA's National Hazard Index, NOAA's NCEI Storm Events Database, WV GIS Technical Center, WV Division of Forestry, and National Inventory of Dams (2022).

Energy Equity and Environmental Justice Data



Source: Smart Electric Power Alliance (2022) based on data provided by the Appalachian Regional Commission (2022).

Utility Planning and Operations Data



Source: Smart Electric Power Alliance (2022) based on data from West Virginia Public Service Commission, Electric Distribution Utility Annual Reliability Reports (2019, 2020)

GIS Microgrid Suitability and Resilience Needs Mapping by Census Tract

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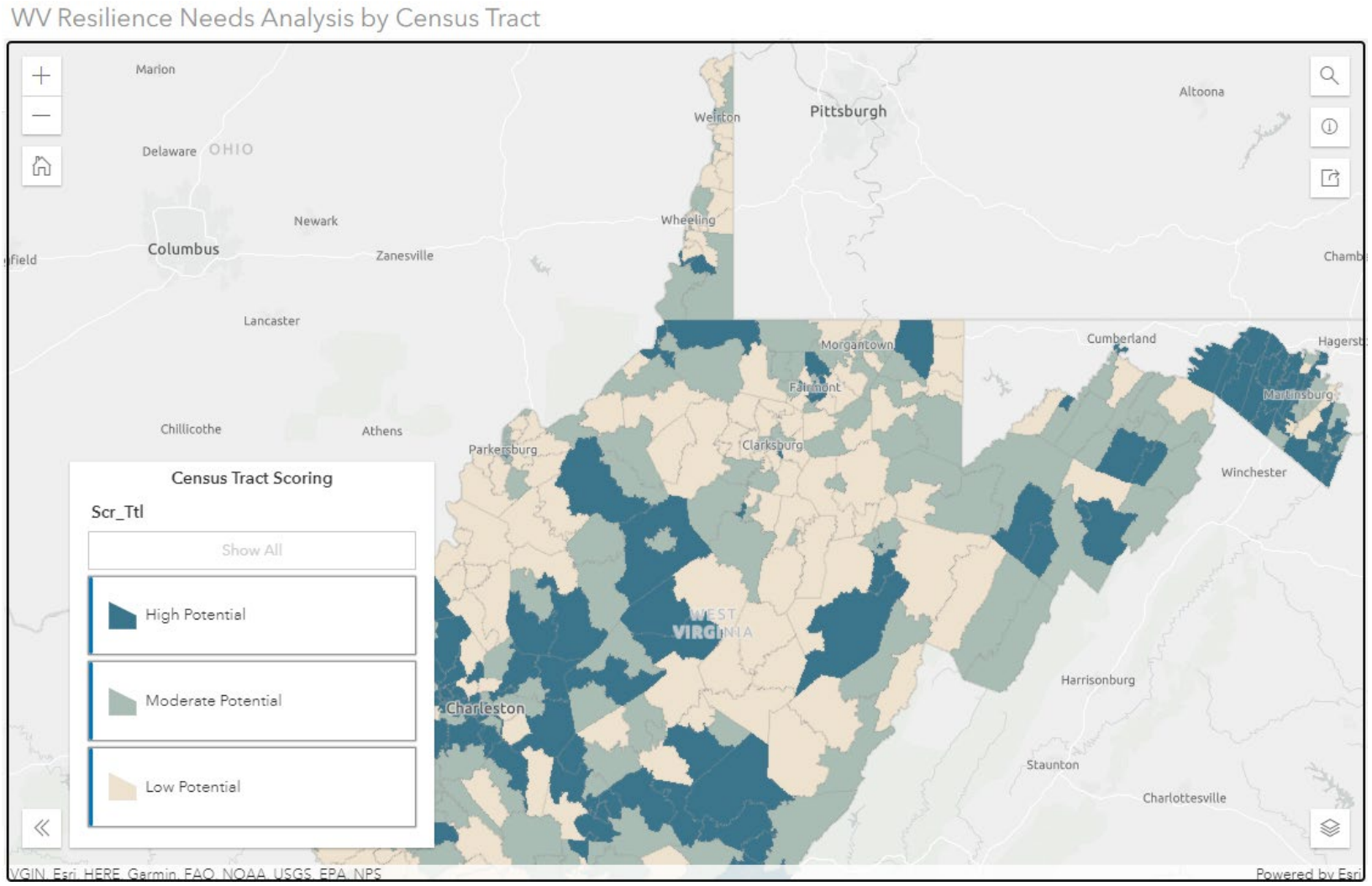

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GIS Microgrid Suitability

Site Selection Methodology

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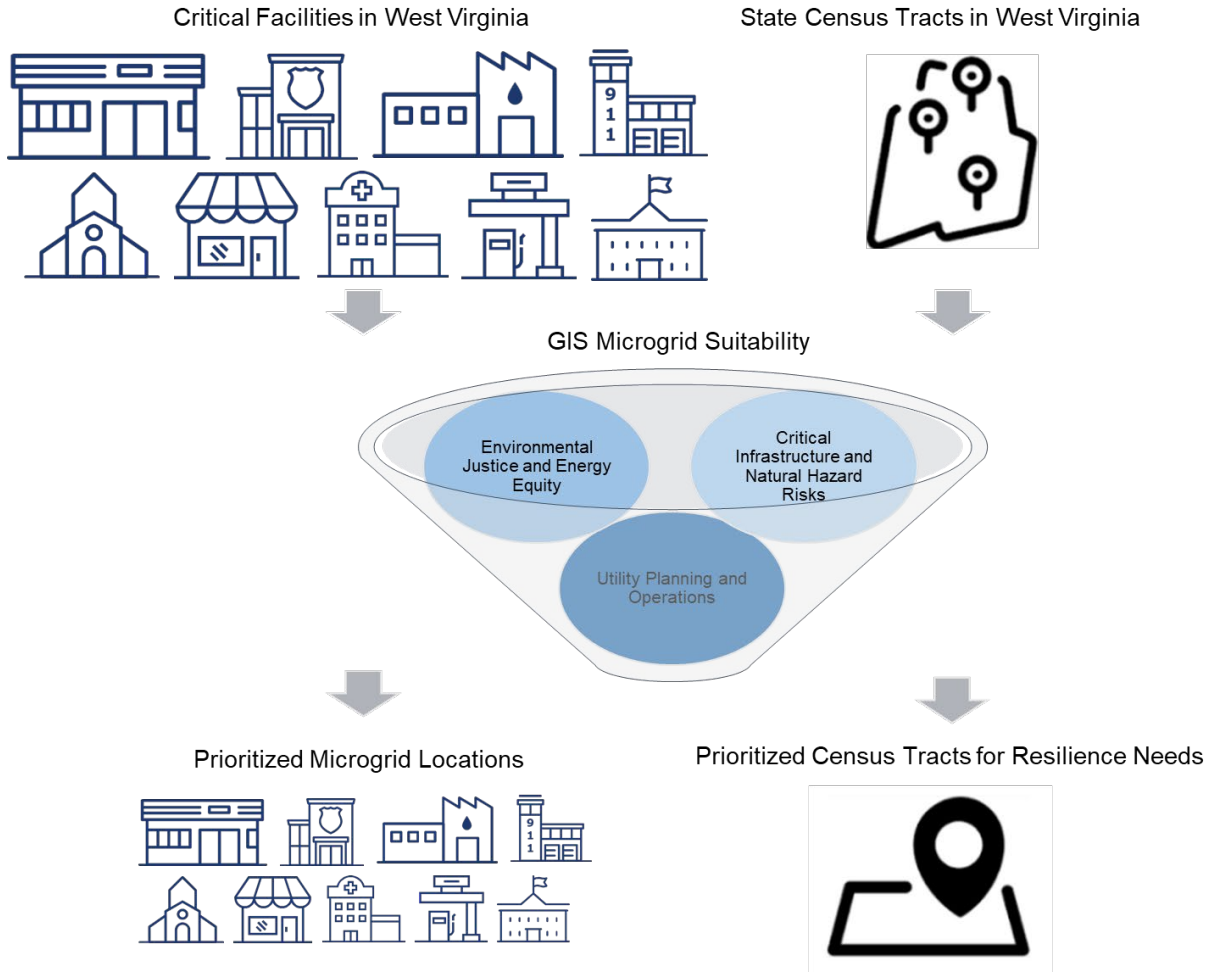
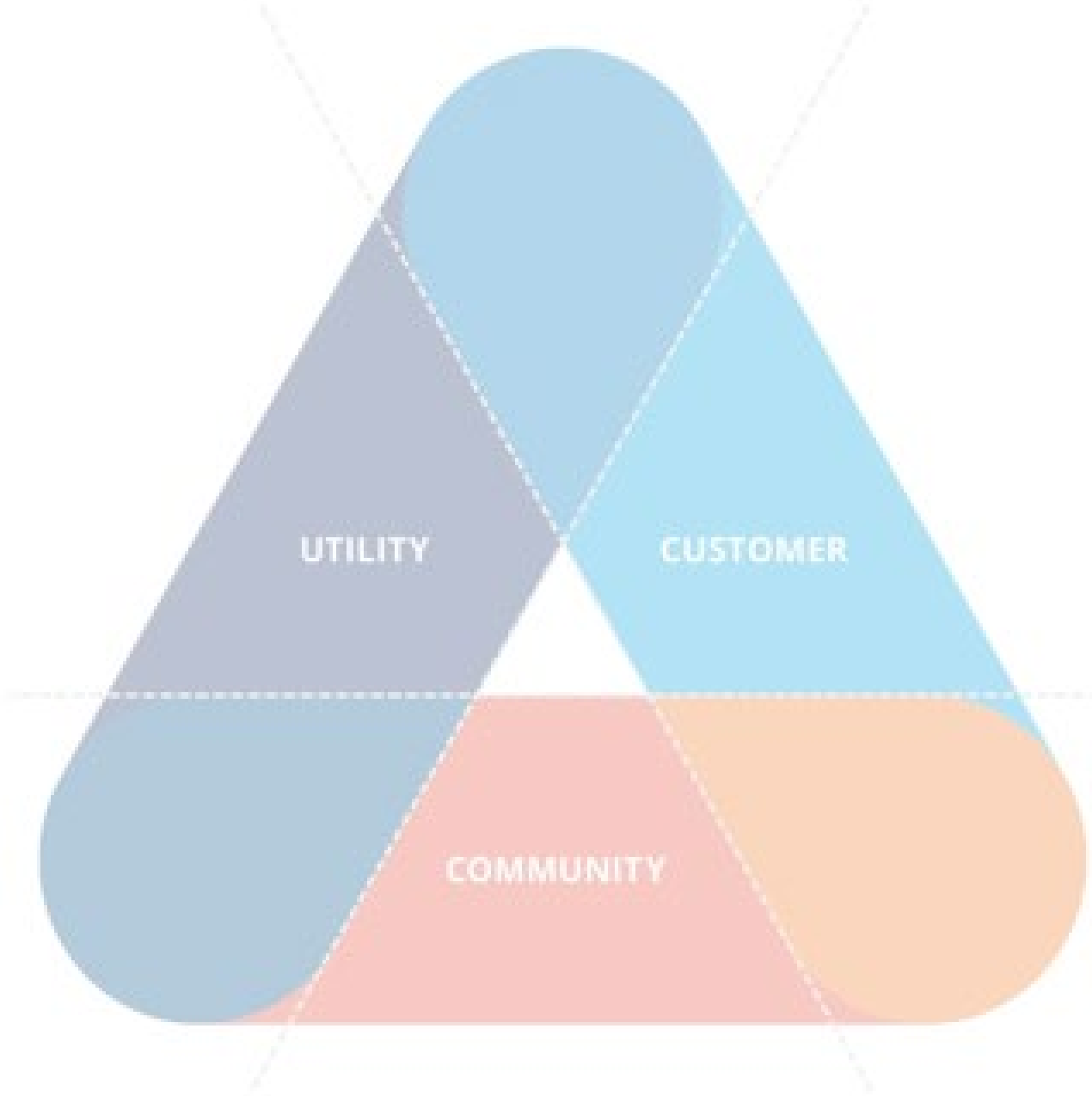
Determining suitable sites and communities that would benefit from microgrids

1. Conduct pre-screening for all critical facilities
2. Assign critical infrastructure and natural hazard risks scoring for each critical facility and census tract.
3. Assign energy equity and environmental justice scoring for each critical facility and census tract.
4. Assign utility planning and operations scoring for each critical facility and census tract.
5. Select the highest scoring critical facility for potential microgrid deployment (site-specific, BTM / FTM, joint investment, grid-scale, battery demonstration)
6. Select the highest scoring census tract for potential resilience projects





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Microgrid Deployment Strategy

Microgrid Design and Analysis

Illustrative Comparative Analysis of Conceptual Microgrid Scenarios

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High Renewable MG

- Emissions Reduction: **High**
- Projected Cost: **High**
- Renewable Islanding: **2 Days**
- Generator Support: **n/a**

Mid Renewable MG

- Emissions Reduction: **Medium**
- Projected Cost: **Medium**
- Renewable Islanding: **1 Day**
- Generator Support: **365 days**

Low Renewable MG

- Emissions Reduction: **Low**
- Projected Cost: **Low**
- Renewable Islanding: **6 hrs**
- Generator Support: **365 days**

Emissions reduction potential **Economics** cost, $ **Carbon-free** islanding duration **Fossil fuel** islanding duration

Based on load and solar analysis, microgrid scenarios of solar PV, battery energy storage, and standby generation were developed. The high renewable scenario includes only solar PV generation and a battery energy storage system (BESS), which is able to provide 48 hours of renewable islanding capability albeit at a higher cost. The mid- and low- renewable scenarios offer less costly microgrid designs that propose smaller solar PV and BESS components that are able to provide reduced renewable islanding capabilities that are offset by natural gas standby generators to provide indefinite islanding capabilities.

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GIS StoryMap and Toolkits

Prioritize Microgrid Locations

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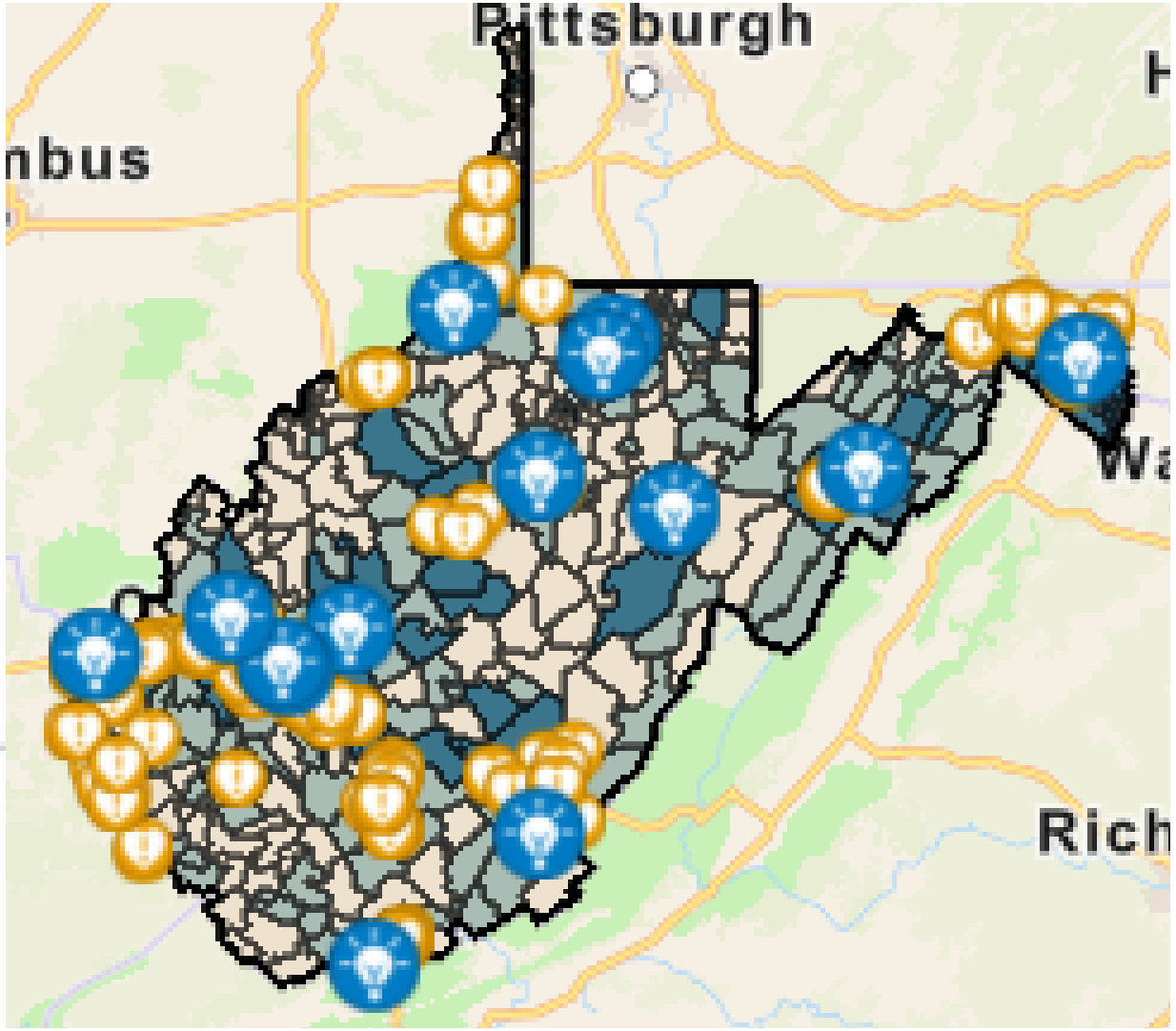
Snapshot from [SEPA's WV GIS Resilience Needs Map]



Community Microgrids

Prioritized Microgrid Locations

Boundaries & Borders

State Border

Census Tract Borders

Census Tract Resilience Needs Analysis

Total Census Tract Score

Scr_Ttl

Higher Potential

Moderate Potential

Lowest Potential

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Conclusion

Key Takeaways

Lessons learned to consider

- Customers need to first understand resilience is a grid issue that can be solved in many different types of ways. It is important to consider microgrids as one solution of many to be explored.
- Evaluating microgrids by looking at the problems they are trying to solve and the services they can provide is a key step to build an understanding of where microgrids can provide the most resilience value in West Virginia
- Utilizing this study to facilitate early and often coordination between utilities, local and state governments and other stakeholders in West Virginia, who each have specific roles and responsibilities can support utility operations and planning of the electric system and emergency preparedness planning
- Identifying potential microgrid sites for community resilience in West Virginia requires a combination of inventorying critical infrastructure facilities, defining areas of natural hazard, system and social vulnerabilities, and evaluating load profiles and microgrid scenarios
- While this study focuses on microgrids as a community resilience solution, the mapping tools and datasets compiled as a part of this project can be leveraged for energy and community resilience planning across the state

Next Steps

Leveraging results for ongoing and future initiatives

State Energy Office	Utilities	Emergency Management
Leverage additional technical feasibility studies developed by SEPA to conduct more detailed benefit-cost analysis on a site-by-site basis to account for actual rates, energy consumption trends, and site feasibility.	Integrate results and analysis in this study with distribution and integrated resource planning teams to identify win-win microgrid projects as non-wires solutions within the community.	Pursue FEMA BRIC applications to conduct site-specific feasibility studies and build microgrids prioritized in this study with key stakeholders from West Virginia Emergency Management Division and FEMA.
Build partnerships at identified microgrid locations and census tracts with resilience needs to implement projects and to apply for funding opportunities.	Leverage prioritized list of potential microgrid projects to pursue resilience as a service program offerings.	Update state security and energy assurance planning to include microgrids as one solution set.
Leverage additional technical feasibility studies developed by SEPA to conduct more detailed benefit-cost analysis on a site-by-site basis to account for actual rates, energy consumption trends, and site feasibility.	Leveraged prioritized list of potential microgrid projects to pursue DER program offerings for critical customers and within communities of resilience need.	Update hazard mitigation planning to include microgrids for resilience strategies and census tract resilience needs outlined in this report.
Pursue IIJA state formula funding to conduct additional technical assistance and stakeholder engagement at specific sites or within specific communities.	Pursue potential microgrid projects and associated funding applied towards projects located on or near-by mine lands	

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Questions?

Mac Keller
Senior Analyst, Research & Industry Strategy
Smart Electric Power Alliance
mkeller@sepapower.org
202-559-2030