

ROADMAP TO RESILIENCE



October 2020 PUB2885

ACKNOWLEDGMENTS	ACRONYMS	EXECUTIVE SUMMARY	INTRODUCTION	DEVELOPMENT PROCESS	STAKEHOLDER ENGAGEMENT	BASELINE ANALYSIS	
LEVERAGE PARTNERS AND ASSETS	IDENTIFY INNOVATIVE FUNDING SOURCES	FEDERAL & NATIONAL LAB RESOURCES	MEASURE SUCCESS	PARTNER COMMUNITIES	CONCLUSION	APPENDICES	DEPARTMENT OF NATURAL RESOURCES

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1 ACKNOWLEDGMENTS

The Missouri Department of Natural Resources' Division of Energy developed the Partnering with Missouri Communities: Roadmap to Resilience (Roadmap) with assistance from AECOM, Consumer Council of Missouri, Paragon Business Solutions and the Midwest Energy Efficiency Alliance. The Roadmap is intended to support the U.S. Department of Energy's partnerships with local governments, which drive innovative opportunities for energy efficiency and renewable energy practices that improve energy affordability, reliability and resilience. We would like to recognize and thank those who participated in the development of this Roadmap, including members of the partner communities (the City of Rolla, the City of St. James and the City of Stockton) for providing essential information, data and insights throughout the process.





2 ACRONYMS

ANCR The Alliance for National and Community Resilience

CDBG Community Development Block Grant Program

CPP Critical peak pricing

CWSRF Clean Water State Revolving Fund

DSIRE Database of State Incentives for Renewables and Efficiency

DWSRF Drinking Water State Revolving Fund

EPA Environmental Protection Agency

ESA Energy service agreement

ESCO Energy savings company

ESPC Energy savings performance contracts

FEMA Federal Emergency Management Agency

HUD Department of Housing and Urban Development

ILSFA Illinois Solar for All

IOU Investor-owned utility

LEED Leadership in Energy and Environmental Design

MEEA Midwest Energy Efficiency Alliance

MoDOT Missouri Department of Transportation

MoDNR Missouri Department of Natural Resources

MDHEWD Missouri Department of Higher Education and Workforce Development

MPUA Municipal Public Utility Alliance

MRCTI Mississippi River Cities and Towns Initiative

NAP Neighborhood Assistance Programs

NEA National Endowment for the Arts

NIBS National Institute of Building Sciences

NIDIS National Integrated Drought Information System

NREL National Renewable Energy Laboratory

NYSERDA New York State Energy Research and Development

OBF On-bill financing

OBR On-bill repayment

PACE Property Assessed Clean Energy

PPA Power purchase agreement

PPP Public-private partnership

PTR Peak-time rebate

SBA Small Business Administration

SMSC Small- to medium-size communities

SEARCH Special Evaluation Assistance for Rural Communities and Households

SEP State Energy Program

REAP Rural Energy for America Program

REDA Renewable Energy Development Assistance

RESP Rural Energy Savings Program

RFI Request for information

RTP Real-time pricing

T&D Transmission and distribution

TOU Time-of-use

USDOE United States Department of Energy

USDA United States Department of Agriculture

VPP Variable peak pricing



EXECUTIVE SUMMARY ACRONYMS

MEASURE SUCCESS



3 EXECUTIVE SUMMARY

Resilience for Small-to Medium-Sized Communities

The ability of communities to withstand, adapt to and reduce the impact of acute shocks and chronic stresses while preserving and improving their unique characters, sense of community and livability.

Resilience Vision

Resilient small-to-medium-sized communities are equipped with energy resources to thrive environmentally, socially and economically in the face of chronic stresses and acute shocks.



Resilient communities keep families safe, provide opportunities for improved livability and promote long-term stability. Such communities can reinforce and strengthen community cohesion. Even so, the road to resilience can be daunting, particularly for SMSC¹. Many smaller communities face unique challenges compared to their larger counterparts, including lower population densities and lack of investment². These challenges can exacerbate a community's lack of preparedness and increase barriers to effective resilience. planning.

The Roadmap to Resilience was developed to support SMSC on their paths towards resilience. This work recognizes that improving access to affordable, reliable and resilient energy services is often at the core of ensuring community resilience. The information presented is based upon leading practices and baseline analyses for existing resilience planning efforts in communities in order to identify and develop priorities, tools and implementation strategies.

As part of the Roadmap development process, the cities of Rolla, St. James and Stockton agreed to engage as partner communities. These cities represent different geographies, demographics, assets, priorities and existing resilience initiatives,

all of which were considered throughout the development of the Roadmap to create a flexible, scalable approach. Additionally, partner organizations such as the Consumer Council of Missouri (CCM), Midwest Energy Efficiency Alliance (MEEA), Municipal Public Utility Alliance (MPUA), Office of Public Counsel (OPC) and Renew Missouri.

The Roadmap is comprised of six guiding actions that SMSC can use to navigate resilience efforts. The actions focus on energy efficiency and renewable energy solutions, opportunities for collaboration and partnerships, funding solutions, methods to reduce energy burdens and utility rate structures that promote resilience. These actions will guide community resilience planners through assessing, envisioning, implementing and evaluating the successes of their unique resilience initiatives.

¹ For the purposes of this document, small-size communities are defined as rural areas, non-urban areas with a population of less than 2,500 people. medium-size communities are defined as urban clusters, which are urban areas with a population of 2,500 to 50,000 people. U.S. Census Bureau (2019). 2010 Census Urban and Rural Classification and Urban Area Criteria. September 04, 2020. census.gov/programs-surveys/geography/quidance/ geo-areas/urban-rural/2010-urban-rural.html.

² U.S. Department of Energy. Rural Resources for States, Local Governments, and K-12 School Districts. Retrieved September 04, 2020. energy.gov/eere/slsc/downloads/rural-resources-states-local-governments-and-k-12school-districts.



4 INTRODUCTION

Small- to Medium-Size Community Resilience

One-third of Americans live in incorporated SMSC³. However, SMSC are facing crises of economic decline, decreasing population, aging infrastructure, lack of investment and other issues contributing to a state of chronic stress. There is an urgent need for resilience planning to aid in mitigating stresses and improving the ability of SMSC to recover from large-scale events such as natural disasters and extreme weather events. In order to best meet these needs, effective resilience planning should focus on the unique environmental, social and economic factors of SMSC. Despite the unique barriers these smaller communities face, their smaller size also affords an intimate knowledge and familiarity with multiple community systems, an increased likelihood of coordination across regions and grass-roots community engagement. Additionally, these communities often have shared systems, such as utility operators that may simultaneously be responsible for water treatment and potable water service delivery, that enable more streamlined knowledge flow and processes. These community strengths enable local leaders to address

Figure 1. Chronic Stresses and Acute Shocks Defined

Chronic Stress

Persistent, long-term issues or hardships that weaken a community's social, economic, and environmental fabric and exacerbate outcomes to acute shocks. Examples include:

- Declining population.
- Energy burden.
- Inefficient public transportation systems.
- Poor air and soil quality.

Acute Shock

Sudden, high intensity events that pose a direct threat to a community. Examples include:

- Tornados.
- Disease outbreaks.
- Extreme heat.

challenges with limited compartmentalization and contribute to the development of successful and comprehensive resilience plans that are rooted in collaboration and community engagement.

Key Resilience Challenges

As focus on urban resilience grows and a larger proportion of available resources is funneled to larger cities, the resilience gap is widening between cities and SMSC, increasing a dynamic of inequity⁴. Continued population decline and challenge to community development are expected to further increase this resilience gap. Without funding strategies and partnerships that target unique SMSC needs, these communities will continue to face environmental, social and economic challenges with limited ability to prepare, recover and grow.

SMSC are typically more frequently and directly affected by chronic stresses than acute shocks. A comparative assessment of community resilience within FEMA Region 4⁵ shows that rural areas exhibit lower levels of resilience than urban areas, due to below average infrastructure and institutional resilience as well as low social and community capital resilience⁶⁷. In contrast, the

³ U.S. Census Bureau (2019). 2010 Census Urban and Rural Classification and Urban Area Criteria. September 04, 2020. census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html.

⁴ Cutter, S.L., Ash, K.D., and Emrich, C.T. (2016). Urban-Rural differences in disaster resilience. American Association of Geographers, 106(6), 1236-1252.

⁵ FEMA Region IV 4 includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

⁶ Institutional resilience is defined as characteristics related to mitigation, planning, and experience with disaster events.

⁷ Social and community capital resilience refers to the availability of resources to support community organizations and resources that enhance sense of community, place attachment and community participation.



most resilient counties are within metropolitan areas and have high social, economic and institutional resilience⁸. Social, community, economic and institutional resources can not only strengthen community fabric to prevent chronic stresses, but also can help communities strengthen systems to alleviate chronic stresses and respond effectively after acute shocks.

A lack of robust infrastructure can increase vulnerability during an extreme weather event and prolong recovery time due to a lack of system redundancy or resources. Through holistic resilience planning leaders and decision-makers consider various systems and infrastructure that are integral to the social, economic and environmental wellbeing of their unique community such as energy systems, critical infrastructure, economic factors and community operations. Without holistic resilience planning, communities will face challenges in attracting and retaining citizens and businesses. This can contribute to issues of declining population that many communities already face and make economic growth more challenging. As a result, the presence of chronic stresses can intensify the consequences and impacts of larger-scale events, such as extreme weather events, by weakening societal fabric over time.

Focus of the Roadmap to Resilience

This Roadmap to Resilience document presents a set of actions and processes that enable communities to develop resilience plans that address their unique interests and priorities. The Roadmap is intended to provide scalable and applicable information to many SMSC. Improving energy systems is often at the core of resilience planning, so the Roadmap centers on resilient and reliable energy systems that include a combination of both energy efficiency measures and renewable energy infrastructure. Through energy efficiency and renewable resources, communities can increase resiliency by reducing critical load, increasing redundancy, reducing energy burden and hardening infrastructure.

The chapters that follow outline approaches to resilience and baseline actions that can enable communities to address energy efficiency, renewable energy adoption and energy cost burden reduction, with attention paid to the special needs of vulnerable populations. To do so, the Roadmap provides leading practices, case studies, resilience tools and mitigation strategies that demonstrate the value of using a comprehensive approach to planning in order to account for interrelated resilience impacts on environmental, social and economic performance. To inform the Roadmap's comprehensive approach, three Missouri communities were selected to provide input throughout the development process: the cities of Rolla, St. James and Stockton.

Roadmap Framework

The Roadmap to Resilience is based on four general phases of resilience planning. These phases frame the approach for the Roadmap and are presented in this section. The resilience actions presented support one or more of these resilience phases. All four phases are guided by the prevailing concepts of governing with transparency and inclusivity, which will build local support and effectively and comprehensively identify and address areas of priority to the community.

1 ASSESS. Defining critical areas and examining existing conditions. In this phase, communities define their resilience objectives and goals as well as identify resilience threats and stressors. It is critical to have a variety of stakeholders involved in this phase because of the value of having comprehensive and cross-sectoral representation. Additionally, a baseline assessment of existing energy assets and conditions is outlined to serve as a foundation

for resilience-building efforts. Examples of assessment considerations include existing community energy burden, utility structure and distributed energy resources.

2ENVISION. Collectively set resilience goals and quantitative targets. Communities use the baseline conditions identified in the "Assess" phase to envision actionable targets that can be achieved through implementable measures. Feedback and approval from stakeholders and local authorities is solicited as needed in order to refine and finalize energy targets and goals.

⁸ Cutter, S.L., Burton, C.G., Emrich, C.T. (2010). Disaster Resilience Indicators for Benchmarking Baseline Conditions. Journal of Homeland Security and Emergency Management. Vol. 7: Iss. 1, Article 51. 10.2202/1547-7355.1732.



3 IMPLEMENT. Engage participants and integrate solutions.

Communities work with key stakeholders to define clear, actionable steps to implement initiatives that accomplish the targets set in the "Envision" phase. This will include developing partnerships and timelines, as well as considering funding sources to implement effective initiatives.

4 EVALUATE. Evaluate potential impacts and benefits of investments and initiatives.

Communities monitor strategies and progress on critical areas, report findings and adjust planning

ongoing monitoring of metrics and goals. To support the four phases, six actions have

and implementation as needed to support

been applied to serve as building blocks for communities to launch their resilience planning efforts through each phase. These actions are:

- Stakeholder Engagement.
- Baseline Analysis.
- Leverage Partners and Assets.
- Identify Innovative Funding Sources.
- Use Federal and National Lab Resources.
- Measure Success.

Each of these actions are expanded upon in subsequent chapters of the Roadmap. The diagram in Figure 2 shows what actions enable communities and resilience planners to accomplish each of the four phases. Throughout the Roadmap, each action will be accompanied by the graphical badge that represents the phase(s) it supports. It should be noted that the developed framework and actions are overarching and interdisciplinary actions which support resilience visioning for many areas of planning. The Roadmap applies the framework and tools to the focused area of enhanced energy resilience.



Figure 2. Roadmap Framework



5 ROADMAP TO RESILIENCE DEVELOPMENT PROCESS

Stakeholder Engagement Process

In order to develop a thorough understanding of resilience needs of SMSC and inform the development of the Roadmap to Resilience, it was critical to conduct outreach to stakeholder groups and prioritize stakeholder engagement. Engaged partners and stakeholders provided information that was aggregated and synthesized with existing resilience planning resources to guide Roadmap development.

Along with the partner communities, the Project Team engaged the MPUA, MEEA, CCM and Renew Missouri. Additional stakeholders such as municipal utilities, local government officials, owners and facility managers of critical facilities, energy efficiency professionals and emergency planning personnel were invited to attend a series of stakeholder engagement workshops and, in specific instances, were also engaged through individual conversations. The discussions provided opportunities for stakeholders and partners to voice concerns, identify co-benefits and leverage partnerships.

Initial Community Meetings

Stakeholder engagement began with one-on-one meetings held in each of the partner communities. The invitees are summarized in Table 1.

Table 1. Initial Community Meetings Summary

PARTNER COMMUNITY	INVITEES	DATE ENGAGEMENT HELD
City of Stockton	Mary Norell, Mayor	June 5, 2019
City of St. James	Rick Krawiecki, Mayor James Fleming, City Administrator Harold Selby, Former City Administrator	June 6, 2019
City of Rolla	John Butz, City Administrator Steve Hargis, Public Works Director	June 6, 2019





The Project Team held in-depth conversations with each community about its community profile. Community representatives provided overviews of their communities, perceived resilience strengths and weaknesses, current barriers to improving resilience, existing partnerships and priorities. During these discussions, the Project Team solicited specific information related to resilience that included discussion of utility rate structures, energy assets, utility customer demographics and needs and existing energy system performance. Many of the representatives were accompanied

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by supporting staff and personnel from their local utility to attend and provide additional information.

Meeting each community in its respective city, rather than at an off-site location, proved instrumental in developing relationships with local officials. This effort allowed the Project Team to experience each location in person and gather information related to how residents experience their own communities. Driving through Stockton and seeing the solar panels outside of the city hall, walking through the campus of the Missouri University of Science and Technology in Rolla and seeing the small businesses of St. James provided additional context and laid the groundwork for the subsequent workshops.

Stakeholder Engagement Workshops

Following the initial one-on-one meetings, four workshops were held to convene stakeholders, present leading practices regarding resilience and obtain feedback and community perspective. Each of the stakeholder engagement workshops was focused on a specific topic relevant to resilience in SMSC. A summary of the workshop topics is shown below in Table 2, and the findings from each of the workshops are provided in Appendix D.

Table 2. Stakeholder Engagement Workshop Summary

WORKSHOP	ТОРІС	DATE HELD
First	Energy and Critical Facilities Infrastructure	July 30, 2019
Second	Economic Development and Growth	Sept. 12, 2019
Third	Resilient Community Operations	Oct. 22, 2019
Fourth	Energy Burden	Nov. 21, 2019

Each workshop was structured to include three primary components:

COMMUNITY REPORT-OUTS.

In advance of each workshop, guiding questions were sent to the partner communities to assist with preparation for small group discussions.

2PROJECT TEAM OR SPEAKER PRESENTATIONS.

The Project Team prepared presentations to provide information relevant to the designated topic for each workshop. Guest speakers were also invited to participate, as appropriate.

SMALL GROUP DISCUSSIONS.

Groups were asked to take 10 to 15 minutes to discuss focused discussion questions, followed by report-outs of summaries and preliminary conclusions to the broader group.

Regional Inventory

A comprehensive inventory of existing resilience efforts and leading practices was cataloged as part of the broader Roadmap development goals and tasks. Existing community efforts were evaluated for priority considerations, partnership opportunities, funding sources and current practices. This evaluation informed metric development, partnering opportunities, funding and financing options and optimal utility rate structures to address critical infrastructure facilities, energy burden and overall community resilience.

Community efforts from various geographic regions, population densities, economic conditions, community demographics and other factors were reviewed for a holistic view of how communities around the nation address resilience. After reviewing and comparing approaches, information was distilled at a high-level to identify leading practices and case studies pertinent to resilience planning efforts for SMSC.



Funding Source Review

Research was conducted to identify how cities of varying sizes fund resilience projects, as funding is a common barrier to SMSC moving forward with implementing plans and initiatives. Topics included types of funding approaches, funding databases, application processes and leading practices. Additionally, a review of funding databases and resources such as the Database of State Incentives for Renewables and Efficiency (DSIRE), Grants. gov and the U.S. Department of Energy's (USDOE) Better Buildings Finance Navigator was conducted to identify available grants and incentives, eligible project types and applicant groups and funding amounts⁹. Grant, incentive and financing options targeted at SMSC and rural areas were highlighted. In addition, information from key stakeholders who have performed research on funding opportunities specifically targeted to SMSC was reviewed.

Metric Development

A review of existing resilience metrics was conducted to determine variables correlated to community resilience. These existing metrics were used to develop resilience metrics for SMSC. The resilience metrics and goals of communities of varying sizes were examined to identify additional areas of importance and examples of other metrics, such as prioritizing electric system resilience or energy burden. Following the assessment of potential variables and metrics, information provided by the three partner From the information obtained, a suite of metrics was developed. The metrics were designed to measure areas that correlate to a community's level of resilience and are of importance for medium and small communities. Ease of measurement and availability of data were paramount in creating the metrics. Recognizing the unique circumstances of each community, specific metrics were developed to allow cities to set targets reflective of their current situations, goals and potential for progress. The metrics are presented as a catalogue from which communities can select those items that are applicable to meeting their resilience goals.

Existing Resilience Plans and Standards

In developing the Roadmap, a review of existing resilience plans and standards was conducted to evaluate areas to address in further detail.



communities was reviewed to determine priority areas, available data and current measurement methods.

⁹ DSIRE: dsireusa.org/.

Grants.gov: grants.gov/.

DOE Better Buildings Finance Navigator: betterbuildingssolutioncenter.energy.gov/financing-navigator

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Resilience Plans

A number of plans, initiatives and other efforts that are rooted in strategic planning efforts, most for SMSC are presented in Table 3. Although they are not always identified as "resilience" plans, they are based on efforts to improve resilience and are often connected to other community priorities, ongoing initiatives and activities. It should be noted this is not a comprehensive list and there are additional community resilience or climate action plans produced by other communities.

Table 3. Plans, Initiatives and other Efforts Based on Strategic Planning Efforts

COMMUNITY	PLANS, INITIATIVES AND OTHER EFFORTS	YEAR
Greensburg, Kansas	Sustainable Comprehensive Master Plan ¹⁰	2012
Illinois	<i>Illinois Solar for All</i> : program with program documentation including a vendor manual, QA/QC manual and technical guidelines ¹¹	2019
Mississippi River	<i>Mississippi River Cities and Towns Initiative</i> : initiative rooted in programs, events and platforms rather than an official plan ¹²	2012
Nashua, New Hampshire	<i>Livable Nashua</i> : Interactive dashboard and online tool, rather than traditional plan document ¹³	2018
Nevada City, California	Nevada City Energy Action Plan ¹⁴	2015
Saratoga Springs, New York	2015 Comprehensive Plan ¹⁵ Builds off of NYSERDA's Climate Change in New York State Plan	2015
Weed, California	City of Weed Community Inspired Resilience Plan ¹⁶	2016
St. Louis, Missouri	Climate Action and Adaptation Plan for the City of St. Louis Sustainability Plan ¹⁷	2017
Kansas City, Missouri	Metro KC Climate Action Plan ¹⁸	TBD

¹⁰ Greensburg, Kansas. (2008). Sustainable Comprehensive Master Plan. September 04, 2020. greensburgks.org/residents/recovery-planning/sustainable-comprehensive-master-plan/view.

¹¹ Illinois Solar For All. September 04, 2020. llinoissfa.com/.

¹² Mississippi River Cities and Towns Initiative. September 04, 2020. mrcti.org/.

¹³ Livable Nashua. September 04, 2020. livablenashua.org/home.

¹⁴ Sierra Business Council. (2015). Nevada City Energy Action Plan. nevadacityca.gov/files/documents/EnergyActionPlan1314062855072016PM.pdf.

¹⁵ Saratoga Springs, New York. Sustainability and Resiliency. saratoga-springs.org/DocumentCenter/View/3928/2015-Comprehensive-Plan.

¹⁶ City of Weed. (2016). City of Weed Community Inspired Resilience Plan. resilience-weed.org/.

¹⁷ City of St. Louis. (2017). Climate Action and Adaption Plan for the City of St. Louis Sustainability Plan. stlouis-mo.gov/government/departments/planning/sustainability/documents/cap-final-report.cfm.

¹⁸ Climate Action KC. mkccac.org/.





Resilience Standards

Standards are typically used as evaluation tools that can enable practices and established benchmarks to become widely accepted in communities and organizations. In addition, standards can demonstrate that a community's buildings, infrastructure, or systems have met a level of achievement recognized as acceptable or superior. Standards can be used in a variety of ways to meet resilience goals. Most frequently, standards are:

- Adopted into codes or policies.
- Used to evaluate current performance and identify goals or areas for improvement.
- Used to demonstrate action, progress and leadership.

Appendix B provides information on standards that may be useful to communities in their resilience planning and implementation activities. Of the resilience standards available for reference, the majority focus on discrete systems, such as buildings or performance objectives, which often include energy efficiency. Local building codes, normally based on nation- or industrywide consensus standards, are the most common example.

Communities can adopt model building codes either in whole or in part. Buildings that are at or above code withstand weather and fire events and address occupant safety better than those not at code. It is estimated that current energy codes provide more than 30% energy savings compared to those 10 years or older¹⁹. Even without building codes, public and private entities can adopt policies incorporating standards to meet resilience goals.

Although standards that address communityfacing impacts are critical to ensuring resilience, such as safety and economic development, there are relatively few standards that address community-wide resilience. Rating systems can allow a community to evaluate its overall level of resilience by looking at functional areas such as housing, energy and food distribution. The Leadership in Energy and Environmental Design (LEED) standards consider categories of sustainability and resilience ranging from energy use to transportation connectivity²⁰. The Alliance for National and Community Resilience (ANCR)

¹⁹ Halverson M.A., et al. 2014. ANSI/ASHREA/IES Standard 90.12013 Determination of Energy Savings: Quantitative Analysis. PNNL-23479, Pacific Northwest National Laboratory, Richland, Washington.

²⁰ U.S. Green Building Council. LEED Rating System. usgbc.org/leed.



has developed Buildings and Housing Benchmarks and is in the process of developing 17 additional benchmarks that communities can, or will be able to, use to evaluate their strengths, vulnerabilities and ability to respond to and recover from disruption²¹. These types of overarching standards, can be overwhelming, costly and time-consuming to use. Smaller communities with limited resources may wish to use standards in targeted areas that are most important to the community rather than attempting to implement an entire suite of standards.

Standards, particularly those with certifications, ratings, or scores, are used to show action towards resilience goals, demonstrate progress and provide concrete examples of resilience and its benefits. For example, a given city can track a facility's performance in the free ENERGY STAR Portfolio Manager® tool as the municipality implements energy and water efficiency or conservation retrofits. By publishing an ENERGY STAR Portfolio Manager®22 score or other building energy metrics, such as energy use intensity, along with information on installed measures, savings, or other information about projects, communities can measure progress towards resilience with regards to efficiency or conservation. Standards can vary in the cost, time, or expertise necessary to use. For example, some standards require significant application fees or independent verification by engineers or other professionals, while others can be accessed by entering information into an online evaluation tool. A community should evaluate which standards are appropriate for application given current resilience status, goals and ability to implement. A holistic set of established standards is particularly valuable to smaller communities with limited resources since the research relating to effectiveness, levels of achievement and criteria for performance have already been created. Six actions have been identified for communities to apply in the implementation of their resilience planning initiatives. They are presented in the subsequent chapters of this Roadmap.

²¹ Alliance for National and Community Resilience. The Community Resilience Benchmarks System. resilientalliance.org/the-benchmarks .

²² Energy Star ®. Energy Star Portfolio Manager ®. energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager.

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6 ACTION #1: **STAKEHOLDER** ENGAGEMENT



Successful stakeholder engagement can produce benefits such as increasing the potential for longterm, broad-based support and the likelihood of successful implementation. Most importantly, stakeholder engagement ensures that planning efforts account for community priorities and existing resilience barriers.

Stakeholders bringing specific knowledge or expertise in a particular area or areas should be engaged throughout the resilience planning process to help assess a community's baseline condition, refine energy targets and goals and assist with developing implementation strategies. Stakeholders are often key to understanding the impacts of planned or existing resilience efforts and evaluating the efforts' effectiveness. Stakeholders may also help community leaders better understand how and when to engage community members at large in resilience planning and education.

Stakeholder engagement processes will vary based upon each community's specific situation, but a number of leading practices have been identified for successful stakeholder engagement.

Stakeholder Engagement Leading Practices

Figure 3. Stakeholder Engagement Leading Practices

INITIAL MEETINGS One-on-one or small group meetings allow leaders and key stakeholders to provide community context, voice concerns and share perspectives.

LOCATION Meetings should be held at local, accessible locations and at convenient times. Local venues allow participants to demonstrate community pride and showcase community assets. Local meetings also increase the opportunity and likelihood of participation. both in attendance and general meeting engagement.

SELECT EFFECTIVE **STAKEHOLDERS**

Focus on technically relevant organizations, governing bodies and financiers that provide representation of a variety of viewpoints and interests for stakeholder engagement. Cities should develop and maintain lists of stakeholders in specific areas with contact information. Steering committees and working groups are examples of stakeholder bodies that are often effective participants in engagement.

MULTIPLE COMMUNICATION PLATFORMS

Multiple engagement methods, such as flyers, town halls, virtual meetings, mailers, social media outreach, focus groups, online surveys and visits to community groups and institutions will help reach different parts of the community.

> CASE STUDIES By reviewing successful case studies of communities in similar situations, stakeholders can gain insight into how other communities were successful and identify practices to

apply locally.

START THE CONVERSATION For data-driven discussions, ask participants to obtain

statistics and other information to present to the group to promote informed discussion. For participant-led conversations, prepare relevant discussion questions for small groups as effective lead-ins. Discussion questions may be circulated to groups to enable thoughtful consideration before small group meetings.

RELEVANT TOPICS

Relevant topics for resilience planning engagement include energy and critical facilities, economic development, resilient community operations and energy burden. Leaders should be encouraged to bring knowledgeable staff to workshops (e.g., emergency

response staff, police and utility personnel). Stakeholders may benefit from being provided definitions or examples of various topics before or during engagement. For example: What are critical facilities; how is energy burden determined?

SHARE EXPERTISE Resilience planning is

most effective when interdisciplinary expertise is shared and leveraged. Successful communities develop planning processes that leverage the roles of multiple departments and agencies. Local organizations that can provide context and insight should not be overlooked.

EMPOWER LOCAL PROVIDE SUCCESSFUL LEADERSHIP Empowering relevant

local organizations to take leadership increases the likelihood that resilience initiatives will be successfully implemented, maintained and well-received.



Case Study 1 Weed, California

Weed, California

The City of Weed is a remote community located along the Interstate- 5 corridor. The city's population of approximately 3,000 people is ethnically diverse because of migrants that work at the local lumber company. The resilience planning efforts began after the Boles Fire destroyed 16% of the city's single-family housing stock in 2014. The fire also destroyed critical infrastructure including the Roseburg Mill, churches and schools. The planning effort was supported in part by the State of California's Community Development Block Grant (CDBG) program. The resulting City of Weed Community Inspired Resilience Plan, which includes a plan for downtown revitalization and identifies 80 elected and informal leaders to serve as resources in promoting the economic and social needs of Weed. The plan focuses on nine categories of resilience planning:

- 1. Leadership, communication and planning.
- 2. Economic sustainability.
- 3. Housing.
- 4. Infrastructure and environmental impact.
- 5. Education.
- 6. Health and well-being.
- 7. Social and cultural.
- 8. Non-disaster emergency safety.
- 9. Disaster preparedness.

For each category, attribute, goals and resources were developed. One of the goals articulated in the plan is to develop alternative energy sources with a strategy of the local Economic Development Corporation and city working with local landholders to install solar panels. Their citizens also indicated an interest in having Weed prioritize vocational workforce training for renewable energy.



Photo courtesy: Barabas

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Board Preparation Workshop

One of the main purposes of collaborating with community stakeholders is to gather and incorporate community feedback. However, organizational boards are not always reflective of the communities that they represent generally. Board membership requirements, such as high membership fees, education requirements, or inaccessible meeting locations, can exclude or discourage low-income, rural, or other disadvantaged community members from joining boards.

Cities can host a series of Board Training Workshops to inform citizens about how they can join an organizational board and provide them with resources to enable broader involvement. The city can invite interested community members to attend a workshop about topics such as the responsibilities of a board member, available positions, financial and time obligations and what questions to ask when considering joining a board. By creating a space to engage vulnerable community members, cities create the opportunity for citizens that face greater participation barriers indicate interest in increasing community's resilience. The city can also invite local organizations that are accepting new board members and looking to better connect with the community to meet with interested community members.

Even though the targeted outcome of these events is to promote comprehensive community representation on organizational boards, such events also present valuable networking opportunities. Community members might make connections beneficial for their professional development and local organizations can increase their community presence and talk to community members about local interests. To further encourage participation of vulnerable populations, organizations should hold meetings and events in accessible locations are familiar to target communities. Organizations can also publicize their events and meetings in places that are widely accessible.

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7 ACTION #2: BASELINE ANALYSIS



Conducting a thorough baseline analysis is a foundational piece of effective resilience planning. The objective of a baseline analysis is to evaluate existing structures, systems, partnerships and initiatives and use the information to identify areas of opportunity.

Leading Practices for Conducting Baseline Analysis

Many resilience leading practices in SMSC mirror those of larger communities and are focused on strategic action, engagement and integrated opportunities. A summary of leading practices in baseline analysis for resilience planning follows:

Define the Baseline

Inventory and measure conditions and boundaries of critical areas. Use reliable data from multiple sources (e.g., state and federal agencies) and identify partners that can assist with data acquisition and management for additional data needs.

Conduct Actionable Risk Assessments

Conduct assessments specific to the community in order to inform pragmatic and incremental resilience plans.

Leverage Stakeholder Engagement Efforts

Use stakeholder engagement opportunities to identify information and data that will contribute to the baseline analysis (e.g., by issuing a Request for Information (RFI), conducting interviews, or issuing surveys.) This form of information gathering is critical to assessing the practicality of initiatives.

Engage the Community

Practice bottom-up, citizen-driven participation for effective resilience planning that addresses community needs. Research shows early engagement can lead to improved outcomes and participation throughout the analysis process²³. Surveys and other forms of community engagement can inform baseline inventories and engage the community early in the planning process.

Take a Strategic Approach

Resilience planning, particularly for SMSC, should emphasize small, smart, incremental investments for ongoing progress and benchmarking rather than large, expensive projects. Identify incremental opportunities to address as the current condition of the community is holistically evaluated.

Realize Co-Benefits

Identify opportunities for multifunctional infrastructure that can address resilience needs and achieve additional community priorities.

Conduct a Financial Inventory

Identify existing financial resources being used, or could be used, to fund resilience measures. Resilience efforts depend on leveraging multiple funding sources, so understanding the existing funding landscape will inform understanding of both funding gaps and opportunities. The analysis may also highlight areas in which education or information is needed about applying for funding sources or to better understand innovative financing techniques that could be used to fund resilient infrastructure.

Create Scalable Solutions

Use strategic planning to identify solutions that can be scaled to meet other communities to meet their unique challenges. By creating scalable solutions, communities are able to apply effective processes to multiple initiatives without needing to re-develop a process each time.

Integrated Resilience Approaches

Use integrated resilience approaches that plan and implement initiatives in a way that not only supports reduction of community vulnerability to a range of threats, but also contributes to improved risk management, city development and community livability.

Prioritize Solutions

Prioritize solutions and initiatives that meet additional community needs and enhance resilience to future threats based on defined goals. If necessary for prioritization, develop weighted criteria that reflect the local priorities, which is key to making scalable solutions.

²³ Reed, M. (2008). Stakeholder participation for environmental management: A literature review. Biological Conservation, 141 (10), 2417-2431.



8 ACTION #3: LEVERAGE PARTNERS AND ASSETS



Opportunities for Collaboration and Partnerships

Developing and using partnerships is important for any community's resilience planning. The objective of developing partnerships is to bring together the skills, resources and perspectives of multiple entities to further resilience planning and implementation in a more comprehensive and effective manner than manner possible through individual efforts.

Leveraging the resources provided by partners can fill critical gaps in funding, expertise, workforce and physical assets, as well as provide other benefits. Partnerships can integrate the community into the surrounding areas and region, align community activities with regional, state and federal initiatives to prevent duplication and provide a broader range of expertise and viewpoints for improved planning processes that more effectively meet community needs. Partnerships also develop relationships that can benefit the community or citizens in areas not directly related to resilience. While partners work toward common resilience goals, they can also realize co-benefits aligned with community needs and hard-to-reach populations. For example, a city can partner with a local non-profit focused on reentry efforts for formerly incarcerated citizens to provide vocational training in the renewable energy field. The Green HVAC program sponsored by the Virginia Department of Correction, in partnership with Johnson Controls, demonstrated that not only could vocational skills related to energy efficiency benefit re-entry goals, but also provide substantial energy savings²⁴. Through a similar a partnership, the city and the non-profit would empower vulnerable community members and promote clean energy, economic development and crime reduction, among other resilience goals and cobenefits.

Types of Partnerships: Informal and Formal

Informal partnerships include collaborative efforts and information-sharing. For example, mayors of neighboring communities may meet periodically to discuss common issues and coordinate activities, or the local electric utility may invite the local fire department to attend occasional joint trainings. Informal partnerships may also be found in ongoing, structured activities, such as a government hydrologist participating in a series of community vulnerability assessment meetings to provide information on flood magnitude and likelihood within a city. It is not uncommon for informal partnerships to evolve into formal partnerships as work progresses from planning into more structured activities.

Formal partnerships are those in which the level of involvement, type of commitment, or nature of the activity require more structured documentation or official action by one of the partners' governing bodies. Such partnerships often occur when more significant resources are involved. Formal partnerships may arise due to particular responsibilities, timelines, resource requirements, risks, legal requirements, or other factors. Documentation can involve a formal contract, a memorandum of understanding, or a work plan. Formal partnerships include those in which one party funds the activities of the other, such as a grant, or when parties share in the responsibilities of a joint activity. For example, if staff from multiple entities are used to implement an energy efficiency program, an agreement should be in place setting forth the roles and responsibilities of each entity's staff.

Partnership Selection

A successful partnership selection process is essential to effective resilience planning and follows key steps:

Figure 4. Partnership Selection Process



²⁴ Lowery, Phillip, (2019). How an HVAC program is reducing recidivism and saving energy in Virginia.

corrections1.com/re-entry-and-recidivism/articles/how-an-hvac-program-is-reducing-recidivism-and-saving-energy-in-virginia-WdfXnx6agVjj8Gnf/.

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Determine Why Partners Are Needed

Communities must first understand their needs in order to develop effective partnerships. A candid assessment of a community's vision, goals, resources, weaknesses and unique opportunities relating to resilience and resilience planning can reveal areas where partners will be beneficial. This often-overlooked step will allow the community to strategically identify and engage with partners to fill needs and maximize relationship benefits.

Identify Partners

Partners should be identified early in the resilience planning process and can include stakeholders and others that meet a need identified by the community or that can provide a resource necessary for resilience planning or implementation.

Partners generally fall into five categories according to their resources, as shown in Table 4. Partners may fall into one or more categories. Many of the most beneficial partners have crosscutting resources and fall into multiple categories, enabling broader support for resilience initiatives. Partners should be selected and involved strategically during all four phases of resilience planning (assess, envision, implement and evaluate). As the start of each phase is approached, community leaders should consider the objectives of the phase, what it will take to accomplish the objectives and if the city has the knowledge or other resources needed to succeed. Likewise, as each phase is conducted, community leaders should be aware of areas in which partners may be needed to fill gaps or provide for more effective community engagement, involvement, or trust. Several partnerships may be needed in each phase to ensure all initiative requirements are met. While some partners will only be needed in one phase, it is often beneficial, particularly given the limited resources in a smaller community, to form partnerships with those entities that can provide value throughout the planning process.

During the assessment phase, partners with experience, community relationships, data, funding and information are important. If resilience concepts or planning are new to the community or personnel is limited, partners may assist with educating staff and the community about resilience, facilitating meetings and guiding the process. Often, these partners are familiar and well-known local organizations. Communities can also look toward neighboring towns, utilities, regional planning commissions, educational institutions, or others with resilience experience to provide leading practices. Partnerships with utilities, emergency management and response entities and state and federal agencies may

PARTNER RESOURCE CATEGORY	DESCRIPTION	EXAMPLES OF PARTNERS WITH RESOURCE
Experience	Stakeholders or partners that have significant experience or knowledge in an area	Utilities, government officials, engineers, social service agencies, community action agencies
Information and Data	Holders of data, records, or other information	State, county, or city agencies, utility billing departments
Staffing	Those with personnel to assist with or carry out an activity	Utility associations, neighboring communities, civic organizations and learning institutions (including those with the ability to provide intern labor)
Physical Assets	Those with equipment or facilities	Local businesses, emergency response agencies
Funders	Entities that can provide financial resources	Federal and state agencies, foundations, other city departments

Table 4. Partner Resource Categories



produce data and information that, along with local knowledge, better identify potential threats and resulting impacts to vulnerable populations and critical infrastructure.

As the planning process moves from assessing the current state of resilience needs to envisioning goals, partners with experience become increasingly important. In addition to partners already engaged in the assessment phase, subject matter experts and those entities with successful resilience programs may assist with identifying options and goals. Local, regional, state and federal partners should all be considered for their expertise. The implementation phase will rely heavily on partners that may be able to provide personnel, physical assets and funding. Not all resilience activities will be conducted by the city alone. Some activities will be carried out by others or involve multiple organizations, such as resilience planning or community vulnerability analysis consultants. The expertise needs of each community's resilience efforts will vary depending on their assets, barriers and goals. Evaluation of a community's progress toward resilience is likely to require data held by others. Partners can be selected that can provide access to data or information that will allow the community to understand its progress and act accordingly.

Engage Partners Effectively

Effective partnerships relating to community resilience-building often share characteristics that should be considered as partnerships are developed and executed. The characteristics of effective partnerships in community resiliencebuilding include²⁵:



Commitment to a Common Goal

A common goal is needed to align entities with diverse backgrounds regarding a clear vision and objectives. Communities can foster commitment by ensuring that partners have a clear understanding of the goal and understand the benefit they receive from the partnership. Depending upon the partner, benefits can include developing stakeholder ownership of the resilience planning process or improving profitability.

Coordination

Coordination is one of the most essential characteristics of partnerships. Even in informal partnerships, partners must understand their roles and applicable time frames. Partners also need to understand others' roles and expectations for coordination. Procedures should be established that allow partners to work together, access necessary resources and resolve conflicts.

Involving partners in the planning process can create coordination in a way that will avoid misunderstandings and conflicts. Documentation of roles and responsibilities will depend upon the nature of the partnership. A simple email or phone conversation may be sufficient, or the development of formal work-plans with specified responsibilities, time frames and protocols may be needed. In more complicated activities or those in which resources are being committed, legally binding agreements may even be needed. Consideration should be given as to when and what type of documentation may be required in the planning process. Ongoing follow-up is needed to ensure that obligations are being fulfilled, partners are communicating and objectives and goals are being met. Followup is particularly important in order to identify activities that need to be adjusted, areas that are not being addressed, known additional resource requirements and additional partnership opportunities.

²⁵ Marana, P., et al. (2018). A framework for public-private-people partnerships in the city resilience-building process. Safety Science. Vol. 110, Part C. 39.





Information-Sharing

Effective information-sharing allows communities to make better decisions and improves partnership activities, both of which will increase community resilience. The need for information-sharing and the development of protocols to do so, is often overlooked. Accurate information that is shared in a timely manner through a uniform process will allow partners to complete tasks more efficiently and measure progress effectively. Partners should understand specifically what, how and when information must be shared. It is also important to provide opportunities, such as periodic project update meeting or other partnership meetings, to share information that does fit into a uniform reporting process.

Flexibility

Even in formal partnerships with contracts, effective partnerships allow structures and roles to adapt and evolve. During any initiative, circumstances will change, new information or needs will be discovered and challenges will occur. In order to meet a community's resilience goals, programs and processes may need to be modified. Holding an early discussion of those areas in which flexibility may be needed, or is allowed, can enable later plan changes. Partners should also discuss what cannot be changed and why. With this groundwork and a willingness to discuss and listen to suggestions, the partnership may be better situated to be flexible and meet changing needs or conditions.

By bringing together the resources, skills and perspectives of multiple partners, a community can address its resilience needs more effectively and comprehensively than by doing so alone. Partnerships are even more effective when time is taken to identify those areas in which partners are needed, strategically identify and use partnerships that can fill those needs and engage partners in a manner that is effective in achieving results. Taking the time to build these effective partnerships will increase the likelihood that a community's resilience planning and implementation are successful.

Small- to Medium-Size Community Assets

Although SMSC face barriers that larger cities may not, smaller communities can also benefit from:

Shared Systems

Many SMSC employ the same individuals in roles across several services due to the smaller scales of their systems. For example, the same operator may be s responsible for water treatment as well as potable water service delivery. This can streamline planning processes and assist systems in adapting in cases in which there are limited resources and rapid decisions need to be made about resource re-allocation.

Knowledge of Systems

As systems and services within SMSC are typically more efficient and streamlined in comparison to those of larger communities, employees and operators tend to have significant breadth and depth of knowledge about their systems. This knowledge is often transferred via in-person communication, contact and trainings in addition to documented information.

Coordination Across Regions

Many SMSC operations are closely connected to those of neighboring communities within the broader region. Not only can this provide the added benefit of redundancy and back up in certain circumstances, it also indicates an awareness of resources, assets and barriers faced by nearby communities. Connected systems may serve as a basis for establishing partnerships for initiatives that may provide benefits to multiple communities.

Community Engagement

Research has shown that citizens in SMSC are oftentimes engaged and committed to their community progress. They are generally loyal to institutions and initiatives²⁶.



²⁶ Marana, P., et al. (2018). A framework for public-private-people partnerships in the city resilience-building process. Safety Science. Vol. 110, Part C. 39.

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9 ACTION #4: IDENTIFY INNOVATIVE FUNDING SOURCES

While many communities recognize the importance of investing in resilience initiatives, SMSC often face challenges in allocating resources to do so. Available funding sources and tools are presented in this section.

Case Study 2 Mississippi River Cities and Towns Initiative

Although this Roadmap presents actions to address both chronic stresses and acute shocks, a National Institute of Building Sciences (NIBS) cost benefit analysis demonstrated that investments in resilience can have a high rate of return in various types of acute shocks. Table 5 summarizes findings from this study and demonstrates that resilience and mitigation measures are rewarding investments. Costs considered in the analysis include those related to property, living expenses, direct and indirect business interruption, insurance and health (e.g. casualties, Post Traumatic Stress Disorder). The study does not quantify other potential benefits of resilience planning such as preserving cultures and connections to family, friends and careers²⁷.

Mississippi River Cities and Towns Initiative

In 2012, several local governments along the Mississippi River partnered to develop the Mississippi River Cities and Towns Initiative (MRCTI) to protect the Mississippi River. The Initiative is funded by the FEMA Pre-Disaster Mitigation Grant program and focuses on five major programs:

- 1. Clean water.
- 2. Sustainable economics.
- 3. Disaster resilience and adaptation.

- 4. International food and water security.
- 5. Celebration of river culture, history, and heritage.

The priorities of the MRCTI are to improve the water quality and sustainable development of the Mississippi River along with environmental protections and economic improvement for the nearby areas with particular focus on vulnerable communities.

Table 5. Benefit Cost Ratio by Hazard andMitigation Measure28

	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost (\$ billion)	\$1/ year	\$4/ year	\$520	\$0.6	\$27
Benefit (\$ billion)	\$13/ year	\$16/ year	\$2,200	\$2.5	\$160
Riverine Flood	6:1	5:1	6:1	8:1	7:1
Hurricane Surge	NA	7:1	NA	NA	NA
Wind	10:1	5:1	6:1	7:1	5:1
Earthquake	12:1	4:1	13:1	3:1	3:1
Wildland- Urban Interface Fire	NA	4:1	2:1	NA	3:1

Public-private partnerships, grants, incentives and bonds are all examples of funding strategies that can be used to expand the financial capabilities of SMSC interested in pursuing resilience through efforts such as conducting building retrofits or meeting or exceeding building codes.

²⁷ National Institute of Building Sciences. (2019). Natural Hazard Mitigation Saves. cdn.ymaws.com/www.nibs.org/resource/resmgr/reports/mitigation_saves_2019/mitigationsaves2019report.pdf.

²⁸ National Institute of Building Sciences. (2019). Natural Hazard Mitigation Saves. cdn.ymaws.com/www.nibs.org/resource/resmgr/reports/mitigation_saves_2019/mitigationsaves2019report.pdf.

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Comprehensive, integrated resilience planning invites the opportunity to seek a variety of funding sources. These sources include federal grant programs, such as those from the U.S. Department of Energy (USDOE), Federal Emergency Management Agency (FEMA), the U.S. Department of Agriculture (USDA) and the U.S. Department of Housing and Urban Development (HUD). State programs such as those administered by state energy offices and agencies that deal with economic development, infrastructure and

Figure 5. Innovative Funding Sources

emergency response may also have funding opportunities. There are also options such as Property Assessed Clean Energy (PACE), on-bill financing and energy savings performance contracts. Tax credits or rebates may be available at the federal, state, local and individual levels. Opportunities could also include infrastructure bonds, climate bonds, environmental impact bonds and resilience bonds to leverage existing investments and provide additional funding opportunities.



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Grant Opportunities

Identifying Grant Opportunities

Interested communities, businesses and individuals can identify grant opportunities by determining the grant category for their project, funding entity offering the grant, grant eligibility requirements, grant application and award timelines and funding

as capacity for any cost matching requirements. Grant seekers can follow the key steps below to determine what grants fit their unique project needs:



amounts. It is recommended to identify partnering and teaming opportunities as an early step, as well



Funding opportunities are dynamic and subject to change. The following resources are updated on a regular basis with available grant opportunities:

Grants.gov²⁹

Grants.gov allows grant seekers to find and apply for federal funding opportunities on the same website. Many federal grants have state agencies as the Prime Recipients; applicants should look to local state energy offices, emergency management agencies and housing offices for additional guidance or possible collaboration opportunities to advocate for an applicant's respective community. Resources such as the Missouri Department of Natural Resources are available to support energy efficiency and resilience work through USDOE state energy program (SEP) formula funding.

U.S. Climate Resilience Toolkit³⁰

The U.S. Climate Resilience Toolkit provides resources for state and local decision makers to make data-driven decisions related to resilience and hazards. Among other resources, the U.S. Climate Resilience Toolkit includes a "Funding Opportunities" page.

Funding Wizard³¹

The Funding Wizard posts funding opportunity updates on a weekly basis. Users can search opportunities by funding type, category, eligibility, or key words. Although created for Californians, the Funding Wizard also contains federal and other nationwide opportunities.

FEMA Non-Disaster Grants Management System (ND Grants)³²

Non-Disaster Grants lists non-disaster grants and provides applicants with a platform to perform and manage tasks such as submitting applications, reviewing and accepting awards and submitting amendments and performance reports.

National Integrated Drought Information System (NIDIS)³³

NIDIS provides information and services to mitigate short and long-term drought impacts and provide relief and recovery support.

HUD Community Development Block Grant (CDBG)³⁴

HUD CDBG provides grants on an annual basis to states, cities and counties to support governments in addressing housing needs in urban communities. The grants are focused on low- and moderate-income populations and providing suitable living environments by expanding economic opportunities. Many SMSC and especially rural communities, are served by distribution cooperatives (co-ops) and small municipal utilities that are often unable to provide sufficient funds for resilience plan implementation. There are grant opportunities designed to meet these circumstances. Table 6 lists some of these grant opportunities.

33 National Integrated Drought Information System. U.S. Drought Portal. drought.gov/drought/.

²⁹ Grants.gov. grants.gov/.

³⁰ United States Global Change Research Program. U.S. Climate Resilience Toolkit. toolkit.climate.gov/.

³¹ CA.gov. Funding Wizard. fundingwizard.arb.ca.gov/web/.

³² Federal Emergency Management Agency. Non-Disaster Grants Management System. fema.gov/grants/guidance-tools/non-disaster-grants-management-system.

³⁴ U.S. Department of Housing and Urban Development. Community Development. hud.gov/program_offices/comm_planning/communitydevelopment.

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Table 6. Grant Programs Addressing Small- to Medium- Size Community Utility Circumstances

FEATURE	ACRONYM	ELIGIBLE APPLICANTS	ELIGIBLE GEOGRAPHIC AREA	PURPOSE	PROJECT TYPES	AWARD SIZE	FINANCIAL STRUCTURE
Rural Energy Savings Program ³⁵	RESP	Current and former Rural Utilities Service (RUS) borrowers, subsidiaries of current or former RUS borrowers and entities that provide retail electric service in rural areas.	Not specified	Lower energy bills for rural families and businesses and alleviate barriers to investment in energy efficiency measures	 Implementation of energy-saving measures Energy costs incurred by qualified consumers 	Not specified	Loan of up to 20 years at a 0% interest rate. Up to 4% of the loan total may be used for startup costs. RUS borrower can charge an interest rate of up to 3% for relending to qualified consumers.
High Energy Costs Grants ³⁶	Not applicable	Most retail or power supply providers serving qualified rural areas, including: • State and local governmental entities • Federally recognized tribes • Non-profits, including cooperatives and limited dividend or mutual associations • For-profit businesses	Rural areas	Lower energy costs for families and individuals in areas with extremely high per-household energy costs	 Acquisition, construction, or improvement of facilities serving residential customers or communities, including: Electric generation, transmission and distribution facilities Natural gas distribution and storage facilities, including equipment, materials and activities Petroleum product storage and handling facilities, including equipment, materials and activities Renewable energy facilities, including solar, wind, hydropower, or biomass technologies used on- or off-grid Backup or emergency power generation or energy storage technology, including generation equipment installed on con-sumer premises 	Not specified	Grants
Special Evaluation Assistance for Rural Communities and Households ³⁷	SEARCH	 Most state and local governmental entities Non-profits Federally recognized Tribes 	Areas must be both rural and financially distressed	Provide assistance with proposed water and waste disposal projects	 Pre-development planning costs, including: Feasibility studies to support applications for funding water or waste disposal projects Preliminary design and engineering analysis Technical assistance for the development of an application for financial assistance 	Not specified	Not specified

³⁵ U.S. Department of Agriculture. Rural Energy Savings Program. rd.usda.gov/programs-services/rural-energy-savings-program.

³⁶ U.S. Department of Agriculture. High Energy Cost Grants. rd.usda.gov/programs-services/high-energy-cost-grants.

³⁷ U.S. Department of Agriculture. Solid Waste Management Grants. rd.usda.gov/programs-services/solid-waste-management-grants.

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FEATURE	ACRONYM	ELIGIBLE APPLICANTS	ELIGIBLE GEOGRAPHIC AREA	PURPOSE	PROJECT TYPES	AWARD SIZE	FINANCIAL STRUCTURE
Solid Waste Management Grants ³⁸	Not applicable	 Most state and local governmental entities Non-profits Federally recognized Tribes Academic institutions All applicants must have: Proven ability, background, or experience to successfully complete a project similar to the one proposed Legal authority and capacity to provide technical assistance or training 	Rural areas, with special considerations possibly given for projects serving: • Areas with fewer than 5,500 or fewer than 2,500 people • Regional, multi-state, or national areas • Lower-income populations	Reduce or eliminate pollution of water resources	 Evaluation of current landfill conditions to identify threats to water resources Technical assistance or training to enhance the operation and maintenance of active landfills Technical assistance or training to help communities reduce the amount of solid waste coming into a landfill Technical assistance or training to prepare for closure and future use of a landfill site 	Not specified	Grants
The Clean Water/ Drinking Water State Revolving Funds ³⁹	CWSRF And DWSRF	 Communities Private Entities Non-profit organizations Citizen Groups 	All U.S. States and Puerto Rico	Address states' highest-priority water quality and drinking water needs	 Construction of publicly owned drinking water and wastewater facilities Nonpoint source projects Source water protection projects Construction of decentralized wastewater treatment systems Stormwater projects Water conservation Green infrastructure Watershed projects Energy conservation Security measures Technical assistance 	Determined by project size and ability to repay.	Loan of up to 30 years at a 1.5% average interest rate (FY18). Funding may also include additional subsidies and repayment starts one year after project completion.

³⁸ U.S. Environmental Protection Agency. Learn about the Clean Water State Revolving Fund. epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf#eligibilities.

³⁹ U.S. Environmental Protection Agency. Learn about the Clean Water State Revolving Fund. epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf#eligibilities.

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FEATURE	ACRONYM	ELIGIBLE APPLICANTS	ELIGIBLE GEOGRAPHIC AREA	PURPOSE	PROJECT TYPES	AWARD SIZE	FINANCIAL STRUCTURE
Rural Energy for America Program ⁴⁰	REAP	Agricultural producers and small businesses	Rural areas	Provide financial assistance for renewable energy systems and energy efficiency measures	Wind, solar, biomass and geothermal projects and projects involving hydrogen derived from biomass or water using wind, so-lar, or geothermal energy sources	Renewable energy grants: \$2,500-\$500,000 Efficiency grants: \$1,500-\$250,000 Loan and grant combination: grant portion must exceed \$1,500	Grants limited to 25% of a proposed project's cost. Loan. L guarantee may not exceed \$25 million. Combined amount of a grant and loan guarantee must be at least \$5,000 and may not exceed 75% of the project's cost.
Rural Energy for America Program Energy Audit and Renewable Energy Development Assistance ⁴¹	REDA	 State, Tribal, or local government entities Higher education institutions Rural electric cooperatives Public power entity Resource Conservation and Development (RC&D) Councils 	Rural areas and agricultural producers	Promote American energy independence and lower energy costs for small businesses and agricultural producers	 Energy audits Renewable energy technical assistance Renewable energy site assessments 	The maximum amount for an energy audit and REDA grant is \$100,000	Not specified
Community Facilities Direct Loan and Grant Program ⁴²	Not applicable	 Eligible borrowers include: Public bodies Community- based non-profit corporations Federally recognized Tribes 	Rural areas	Provide affordable funding to develop essential community facilities in rural areas	 Purchase, construction, or improvement of essential community facilities; purchase of equipment; related project expenses. Examples of essential community facilities include: Healthcare facilities Public facilities Community support services Public safety services Educational services Utility services 	 Low interest direct loans Grants A combination of the two above, as well as a loan guarantee program. These may be combined with commercial financing to finance one project if all eligibility and feasibility requirements are met 	Not specified

⁴⁰ U.S. Department of Agriculture. Rural Energy for America Program Renewable Energy Systems and Energy Efficiency Improvement Guaranteed Loans and Grants. rd.usda.gov/programs-services/rural-energy-americaprogram-renewable-energy-systems-energy-efficiency.

⁴¹ U.S. Department of Agriculture. Rural Energy for America Program Energy Audit and Renewable Energy Development Assistance Grants. rd.usda.gov/programs-services/rural-energy-america-program-energy-audit-renewable-energy-development-assistance.

⁴² U.S. Department of Agriculture. Community Facilities Direct Loan and Grant Program. rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program.



Applying for Grants

Once interested applicants have selected what grant opportunity they would like to pursue, they should consider the following leading practices:

Review application requirements

Thoroughly review the Funding Opportunity Announcement (FOA) provided for the grant opportunity and follow instructions exactly.

Ask questions

If clarification is needed on an application requirement, ask the contacts listed in the application. Even if there are no questions, attending technical assistance or instructional calls or webinars is recommended.

Make a compelling case

Clearly express what problem needs to be solved, why this problem needs to be solved and how the project will solve or alleviate the problem.

Be clear and concise

Use clear and concise language and provide detail for topics such as budgets, plans and goals. Do not stretch responses to use the full-page allowance if it is not needed to get the point across.

Review the application

Review the application to make sure every question has a response. Respond "Not applicable" rather than leaving a section blank. Make sure all instructions are followed for format and page limits and have the application reviewed by another person, if possible. Many communities often lack resources to develop applications or are unfamiliar with the grantwriting process, which can seem burdensome, difficult and daunting. This can be worsened by a lack of familiarity with match requirements and what that process entails.

Figure 6. Match Requirement Defined

Match Requirement

Most federal grant programs require that a certain percentage of the funded program cost must come from a non-grant source. This is known as a match requirement. Sources of match funds include:

- **Cash match.** Monetary funds that benefit the program's goals.
- In-kind match. Non- cash funds in the form of donated goods or services that benefit the funded program's goals and can be monetized.

Match funds can be provided by the grantee organization or an external, non-federal third party such as an organizational partner. The grantee should document match contributions in order to satisfy grant requirements.

Example: If an organization received a federal grant to fund an energy efficiency education campaign and the grant terms included a match requirement, the grantee organization could offset campaign costs by contributing funds for printing education materials as a cash match. Alternatively, a partner organization could donate its personnel time and expertise to train volunteers to effectively inform participants about energy efficiency as an in-kind donation.



In addition to the leading practices listed above, the online resources provided below can guide funding candidates through the application process. Community members or personnel who have gained experience in grant writing may be called upon to support future grant applications and fill a long-term role, if the opportunity is available.

- Grants.gov's Grants Learning Center.⁴³
- The National Oceanic and Atmospheric Office for Coastal Management's Resources and Tips Page.⁴⁴
- The U.S. Department of Health and Human Services' Tips for Writing & Submitting Good Grant Proposals.⁴⁵

Financing Options for Energy Efficiency and Resilience Projects

Communities can also leverage financing options such as leases, loans, on-bill financing (OBF) and on-bill repayment (OBR), PACE programs and energy services firms to finance energy efficiency, distributed generation and other energy projects that enhance community resilience. Financing options such as these allow property owners to invest in energy upgrades without the high upfront capital costs and receive cost savings, reduce greenhouse gas emissions, increase emissions comfort and create other benefits that otherwise would have been unaffordable. The descriptions for these financing options are based on those provided by USDOE's *Better Buildings Finance Navigator.*⁴⁶ In addition to the descriptions below, project owners seeking project funds can use the Finance Navigator to take a short quiz that will match them with the financing option that best fits their project needs. The tool also provides a database of trusted providers which the user can filter by finance offerings, sectors, technologies and location.

Figure 7. Typical Lease Financing Structure



Lease Financing

Property owners or renters may be able to use lease financing to install energy efficiency or distributed generation equipment without purchasing it. Depending upon program availability, a lease customer can arrange a lease with the manufacturer, vendor, or installer of their desired energy equipment. Once the lessor and customer sign a lease agreement, the lessor coordinates with a contractor or energy services company (ESCO) to install the equipment. After the equipment is installed, the customer pays the lessor regularly scheduled payments according to their lease agreement.

Although this is the general structure of lease financing, there are three main types of lease agreements that differ slightly in structure.

Capital Lease

The customer owns the equipment and is responsible for legal and accounting requirements during the lease term. Usually, the lessor takes security interest in the equipment so that they can reclaim the equipment if there is an issue. At the end of the lease term, the customer can extend the lease, buy the equipment at a lesser value, or return the equipment. The typical duration of a capital lease contract is three to five years.

Operating Lease

The lessor owns the equipment and the customer pays a fixed monthly payment. Rental payments

⁴³ Grants.gov. Grants Learning Center. grants.gov/web/grants/learn-grants.html.

⁴⁴ National Oceanic and Atmospheric Administration, Office for Coastal Management. Resources and Tips coast.noaa.gov/funding/resources-tips.html.

⁴⁵ U.S. Department of Health and Human Services, Health and Resources and Services Administration. Tips for Writing and Submitting Good Grant Proposals. hrsa.gov/sites/default/files/grants/apply/writestrong/ grantwritingtips.pdf.

⁴⁶ U.S. Department of Energy, Better Buildings. Better Buildings Finance Navigator. betterbuildingssolutioncenter.energy.gov/financing-navigator/find.



are operational expenses for the customer and may be tax-deductible. In order to participate in an operating lease, the customer must be creditworthy. At the end of the lease term, the customer can extend the lease, buy the equipment at a lesser value, or return the equipment. The typical duration of an operating lease contract is three to five years.

Solar Lease

Solar leases are similar to operating leases but are specifically used for leasing solar equipment. The lessor owns the solar equipment and the renter pays a fixed monthly rate. All tax rebates and incentives are collected by the lessor. The typical duration of a solar lease contract is seven to 15 years.

Tax-Exempt Lease

Public and municipal entities may qualify for taxexempt leases for equipment, which allows them to pay for equipment using annual revenues. The lessor can claim federal income tax exemption on interest from the customer, which allows the lessor to offer a lower rate to the customer. If the customer fails to make payments in a given year during the lease term, the customer and lessor must end their contract and the equipment is returned to the lessor. The duration of a taxexempt lease contract is flexible.

Loan Financing

Customers can borrow money from banks, manufacturers, vendors and contractors to finance energy efficiency or distributed generation equipment projects. Once funds are received, the customer is responsible for purchasing and owning equipment as well as using in-house staff or hiring a contractor or ESCO to install and manage equipment. Loans typically require a down payment and the loan term, interest rate and down payment depend on the customer's creditworthiness, lender's perception of risk and project requirements. Customers may experience limitations on receiving loans due to poor

e Below-market and philanthropic loan programs can

provide lower interest rates or high tolerance for poor creditworthiness. Customers that qualify for these types of loans typically are in the affordable multi-family, non-profit, or private education and healthcare sectors. Public organizations, foundations and government entities may create loan programs for these customers in order to promote socio-economic advancements or mitigate environmental impacts.

creditworthiness, existing debt, or the amount of

debt that can be taken on their balance sheets.



Figure 8. Loan Financing Structure



On-Bill Financing and On-Bill Repayment

OBF and OBR are financing mechanisms in which a utility provides capital to customers for energy efficiency or distributed generation equipment projects. Public, utility shareholder, or ratepayer capital is used by the utility for OBF and comes at a low-to-zero interest rate. Investor capital is used by the utility for OBR and comes at a higher interest rate than OBF. The customer is responsible for coordinating with a contractor or ESCO for project installation and must repay their utility through payments on their monthly energy bill. The typical payback period ranges from two to 15 years. Projects are only eligible for OBF or OBR if they are in a utility service territory that supports the applicable financing mechanism. Customers can contact their local utilities or reference DSIRE⁴⁷ to determine if they can use OBF or OBR to support a project.

Property Assessed Clean Energy Financing

PACE financing funds property improvements such as energy efficiency, renewable energy, lighting, heating and cooling and insulation. Through PACE programs, property owners make payments over the course of up to 20 years through an assessment on their property tax bills. The loan and repayment remain with the property even if it is sold. Commercial, industrial, agricultural, notfor-profit and most multi-family property owners may be eligible for PACE financing in their state, if available. However, some communities may decide that PACE assessments, which can lead to a tax sale of the property if not repaid, are in their community's best interest and some find the application process to be difficult. County assessor or collector's offices can indicate whether PACE financing can be used. Interested communities can visit PACENation.us or contact their local PACE program for more information.

Figure 9. Typical On-Bill Financing or Repayment Structure



⁴⁷ Database of State Incentives for Renewables and Efficiency (a). Database of State Incentives for Renewables and Efficiency (a). dsireusa.org/.



Energy Services

Efficiency-As-A-Service

Efficiency-As-A-Service is a financing tool used to implement energy or water efficiency projects. An energy services agreement (ESA) provider pays for project development, installation and maintenance. The ESA provider is responsible for coordinating with a contractor or ESCO for project installation and maintenance if needed. Once the customer and ESA provider enter a contract, the provider conducts a baseline analysis to gauge the customer's energy consumption and estimates energy savings. After the contractor installs the equipment, measurement and verification (M&V) analysis is conducted to determine actual savings compared to the customer's baseline energy use. The customer is only required to pay the ESA provider a charge per unit of energy saved that is set below the customer's baseline utility price. Thus, the customer only pays for energy saved and the ESA provider is paid based on actual project savings. A typical Efficiency-As-A-Service contract ranges from five to 15 years and the customer can buy the project equipment at a lesser value, extend their contract, or return the equipment at the end of the contract term.



Figure 11. ESCO Financing Structure

Energy Savings Performance Contracts

ESPCs allow property owners to partner with ESCOs to finance energy efficient facility upgrades. The upgrades are financed through both the ESCO and a portion of the improvement's cost savings from the energy improvement project. The property owner owns all of the improvements and continues to earn savings after the ESPC ends. Interested property owners can visit USDOE's Better Buildings Energy Savings Performance Contracting (ESPC) Toolkit⁴⁸ to find resources and a webinar series on deciding if an ESPC is suitable, how to implement ESPC projects and more. Common ESPC customers include governmental entities or private universities, schools and hospitals. Commercial and industrial, non-profit, multi-family, affordable multi-family sectors customers are less common. Below is a diagram of how federal agencies finance an energy improvement project through an ESCO:



Cycle of cost savings and payments for Federal Energy Savings Performance Contracts source: https://www.energy.gov/eere/femp/about-federal-energy-savings-performance-contracts

⁴⁸ U.S. Department of Energy, Better Buildings. Energy Savings Performance Contracting Toolkit.

better buildings solution center. energy.gov/energy-saving s-performance-contracting-espc-toolkit.


equipment does not meet the customer's needs,

the customer's utility will provide energy service.

In the event that excess energy is generated by the

renewable energy system, the utility May purchase

power at the retail electricity rate or as allowed

pursuant to the interconnection agreement and

state law. This process is called net metering.

If renewable energy generated from the

Power Purchase Agreement (PPA)

A PPA is a financing arrangement in which a thirdparty developer coordinates, installs, owns and operates a renewable energy system or combined heat and power equipment on a customer's property or elsewhere. The installation site does not need to be owned by the customer. The customer signs a contract to purchase power generated from the system from the developer. As the owner of the equipment, the developer receives any tax credits and rebates earned from the renewable energy project, allowing them to offer the customer lower rates. The typical PPA term ranges from 10 to 25 years and the customer can extend the PPA term, purchase the system, or have the equipment removed at the end of the term.

Figure 14. Power Purchase Agreement Structure



Incentives

Financial incentives can encourage SMSC and their residents and businesses to invest in resilience measures. Incentives may be offered from both the private and public sector and can be available to homeowners, small and large businesses, utilities, communities and other entities. Incentives include tax credits, tax exemptions, tax deductions and rebate programs.

Tax Incentives

Businesses and individuals may be able to earn tax incentives in the form of tax credits or deductions for pursuing resilience through retrofits, installing renewable energy capacity, or energy efficiency measures. Through tax incentives, eligible entities can earn credit towards their income tax equal to a percentage of a resilience-related expense, up to a maximum amount. Public and certified 501(c)(3) non-profit organizations typically cannot access tax incentives or deductions because they are not taxed. However, in limited circumstances involving specific financing structures, for-profit entities leasing qualifying assets to non-profits or public entities may be able to take advantage of tax credits or deductions. For-profit businesses and community institutions that are eligible for tax incentives should consult a tax professional to understand implications and maximize benefits. Tax incentives are provided by the federal government as well as some states.



Rebate Opportunities

Rebates opportunities are dynamic and subject to change. States, municipalities and utilities offer residential and commercial groups rebates through programs that cover resilience measures, such as solar energy projects and energy efficiency measures. Along with state, municipality and utility websites, the following resources are updated on a regular basis with available incentive opportunities:

DSIRE49

DSIRE is a comprehensive database for incentives and policies that support renewable energy and energy efficiency in the United States.

The American Council for an Energy Efficient Economy's (ACEEE) State and Local Policy Database⁵⁰

ACEEE's State and Local Policy Database provides information on state and local energy efficiency policies. Information on state energy efficiency financial incentives is included in the database for each state.

Figure 12. Missouri's Electric Service Areas

Missouri's electricity needs are served by four IOU), IOUs - Evergy Missouri West, Evergy Missouri Metro, Ameren Missouri, and Liberty Utilities - Empire District - as well as numerous co-ops and municipal utilities. Rolla and St. James are served by their own municipal utilities, while Stockton is served by Liberty Utilities - Empire District. The Cities of Rolla and St. James may have more control over their utilities rate structures and operations municipality since the utilities are owned by the communities. However, the City of Stockton may not have as much direct control because the Missouri state Public Service Commission determines what Liberty Utilities – Empire District's rates

are for each customer class. However, parties can intervene in cases before the Public Service Commission and offer testimony regarding rates, service and other matters.

Source: psc.mo.gov/ CMSInternetData/Electric/ Missouri%20Electric%20Service%20 Area%20Map%2011-8-19.pdf



⁴⁹ Database of State Incentives for Renewables and Efficiency (1). Database of State Incentives for Renewables and Efficiency (1). database of State Incentives for Renewables and Efficiency (1).

⁵⁰ American Council for an Energy-Efficient Economy. State and Local Policy Database. database.aceee.org.



Public-Private Partnerships

Public-Private Partnerships (PPPs) are agreements between public- and private-sector entities that create a structure to work toward a shared objective through collective resources, benefits and risks. By partnering with private-sector entities such as consultants, developers and financers, PPPs can leverage diverse skill sets to take an integrated, innovative and modern approach to improving resiliency. Through PPP risk-sharing, most project risks are shifted from the public to the private sector, motivating private partners to accomplish high-performance outcomes. Ultimately, PPPs allow public agencies to leverage additional financial resources to pursue resilience projects that they may not have been able to consider without additional support.

Utility Rate Structures

Certain rate structures can allow utilities to defer capital investments, decrease emissions and increase resilience by reducing peak load on grid systems while contributing to the reduction of energy burden in communities. However, not all cities have significant control over how its utilities operate. Community control over utility rate structure depends on whether the utility is an investorowned utility (IOU), municipal utility, or rural electric cooperative. Communities usually have more direct influence over municipal utilities and cooperatives than they have over IOUs' business models. Therefore, it is critical to develop partnerships with local utilities to address resilience goals and planning initiatives. Early onboarding of partners is a key component for implementation and will help address regulatory hurdles that may arise.

Various rate structures can affect utility capital investments, customer energy usage and emissions. Time-varying rate structures, such as time-of-use (TOU) rates, can encourage customers to shift energy usage to off-peak times to reduce consumption (e.g., lower demand). Inclining block rates can encourage conservation. Time-varying rates and inclining block rates may allow utilities to optimize capital investments in new or updated generation and T&D infrastructure that would otherwise be required to meet high peak demand or higher energy usage needs over time. Demand charges, although traditionally only applied to large commercial customers, can be applied to all types of rate structures to impact demand, sometimes resulting in savings. Coupled with customer education and information, time-varying rates can encourage customers to adjust their energy usage by shifting consumption to lowercost off-peak hours, lowering their energy bills and reducing utility system costs.

Increasing energy efficiency or changing usage patterns to shift demand to off-peak times can allow utilities to optimize resources. The resulting reduced power supply costs and deferred need for installation, upgrades, or T&D infrastructure replacement can also reduce the cost to serve customers. As part of an electric utility's integrated resource plan, a cost/benefit ratio should be calculated to identify suitable demandside management projects, which can also contribute to emission reductions. Additionally, rate structures can encourage customers to invest in energy efficiency and shift load to lower-cost time periods.

Block Rates

Utilities typically charge residential customers a monthly fixed customer charge, also known as a base charge or service availability charge and an energy charge in cents per kWh. An energy charge is usually either a flat rate, inclining block rate, or declining block rate. If a utility uses a flat rate, a customer is charged the same number of cents per kWh for all of their energy usage. Inclining block rates charge higher rates for higher levels of consumption to send price signals to use less electricity. Declining block rates follow the opposite pattern of inclining block rates, charging less per kWh at higher volumes of usage.

Figure 13. Impact of Residential Rate Design on Monthly Bill^{51}



⁵¹ Regulatory Assistance Project (2016). Electricity Regulation in the US: A Guide (Second Edition). raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/.



The rate structure may influence customer energy usage behavior. Customer bills for inclining rates increase more rapidly than customer bills for declining rates beyond a given base level or levels. Consequently, customers that on inclining block rates are expected to use less energy than customers on other rate designs in order to keep their energy bills lower. Inclining block rates encourage energy conservation, which may reduce the need to run generation units and lower emissions.

Additionally, inclining block rates are generally beneficial for low-income customers, since, "most low-income consumers have significantly belowaverage usage and an inclining block rate design will keep their bills lower."⁵² Some low-income households may have higher than average usage if they have older, inefficient housing or if they have a large number of residents, but such issues can be can addressed with energy efficiency and weatherization programs. Energy efficiency and weatherization programs can reduce the longterm usage of a household, lowering participants' bills and enabling better use of billing assistance funds.⁵³

Time-Varying Rates and Demand Charges

Time-varying rates charge customers differently depending on when energy is used. There are several kinds of time-varying rates, including time-of-use (TOU) rates, critical peak pricing (CPP), peak-time rebates (PTR), real-time pricing (RTP) and variable peak pricing (VPP). TOU pricing charges customers higher rates during previously specified on-peak (e.g., higher-demand) periods and lower rates during previously specified off-peak (e.g., lower-demand) periods. With CPP, customers are usually notified one day ahead of time that rates will rise sharply during specific high-demand, highsystem stress events. Customers receive PTR credits when they decrease energy usage during specific high-demand, high-system stress events. VPP is a rate structure in which high pricing time periods are set in advance, but rates may change for events throughout the year.

On-peak periods typically occur during the day on weekdays and off-peak periods typically occur during nights and weekends. Utilities can serve customers at a lower cost during off-peak times since on-peak periods may, for instance, require the use of peaking units and incur higher line losses. Generally, residential time-varying rates are based on customers "opting in" to participation, although there is growing interest in opt-out and mandatory participation models. Like other rate structures, TOU rate structures vary from utility to utility according to factors such as resources, load and weather patterns.

Coupled with timely customer education and information, time-varying rates can encourage customers to change their energy usage behavior and shift consumption to off-peak hours to lower their energy bills. Such shifts in consumption can also lower utility system costs by optimizing capital investments in generation and T&D infrastructure and greenhouse gas (GHG) emissions may decrease.



⁵² Regulatory Assistance Project (2016). Electricity Regulation in the US: A Guide (Second Edition). raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/.

⁵³ Regulatory Assistance Project (2016). Electricity Regulation in the US: A Guide (Second Edition). raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/.

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Green Pricing

Many utilities offer their customers green pricing options to support renewable energy resources.⁵⁴ Through green pricing, customers can choose to pay for renewable energy resources, which may be procured by the utility. Green pricing options allow customers to pay a premium to support the addition of renewable energy resources to their energy supply mix.⁵⁵ Energy from the renewable energy source is not necessarily supplied directly to the customer, but the renewable energy may displace traditional generation and lead to emissions reductions, environmental benefits and other outcomes.

Key Recommendations

Community leaders can leverage a variety of funding sources to fund their resilience projects. Key recommendations are listed below:

1 USE AVAILABLE RESOURCES.

Federal agencies, utilities, universities, non-profits and other groups offer useful tools to identify funding opportunities and provide guidance on how to apply for funding opportunities.

STAY INFORMED.

Leverage online databases, such as Grants.gov and DSIRE, which update opportunities regularly.

LEARN FROM PEERS.

SMSC and especially rural communities that are served cooperatives and municipal utilities have unique funding needs. To learn how other SMSC fund projects, contact their resilience planning leaders or reference the case studies of communities that funded similar projects.

4 FIND A FUNDING SOURCE. Apply the funding mechanism that is

Apply the funding mechanism that is appropriate for a specific resilience project. Grants and PPPs may be appropriate funding resources for communities, businesses, or nonprofits. Incentives, rebates and financing options such as PACE and ESPCs may be appropriate for businesses, building owners and homeowners and other entities. Adopting dynamic rate structures to promote energy efficiency and lower peak demand may be an appropriate strategy for utilities to increase reliability while optimizing capital investments in generation and T&D infrastructure.

⁵⁴ Regulatory Assistance Project (2016). Electricity Regulation in the US: A Guide (Second Edition). raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/

⁵⁵ Regulatory Assistance Project (2016). Electricity Regulation in the US: A Guide (Second Edition). raponline.org/knowledge-center/electricity-regulation-in-the-us-a-guide-2/.



10 ACTION #5: USE FEDERAL AND NATIONAL LABORATORY RESOURCES

Federal agencies and national laboratories provide several quantitative and qualitative tools for state and community leaders to leverage for resilience planning. These tools can support projects that address both chronic stresses and acute shocks, such as projects designed to:

- Alleviate energy burden.
- Invest in energy efficiency, renewable energy and energy storage solutions.
- Promote economic development and growth.
- Strengthen critical energy infrastructure.
- Mitigate hazards.
- Increase the resilience of community operations.
- Enhance community livability.

Federal agencies with such tools include the USDOE, FEMA, Federal Transit Administration (FTA), National Institute of Standards and Technology (NIST), National Oceanic and Atmospheric Administration (NOAA) and EPA. National Labs that provide resiliency tools include the Lawrence Berkley National Laboratory (LBNL), National Renewable Energy Lab (NREL) and Argonne National Laboratory. Research organizations such as the United States Global Change Research Program (USGCRP) also provide resilience tools.

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Table 7. Quantitative Federal Agency and National Laboratory Tools

TOOL	AGENCY/ NATIONAL LAB	DESCRIPTION	SOURCE
Solar Resilient™	USDOE	Estimates necessary parameters of grid-connected photovoltaic (PV) solar and battery energy storage to provide power during grid power outages.	solarresilient.org
Technical Resilience Navigator (TRN)	USDOE	Helps organizations identify energy- and water-related resilience gaps in order to develop practical solutions.	trn.pnnl.gov
Resilience Planning Guide	USDOE	Uses a site screening tool and a resilience risk evaluation tool to aid users in deter-mining practical applications of distributed generation within their critical infrastructure and resilience planning.	dg.resilienceguide.lbl.gov dg.resilienceguide.lbl.gov/CHPscreener dg.resilienceguide.lbl.gov/resilience-risk- evaluation-tool
Energy Management Information Systems (EMIS)	USDOE	Set of tools and resources to monitor en-ergy use, identify efficiency opportunities and set energy- related goals to improve resilience.	betterbuildingssolution-center.energy. gov/toolkits/toolkit-implement-energy- management-information-systems-emis- your-building-portfolio
Benefit-Cost Analysis Toolkit	FEMA	Uses a cost-benefit ratio to compare project costs with benefits from hazard miti-gation for specific sites and initiatives. FE-MA requires the tool's use in order to be eligible for FEMA hazard mitigation funding.	fema.gov/grants/guidance-tools/benefit- cost-analysis
Hazus	FEMA	Tool that identifies high-risk locations and potential physical, economic and social impacts from earthquakes, floods and hurricanes using Geographic Information Systems (GIS) technology.	fema.gov/flood-maps/tools-resources/ flood-map-products/hazus
Hazard Mitigation Cost Effectiveness (HMCE) Tool	FTA	Cost-benefit analysis tool for transit agencies and planners designed to enhance resilience in public transportation systems.	transit.dot.gov/funding/grant-programs/ emergency-relief-program/hazard- mitigation-cost-effectiveness-hmce-tool
ENERGY STAR Portfolio Manager®	EPA	Building benchmarking tool for managing the energy and water usage of commercial and public buildings. The tool also allows users to set energy use targets and con-duct comparisons with other buildings.	ener-gystar.gov/buildings?testEnv=false
Distributed Energy Re- sources Customer Adoption Model (DER-CAM)	LBNL	Decision support tool for optimizing distributed energy resources' (DERs) parameters for buildings and microgrids.	gridintegration.lbl.gov/der-cam
Interruption Cost Estimate Calculator (ICE Calculator)	LBNL	Tool for electric reliability planners to estimate service interruption costs and/or the benefits associated with reliability improvements.	icecalculator.com/home
Renewable Energy Integration and Optimization Model Subset (RE-opt Lite)	NREL	Supports commercial building managers in evaluating the economic viability of grid connected DERs and identifying specific parameters needed to sustain critical load during outages.	reopt.nrel.gov/tool
State and Local Planning for Energy (SLOPE)	NREL	Informs data-driven state and local energy planning by providing electricity and natural gas consumption data at jurisdictional levels.	gds.nrel.gov/slope
PVWatts Calculator	NREL	Estimates energy production and energy costs of grid-connected PV solar energy systems.	pvwatts.nrel.gov

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Table 8. Qualitative Federal Agency and National Laboratory Tools

TOOL	AGENCY/ NATIONAL LAB	DESCRIPTION	SOURCE
State and Local Solution Center	USDOE	Collection of resources that provides guidance for public-sector leaders to invest in energy efficiency and renewable energy technologies. Resources are organized around four actions: develop an energy plan, design and implement energy programs, pay for energy initiatives and access and use energy data.	energy.gov/eere/slsc/state-and-local- solution-center
USDOE Guide for Climate Change Resilience Planning	USDOE	Report with stepwise guidance for developing a vulnerability assessment framework and subsequent resilience plan for electricity assets and operations.	adaptationclearing-house.org/resources/ climate-change-and-the-energy-sector- doe-guide-for-climate-change-resilience- planning.html
U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions	USDOE	Report presenting climate change impacts on the U.S. energy sector at the regional level, with a focus on the impacts of extreme weather events and the connection to resilience planning.	ener-gy.gov/policy/downloads/climate- change-and-us-energy-sector-regional- vulnerabilities-and-resilience
Guide to Community Energy Strategic Planning	USDOE	A 10-step guide for supporting long-term energy visioning to comprehensive, future-facing energy strategies.	energy.gov/sites/prod/files/2014/05/f15/ cesp_guide.pdf
Climate Change and the Energy Sector: Guide for Climate Change Resilience Planning	USDOE	Assesses system vulnerabilities to extreme and fluctuating weather and allows for the creation of planning-level documents that include specific energy mitigation action items.	energy.gov/sites/prod/files/2016/10/ f33/Climate%20Change%20and%20 the%20Electricity%20Sector%20 Guide%20for%20Climate%20 Change%20Resilience%20Planning%20 September%202016_0.pdf
State Energy Resilience Framework	Argonne National Lab	Enables state and local governments, in conjunction with energy utilities, to identify resilience concepts, challenges and vulnerabilities in order to implement proven and cost-effective resilience enhancement options.	energy.gov/sites/prod/files/2017/01/ f34/State%20Energy%20Resilience%20 Framework.pdf
Resilience Roadmap	NREL	Comprehensive guidance for federal, state and local entities on resilience planning, with a focus on multi-jurisdictional approaches in the energy and water sectors.	nrel.gov/resilience-planning-roadmap
Power Sector Resilience Planning Guidebook	NREL	Includes key concepts and steps for developing localized resilience plans, with particular focus on the power sector.	nrel.gov/docs/fy19osti/73489.pdf
Community Resilience Planning Guide	NIST	Assists in determining processes for setting priorities and subsequently allocating necessary resources to manage and incorporate social and economic community considerations into planning.	nist.gov/topics/community-resilience/ planning-guide
U.S. Climate Resilience Toolkit	NOAA	Includes resources to identify climate risks and con-duct risk assessments, case studies and other relevant tools to assist in resilience plan development. Also has information for electric utilities.	toolkit.climate.gov/noaa.maps.arcgis.com/ apps/MapJournal/index.html?appid= e94f511d57cb459195f85d68c3e742a9
Power Resilience Guide	EPA	Provides strategies to leverage partnerships and relationships with electric providers in order to resilience to power outages.	epa.gov/communitywaterresilience/ power-resilience-guide-water-and- wastewater-utilities
Local Energy and Environment Program	EPA	Assists local governments in reducing air emissions through energy strategies by providing tools for understanding local emissions, as well as for identifying and implementing effective policies and actions for reducing emissions and realizing co-benefits.	epa.gov/statelocalenergy/local-energy- and-environment-program
United States Global Climate Research Program- Fourth National Climate Assessment	USGCRP	Informs stakeholders of the effects of climate change on various regions in the United States, with particular focus on energy considerations and risk reduction.	nca2018.globalchange.gov



Case Study 3 North Carolina

North Carolina

North Carolina joined USDOE's Better Buildings Challenge in 2009 when they accomplished a 21% reduction in state building energy intensity. In 2018, its governor issued Executive Order 80, which called for a 40% reduction below 2002-2003 baselines for state energy consumption and greenhouse gas emissions. To accomplish these goals and address concerns about avoiding prolonged outages caused by flooding and hurricanes for government-managed facilities, they used USDOE's REopt Lite tool to assess the size, cost, and ability to handle critical loads during outages of solar PV and battery storage solutions at multiple sites. For one specific site, they used the tool to compare four different scenarios. The results showed that they could invest in a smaller, lower cost microgrid system with solar PV if they first applied energy efficiency measures to reduce critical load. The results modeled below are for meeting 50% of building load during a 2-day grid outage.

NC FACILITY AND ELECTRICITY USAGE SCENARIO	BATTERY STORAGE SIZE (KWH)	PV SYSTEM SIZE (KW)	ANNUAL PV PRODUCTION (KWH)	SOLAR PV PRODUCTION AS % OF ELECTRICITY CONSUMPTION	INSTALLED COST
NC Facility #6 - Business as Usual (BAU)	361	191	233,475	22%	\$491,550
NC Facility #6 - 10% More Efficient	325	172	210,128	22%	\$442,395 (~ \$49,000 less than BAU)
NC Facility #6 - 20% More Efficient	289	152	186,780	22%	\$393,240 (~ \$98,000 less than BAU)
NC Facility #6 - 40% More Efficient	217	114	140,085	22%	\$294,959 (~ \$197,000 less than BAU)

Table 9. Solar and Storage and Energy Efficiency Analysis for North Carolina Facility Using REopt Lite

For more information: energy.gov/sites/prod/files/2019/10/f67/distributed-energy-resilience-public-buildingsv2.pdf

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11 ACTION #6: MEASURE SUCCESS

AND ASSETS

Metrics are important to a community's ability to evaluate the benefits of the resilience initiatives and investments through the monitoring of progress towards specific targets. Consistent measures to monitor progress enable communities to effectively demonstrate progress and accountability, promote continuous improvement and make strategic and data-driven decisions.

Developing Effective Metrics

Research was conducted to identify standards and metrics used to measure community and energy system resilience and resiliency planning efforts. Currently, the majority of widely used metrics focus on resilience from the lens of disaster planning and response. However, the value of a more comprehensive approach to resilience planning is also being more widely recognized. Likewise, although most available resilience plans that include metrics account for resilience in an urban, larger community context, data needs and applicable targets need to be tailored to successful resilience planning in SMSC. After potential metrics were identified, they were compared to the information provided by the partner communities regarding goals, experiences, needs and resources and the metrics were then refined to better meet the measurement needs of similarly situated communities.



The metrics found in Appendix C were developed following the baseline research and information gathered from engagements with the partner communities. The metrics measure progress in five areas: Energy Systems, Energy Usage and Burden, Critical Infrastructure, Economic Development and Community Operations. Multiple metrics were developed for each of the aforementioned areas that addresses specific resilience planning activities, initiatives, or programs. The presented metrics cover a range of activities related to a community's resilience, primarily in relation to energy, although other key resilience activities are also included. The general performance targets provided are intended to be measurable and relevant to community resilience. The method of measurement is described and data sources are identified. The methods of measurement and

data sources were designed not only to measure progress, but also to be inexpensive and simple to collect or calculate where possible. A suggested measurement period is provided as well as a brief description of why the metric is important.

These metrics are intended to provide options to choose from and communities do not need to use all of the metrics. A priority scale was provided as a guide; however, it is suggested that communities select metrics that are meaningful and help them reach their strategic planning goals.

Specific targets, or goals, should be established by communities, and while attainability should be a consideration, metrics should also drive improvements in resilience. It is important that metrics be specific and quantifiable, such as specifying a percentage increase rather than



calling for an undefined improvement. Specific, quantifiable targets are more likely to drive results and function as true measures of progress. Targets will be specific to each community and dependent upon available resources, starting points and priorities. Given the limited resources available to SMSC, incremental targets demonstrating progress toward larger goals are encouraged. Community engagement should include discussions about how and when progress will be measured to identify resilience initiatives and goals. Input from community members and city employees will help promote buy-in and make success more likely by ensuring that everyone understands the goals and what is considered progress and success.

Following the period of data collection and measurement, results may show successes or identify areas for expansion, improvement and focus based on measured performance. The metrics will provide objective measures upon which adjustment, decision making, or further evaluation can be based. Publishing or reporting measurements is critical and leading practices support transparency with stakeholders and community members. Informing the community of progress toward the plan's objectives will keep the public engaged and supportive of resilience efforts. Additionally, setting targets and goals, measuring progress, practicing transparency and upholding accountability can enable communities to obtain financial resources and pass ordinances needed to make the community more resilient.

Communities should regularly revisit selected metrics to determine metric usefulness and value, as not all metrics will perform as expected or needed. If a metric is not adequately measuring progress towards an outcome or performance of a program, communities should look for ways to improve metric usefulness or for a different metric that provides better information.

Case Study 4 Bronzeville Neighborhood in Chicago, Illinois

Bronzeville Neighborhood in Chicago, Illinois

The City of Chicago and ComEd partnered to make Bronzeville, Chicago one of the most connected, green and resilient communities in the nation through ComEd's Community of the Future initiative. Key to the initiative's success was establishing metrics early in program development and planning to measure areas of strength and opportunities for growth to achieve goals. One of the initiative's main goals is to promote economic growth and development and prepare for future decarbonization through STEM education, especially among underrepresented populations in the STEM field. To encourage creativity and engagement in STEM education among local high school students, ComEd and the City launched Ideathon, a program that gives students access to cutting-edge technology and creates a platform for developing prototypes and ideas to make their community more resilient and livable. Metrics and surveys showed that 70% of students would participate in Ideathon again if given the chance, with almost all remaining students expressing that they would not be eligible due to graduation approaching for seniors. Metrics also recorded what skills students learned, what areas of focus they would like to spend more time on and favorite topics. This information may be helpful for improving the program to further engage students or to connect them with mentorships and opportunities related to highly favored topics.

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Proposed Resilience Metrics

Metrics were designed to measure progress in five resilience areas:

Energy System:

Electric utility and reliability of power.

Energy Usage and Energy Burden:

Energy consumption and the amount paid for energy.

Critical Infrastructure:

Osystems, networks and assets that are essential for a functioning community.

4 Economic Development: Economy, workforce and transportation.

Community Operations:

O Local government and its ability to serve the public.

It is not expected that communities will use all metrics provided, but the catalogue of metrics provides options that communities can align with their own resilience priorities. Under each area the following are provided a:

Key Metrics

Metrics that are foundational to resilience.

Primary Metrics

Metrics that are generally considered important resilience areas.

Secondary Metrics

Metrics that may be important to a specific community.

It is recommended that communities use all applicable Key Metrics, two or three Primary Metrics and two or three Secondary Metrics for each resilience area.

The complete set of metrics, with targets, measurement methods, data sources and other information are provided in Appendix C. Table 11 sets forth the metrics provided for each resilience area.

Table 10. Metrics

ENERGY SYSTEM METRICS

Key Metrics		
System Vulnerability Assessment	System Risk Mitigation Planning	System Emergency Planning
Primary Metrics		
Electric Utility Service Reliability	Electric Utility Service Reliability for Critical Service Customers	Electric Utility Critical Customers' Unmet Electric Load Due to Power Outage
Reduction of Service Outages	Reduction of Service Outages for Critical Service Customers	Utility System Operator Redundancy
	Electric Utility Distribution System Redundancy	
Secondary Metrics		
Electric Utility Customer Aver- age Interruption Duration Index (CAIDI)	Electric Utility Momentary Average Interruption Fre-quency Index (MAIFI)	Mapped Distribution Infrastructure
Electric Utility Advanced Metering Infrastructure	System Mitigation Plan Re-view	Mitigation of Common System Risks and Threats

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ENERGY USAGE AND BURDEN METRICS

Key Metrics		
Electric Utility System Peak Demand Reduction	Energy Burden	Energy Efficiency and Conservation Education
Primary Metrics		
Energy Efficiency Training for Landlords	Energy Audits Completed	Energy Usage in City Facilities After Installation of Energy Efficiency Measures
Amount of Energy Savings from Energy Efficiency Programs	Low-Income Household Participation in Energy Efficiency Programs	
Secondary Metrics		
Household Energy Usage After Energy Efficiency and Conservation Training	Energy Efficiency Program Participation Rate	Building Energy Code Adoption
Building Energy Code Compliance	Energy Generated by Distributed Energy Systems	Amount of Energy Generated from Renewable Sources
Distributed Energy Resources at City Facilities	Percentage of Energy from Distributed Energy Resources in City Facilities.	Percentage of Energy Generated from Distributed Energy Resources
Energy Efficiency Measures in Older Housing Stock	Energy Burden in Older Housing Stock	Energy Burden in Renter- Occupied Housing
City Facility Energy Benchmarking	Technical and Planning Assistance Partnerships	

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CRITICAL INFRASTRUCTURE METRICS

Key Metrics		
Critical Infrastructure Asset Vulnerability Assessment	Critical Infrastructure Asset Mitigation Planning	Critical Infrastructure Asset Emergency Planning
Primary Metrics		
Backup Sources of Electricity for Critical Infrastructure	Critical Infrastructure Asset Mitigation Plan Review	Mitigation of Common Critical Infrastructure Asset Risks and Threats
Critical Infrastructure Energy Benchmarking	Energy Usage of Critical Infrastructure Facilities After Installation of Energy Efficiency Measures	Backup Communications
Secondary Metrics		

Distributed Energy Resources

ECONOMIC DEVELOPMENT METRICS

Key Metrics		
Household Connectivity	Trail Connectivity	Transportation Access
Multi-Modal Transportation	Community Walkability	
Primary Metrics		
High School Graduation Rate	Educational Equity	Energy Efficiency Programs for Small Businesses
College Graduation Rate	Energy Efficiency and Conservation Education for Small Businesses	Economic Impact of Tourism
	Job Training Programs	
Secondary Metrics		
Job Training for Resilience Efforts	Economic Impact of Power Outages	Overnight Accommodation
Access to Public Transit	Energy Usage After Energy Efficiency and Conservation Training	



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COMMUNITY OPERATIONS METRICS

Key Metrics		
Community Vulnerability Assessment	Community Mitigation Planning	Emergency Planning
Primary Metrics		
Community Population Vulnerability Assessment	Greenhouse Gas Emissions Reduction	Resilience Expenditures
Redundant Personnel for Essential City Services	Budgeting for Resilience	Collaboration in Community Mitigation Planning
Secondary Metrics		
Community Mitigation Plan Review	Mapped Infrastructure	Streetlight Outages
Mitigation of Common Community Risks and Threats	Geographically Dispersed Placement of Emergency Response	Crime Reduction



12 PARTNER COMMUNITIES⁵⁶

Graphics:Reserve space here for a map of Missouri with the locations of Rolla, St. James and Stockton noted. If we can get suitable pictures, may have a picture from each linked somehow to ther location on the map. If pictures are available and suitable, we will place them in other locations as well.

⁵⁶ Information in the partner community descriptions is informed by the stakeholder engagement process, initial community meetings and stakeholder engagement workshops that are described in the Roadmap to Resilience Development Process section of this document.





City of St. James

St. James is taking action to improve its community resilience by building on its existing assets and strengthening its utility systems, critical infrastructure, economic opportunity and community operations. Although the City's municipal utility system has high electric reliability ratings and receives a portion of power supply from renewable resources, the City recently adopted a capital improvement plan to modernize electric, water, sewer and natural gas distribution infrastructure. The City is also strengthening its electric system resilience through their existing tree-trimming and utility upgrade pole program and forthcoming electric interconnection point code enforcement program. The City is taking initial steps to improve emergency community operations through their emergency plan development process. The City is also interested in capitalizing on its community assets and convenient location to increase tourism and become a retirement community to generate revenue for the community.

City Overview

St. James, known for its wineries and trout fishing at nearby Meramec Spring Park, lies on along Interstate 44. The community's historic footprint, including its downtown, primary population center, schools, city parks and cemetery, lie south of the interstate, as do commercial railroad tracks. North of the Interstate, development is newer and less dense and includes restaurants, the St. James Winery, a nursing home, hotels, a Wal-Mart distribution center employing 700 people and additional housing. Commercial activity is found throughout the community, with industrial and heavier commercial facilities primarily on the city's edges. The community is surrounded by agricultural land, with large tracks of wooded areas to the south.

Table 11. St. James Demographic Summary⁵⁷

	ST. JAMES	MISSOURI STATEWIDE
Population	4,112	6,090,062
Area (Square Miles)	4.3	69,704
Income		
Median Household Income	\$44,417	\$53,560
Residents Living Below the Poverty Line	18%	14%

Resilience Efforts

The impacts of small-scale events helped the community understand the need for power and other services for disaster response and a number of resilience activities have been initiated. The community is in the process of developing an emergency plan and is increasing operational redundancy to make infrastructure more dependable. Multi-year tree-trimming and utility pole upgrade programs are underway to help prevent unplanned electricity outages. A new initiative will involve code enforcement related to electric interconnection points to prevent fire hazards. The capital improvement plan, described above, will allow city personnel to address preventative measures and modernization.

57 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.

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Utilities

All of the City's utilities are provided by a municipal system. Although the electric distribution system has high reliability ratings, community leaders described their infrastructure overall as aging. A portion of St. James's power supply comes from renewable resources. Management of the water and wastewater systems has been outsourced. The sewerage system has inflow and infiltration issues, resulting in bypasses of the sanitary systems resulting in discharge of untreated sewerage. The City recently adopted a capital improvement plan to modernize infrastructure rather than only fix what is broken. Although rates have been increased recently, ratepayers still benefit from relatively low rates. The utility system makes a payment in lieu of taxes based on revenue, which funds a significant portion of the City's budget.

Buildings

Housing is primarily single-family and was generally constructed more than 30 years ago. The City has building codes that were adopted in the 1970s. Building permits are required for external construction, but there are no provisions for internal inspections. Planning and zoning requirements for lot sizes have limited rebuilding when older homes are destroyed. Homes are generally not energy efficient, with little incentive to do so given low electricity rates. Rental properties have high rates of electric service disconnection, with customers often having multiple disconnections each year.

Table 12. St. James Housing and Heating Fuel Statistics⁵⁸

	JAMES	STATEWIDE
Housing		
Total Number of Units	1,897	2,775,635
Owner-Occupied	57%	67%
Older than 30 Years	76%	68%
Multi-Family (two or more units)	43%	20%
Renters Paying > 35% of Income in Rent	34%	37%
Median Rent	\$667	\$809
Housing Units With Mortgages>35% of Income	16%	9%
Median Home Value	\$89,000	\$151,600
Heating Fuels		
Natural Gas	37%	51%
Electricity	57%	36%
Propane	1%	9%
Wood	3%	4%
No Heat	2%	>1%

Employment

City leaders indicate that labor shortages impact economic development and City operations. Technical training programs are needed. Shifting employment trends have limited opportunities for college-educated residents and portions of the workforce that have trouble passing drug tests.

Table 13. St. James Employment Characteristics⁵⁹

	ST. JAMES	MISSOURI STATEWIDE
Unemployment	6.7%	5.1%
Population Not in Labor Force	40%	37%
Class of Civilian Worker	S	
Private Business Employees	81%	82%
Government Employees	15%	12%
Self-Employed	4%	6%
Employment Sectors		
Education/Healthcare/ Social Services	23%	24%
Retail	20%	12%
Manufacturing	14%	11%
Entertainment/Food/ Tourism	7%	9%
Transportation/ Warehousing/Utilities	5%	5%
Finance/Insurance	6%	7%
Professional/Scientific/ Management/Admin	13%	10%
Construction	3%	6%
Public Administration	3%	4%
Agriculture	2%	2%

⁵⁸ United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.

⁵⁹ United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.



Community Assets

Community leaders described community assets including historic charm, a walkable downtown and a low cost of living. Tourism is a major contributor to the City's economy, with the winery and Meramec Spring bringing in more than 400,000 visitors annually. The community wants to expand its tourism offerings and become a weekend destination. Other assets include the St. James Veteran's Home and Veterans Affairs Clinic. Leveraging these assets and the City's proximity to Fort Leonard Wood and Rolla, which has medical facilities, St. James would like to become a retirement community. To further its tourism and retirement community goals, City leaders would like to broaden transportation options by providing a shuttle or trolley between St. James and Rolla and becoming a golf cart community for travel between the north and south portions of the City.







City of Stockton

Much of Stockton's resilience efforts are shaped by the City's experience with the tornado of 2003, pursuit of reaching a goal of 100% clean, renewable energy and the natural waterfront location that is ripe for tourism. Community leaders plan for tornado response and the City recognizes the need to expand their network of two tornado shelters. The City also adopted a new building code after the 2003 tornado and recognizes that the code needs to be updated to support more resilient infrastructure. To accomplish the City's energy goal, the City is undertaking community-driven initiatives to increase energy efficiency, solar energy generation and active, pollution-free transportation use. Lastly, the City aims to enhance economic development by expanding dining, accommodation and retail developments for Stockton Lake tourists to enjoy.

City Overview

Table 14. City of Stockton DemographicSummary60

	STOCKTON	MISSOURI STATEWIDE
Population	1,818	6,090,062
Area (Square Miles)	2.1	69,704
Income		
Median Household Income	\$40,973	\$53,560
Residents Living Below the Poverty Line	23%	14%

The City of Stockton is on the northern edge of Stockton Lake, a 25,000-acre lake considered one of the top 10 sailing destinations in the United States that attracts more than 1 million visitors each year. The county seat of Cedar County, the City is situated at the intersection of two state highways. Stockton's commercial and industrial areas are primarily along or near the highways. Its schools, grocery store, healthcare facilities, senior center and City Hall are all in the southwest portion of the city. Housing is primarily located in the center of the community. Within the city limits are large, contiguous parcels of land available for development. A small, private airport is located just outside of the city limits. The lake and agricultural land surrounds much of the City. The closest larger community is Bolivar, an 11,000-person municipality located 20 miles away. Springfield, Missouri's third-largest city, is 50 miles to Stockton's southeast. Areas adjacent to Springfield are the fastest growing in the state.



60 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.





Resilience Efforts

The residents of Stockton have lasting memories of the 2003 tornado and their resilience initiatives often address its impacts. The community has used stakeholders to plan for tornados and there are two shelters in town, with a recognized need for more.

The City installed two solar arrays that have been generating solar power since early 2019. Together, the arrays have a total 177 kilowatt capacity generating an estimated 264 megawatt-hours per year, which can provide all of the energy required to operate the City's water pumping stations. The solar installations are means to provide water in case of a tornado or other energy disruption. The City is funding the project over a 10 year period with energy savings from installing the solar modules and replacing city light bulbs with LEDs. The project enables all city water customers to reap the benefits of clean solar energy, along with an estimated \$1,278,950 in energy savings over 25 years. Stockton is establishing an "agrivoltaic" pollinator meadow on the land surrounding the north array to attract honeybees and other pollinators that will benefit home gardeners and enhance local food security. Working with stakeholders toward a goal of 100% clean, renewable energy, city leaders continue to implement community-driven solutions to transition towards local, affordable solutions such as energy efficiency, solar energy and electric transportation. In October 2018, the city partnered with Liberty Utilities – Empire District to install two electric vehicle charging stations on the town square.

By legalizing golf carts on City streets, this vehicledependent community is moving toward its goal of streets that are safe for vehicles, bicycles, golf carts and pedestrians. Additionally, compared to how streets were impassable for more than two days following the 2003 tornado, golf carts are considered a more viable form of transportation after storms.

Utilities

The City provides water and sewer services, maintains streets, streetlights and parks and provides trash and recycling services. City leaders report that sewer costs are the most expensive item in the budget and that the rates are high. The wastewater/sewer system that was built after the tornado, with outdated parts, has had past compliance issues, which contributes to ongoing expenses. Some residents are chronically late making utility payments, resulting in regular shutoffs. The City is often understaffed. Staff tends to be younger with high turnover, often moving to larger cities for higher salaries. Law enforcement is provided by the county, although the City has been exploring options for its own police force. Electricity is provided by Liberty Utilities - Empire District and the community reports no major issues with reliability. Broadband access has not expanded in recent years and lack of internet access has impacted land sales.

Buildings

Many of Stockton's homes were damaged during a 2003 tornado outbreak that caused significant loss of life and property damage in the City. As a result, several of the older homes were repaired and renovated and newer commercial and residential structures replaced those that were lost. A small number of homes in low-lying areas are prone to flooding. The city adopted a building code shortly after the 2003 tornado, but City officials stated that it needs to be updated. Additionally, the City enacted a PACE financing ordinance in 2018.

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Table 15. Stockton Housing and Heating Statistics⁶¹

	STOCKTON	MISSOURI STATEWIDE
Housing		
Total Number of Units	942	2,775,635
Owner-Occupied	45%	67%
Older than 30 Years	67%	68%
Multi-Family (two or more units)	15%	20%
Renters Paying > 35% of Income in Rent	48%	37%
Median Rent	\$613	\$809
Housing Units With Mortgages>35% of Income	12%	9%
Median Home Value	\$85,900	\$151,600
Heating Fuels		
Natural Gas	32%	51%
Electricity	61%	36%
Propane	4%	9%
Wood	3%	4%
No Heat	0	>1%

Employment

Stockton's largest employer is the school system, with many small businesses operating in the community. The City has an industrial park with two tenants. Community leaders report that there is a need for trade schools and training in the area and that low pay and limited options lead to the community's best students seeking opportunities elsewhere. The opioid crisis has impacted the City and workforce due to drug test failures and, more recently, homelessness.

Table 16. Stockton Employment Characteristics⁶²

	STOCKTON	MISSOURI STATEWIDE
Unemployment	10.7%	5.1%
Population Not in Labor Force	52%	37%
Class of Civilian Work	ers	
Private Business Employees	80%	82%
Government Employees	10%	12%
Self-Employed	10%	6%
Employment Sectors		
Education/ Healthcare/Social Services	24%	24%
Retail	20%	12%
Manufacturing	11%	11%
Entertainment/Food/ Tourism	11%	9%
Transportation/ Warehousing/Utilities	2%	5%
Finance/Insurance	3%	7%
Professional/ Scientific/ Management/Admin	2%	10%
Construction	10%	6%
Public Administration	4%	4%
Agriculture	4%	2%

Community Assets

As the largest community near Stockton Lake, the City has casual dining opportunities and some lodging facilities. Community leaders want to expand dining, accommodation and retail options to include more upscale choices. They consider outdoor recreational opportunities to be one of City's primary strengths due to the community's proximity to public use areas, parks and marinas. Most development along the shores of Stockton Lake is prohibited by the U.S. Army Corps of Engineers. With more than 180 acres not subject to this prohibition and available for development in the City, capitalizing on tourism is seen as a significant opportunity. Another economic opportunity identified is related to the recent legalization of medical marijuana in Missouri. Entities interested in locating in the City's industrial park have applied for licenses and some area farming operations are considering becoming marijuana producers.



61 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.

62 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.

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With less than half of the residents in the workforce, leaders describe the area as a lake and retirement community. The Korth Senior Center is a vital part of the community, providing meals to people 60 and older whether or not they can pay. In April 2019, Stockton opened its new Lake Stockton Healthcare Facility, a 90-bed long-term skilled nursing facility with a 30-bed memory unit designed to meet the specific needs of individuals with Alzheimer's disease and other forms of dementia. Leaders believe that the quality of life (peaceful, tolerant and a strong sense of community) offered by this "country community" is a major attraction for prospective residents. One challenge in this area is access to healthcare. Although there are health clinics staffed with medical professionals and a health department in the City, there is not a full healthcare system. The nearest hospital is in Bolivar and residents often travel to Springfield for health services.







City of Rolla

The City of Rolla's resilience efforts focus primarily on its energy system and critical infrastructure. The City is home to a 3.2-megawatt capacity solar farm that can power 350 homes. The City is also working to reduce municipal energy usage through energy efficiency measures. The electric system serving the community has a new substation that receives routine improvement to improve reliability. The City is also updating its emergency operations plan and holds annual emergency exercises to identify areas of improvement, gaps, resources and partnerships to increase resiliency. Current emergency resilience resources in Rolla include diesel generators that can provide backup power to the nearby hospital, Red Cross designated shelters and the local airport's storage of emergency supplies. The City also has complete streets initiatives underway to develop safe and accessible streets for motorists, pedestrians and bicyclists. Lastly, Rolla developed an Economic Marketing Plan to attract professionals in the healthcare, biomedical and armaments industries.

City Overview

Table 17. City of Rolla Demographic Summary⁶³

	ROLLA	MISSOURI STATEWIDE
Population	20,117	6,090,062
Area (Square Miles)	12	69,704
Income		
Median Household Income	\$34,934	\$53,560
Residents Living Below the Poverty Line	31%	14%

Rolla is the largest of the partner communities in population and in size. Located at the crossroads of Interstate 44 and State Highway 63, the primary north-south corridor in central Missouri, Rolla is the county seat of Phelps County. The City is also the home to the Missouri University of Science and Technology, which has an enrollment of 8,600 and is well-known for its school of engineering. Most of the community lies south of the interstate, although commercial and residential development is expanding to the north. A small number of University facilities and some student housing is located north of the interstate. A pedestrian bridge over the interstate is expected to be completed in late 2020 to connect the northern developments to the main campus.

Resilience Efforts

The Missouri Public Energy Pool, of which RMU is a member, has a long-term power purchase agreement for all of the energy produced at a 3.2 megawatt solar farm located in Rolla. Built in 2016, the solar farm supplies enough energy for approximately 350 homes, reaches maximum output for four to five hours per day.

There is no public transportation in Rolla. Although City leaders believe that public transportation is needed, the community lacks revenues and resources to support a system. City leaders are working on Complete Streets initiatives to make streets accessible and safe for all users, including bicycles and pedestrians. Broadband access is limited on the outskirts of town.

63 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs







The City, which has a part-time Emergency Management Director, is updating its emergency operations plan and participates in annual emergency exercises to identify areas for improvement, gaps, resources and partnerships to strengthen. Rolla and Phelps County maintain a strong working relationship and the county has a comprehensive natural disaster mitigation plan.

Rolla has also implemented resilience measures in several other areas. Seventeen diesel generators are available for backup power, with three located near the hospital and others stored near critical infrastructure (e.g., wells and water towers). All streetlights have been converted to LED fixtures and all traffic lights have battery back-up with LED fixtures. The City is working to decrease its internal electrical loads with efficiency measures. The community prepared a long-term operation plan and is aware of the increasing cost and decreasing revenue per mile of infrastructure. The City conducted a sewer lateral line replacement program to reduce inflow and infiltration issues in its wastewater system. Rolla has Red Crossdesignated shelters with contracts in place. The City's airport is used as a staging area for emergency supplies. Rolla's communications infrastructure is strong, although there is a need for new portable radios for police and fire services.

Utilities

Rolla Municipal Utilities (RMU) provides power to approximately 9,600 metered customers and water to 7,800 metered customers⁶⁴. The Public Works Department is responsible for streets, sidewalks, storm and sanitary sewers and wastewater treatment. Municipal utility charges are provided on one bill. A number of customers, some of whom would not be considered lowincome, experience multiple disconnections for non-payment during the year. RMU has not yet identified why customers that are not considered low-income experience shut-offs due to nonpayment. The utility does not provide any incentives for efficiency measures. Rolla's power portfolio includes renewable energy sources and the City sells Renewable Energy Credits to some commercial customers along with offering a community solar program. Both the City and RMU participate in long-term planning and the water and wastewater systems are in above-average condition. A robust water main replacement program was initiated approximately 20 years ago and 70% of the mains are now composed of PVC piping. In addition to water main replacement, RMU initiated a program to replace water service lines within City rights-of-way from copper to PEX tubing. There are three wastewater treatment plants, two of which are scheduled for major upgrades in 2021, and water supply adequacy is ensured by the water wells used. The University owns the water mains on its campus, and hydrants behind the University's metering impact water pressure and performance. The electric system has a new major substation and receives routine reliability improvements. Power is primarily purchased at wholesale and procured regionally in a pool with other cities. The University has its own electrical distribution system and purchases power from RMU. The City attributes the success of its utilities to its long-term employees, even though the community struggles to maintain competitive wages in certain job categories such as journeyman linemen. Natural gas distribution service in Rolla is provided by Ameren Missouri.

⁶⁴ Rolla Municipal Utilities. rollamunicipalutilities.org/.

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Buildings

While more than half of Rolla's housing stock is single-family units, it has a higher percentage of multi-family units than most Missouri communities due primarily to the City's University population. Although 60% of the housing was built more than 30 years ago, community leaders indicate there has been housing growth in the past decade, including older areas being redeveloped and student housing beginning to locate in the downtown area. The City primarily uses the 2018 International Code Council (ICC) Codes and has adopted the 2000 ICC Energy Code.

Table 18. Rolla Housing and Heating Statistics⁶⁵ MISSOURI

	ROLLA	STATEWIDE
Housing		
Total Number of Units	8,968	2,775,635
Owner-Occupied	42%	67%
Older than 30 Years	61%	68%
Multi-Family (two or more units)	43%	20%
Renters Paying > 35% of Income in Rent	19%	37%
Median Rent	\$1,024	\$809
Housing Units With Mortgages>35% of Income	19%	9%
Median Home Value	\$125,100	\$151,600
Heating Fuels		
Natural Gas	24%	51%
Electricity	68%	36%
Propane	7%	9%
Wood	1%	4%
No Heat	>1%	>1%

Employment

Rolla's median household income, number of residents living below the poverty line and percentage of population not in the labor force are impacted by its student population. Workforce skills for those that are unemployed tend to be limited and community leaders would like to pursue additional trade and vocational training to enhance the tight labor pool. The opioid crisis impacts the workforce since a portion of potentially employable persons is unable to pass drug tests. Community leaders are also concerned about the interplay of drug- free workplaces and medical marijuana. In addition to a labor force that includes students in unskilled, intern and research positions, the community's proximity to Fort Leonard Wood provides opportunities for military spousal employment. Although the cost of labor is attractive to employers, many of the community's young people leave for better salaries in larger communities and it can be difficult to attract young professionals.

The community has a strong employment base due to the University and local hospital. With its low cost of labor, competitive utility rates and good schools, the community has seen steady growth over the last five decades, but community leaders believe the City needs a more diversified tax base, specifically, a larger industrial base for balanced tax revenues. The City has developed an Economic Marketing Plan targeting two areas for recruitment: healthcare/biomedical and weapons/ armaments. Other priorities for the City include transportation development and traffic calming on Highway 63 through town.

65 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.

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Table 19. Rolla Employment Characteristics⁶⁶

	ROLLA	MISSOURI STATEWIDE
Unemployment	5.4%	5.1%
Population Not in Labor Force	48%	37%
Class of Civilian Workers		
Private Business Employees	74%	82%
Government Employees	22%	12%
Self-Employed	4%	6%
Employment Sectors		
Education/Healthcare/ Social Services	41%	24%
Retail	13%	12%
Manufacturing	5%	11%
Entertainment/Food/ Tourism	14%	9%
Transportation/ Warehousing/Utilities	4%	5%
Finance/Insurance	3%	7%
Professional/Scientific/ Management/Admin	5%	10%
Construction	4%	6%
Public Administration	6%	4%
Agriculture	1%	2%





66 United States Census Bureau (2018). American Community Survey, 5-Year Data Profile 2014-2018. census.gov/programs-surveys/acs.



13 CONCLUSION

As improving resilience within communities becomes increasingly critical, it is important to understand the unique resources and barriers that SMSC face. The Roadmap to Resilience is a document that was compiled as a partnership between the Missouri Department of Natural Resources and local communities, local governments, utilities and energy agencies in order to serve as a resource for SMSC in resilience planning. The actions, metrics and case studies are presented to show effective strategies pertaining to partnerships, funding and leading practices for long-term resilience planning and implementation of initiatives.



14 APPENDICES

APPENDIX A: ROADMAP TO RESILIENCE RESOURCES

Resilience Plans and Community Examples

Greensburg, Kansas's recovery planning website includes links to the city's Sustainable Comprehensive Master Plan, Long-Term Community Recovery Plan and the NREL 5 Year Building Performance Report (greensburgks. org/residents/recovery-planning/sustainablecomprehensive-master-plan/view).

The Illinois Solar for All Program is designed to advance low-income adoption of PV distributed solar generation and community solar (illinoissfa. com/).

The Mississippi River Cities and Town Initiative works to promote economic development and environmental security and stability along the Mississippi River corridor by providing tools and support to its member mayors. The effort aims to help attract green jobs, move toward a sustainable economy and achieve local environmental protection goals (mrcti.org/).

In lieu of an official resilience plan, Livable Nashau created a dashboard and online tool through which residents can track the progress of the New Hampshire community's resilience efforts (livablenashua.org/home).

Nevada City, California has a Sustainability Resource Plan and Energy Action Plan that can be found at:

- Sustainability Resource Plan: nevadacityca.gov/ pview.aspx?id=20800&catid=564
- Energy Action Plan: nevadacityca. gov/files/documents/ EnergyActionPlan1314062855072016PM.pdf

Saratoga Springs, New York's Sustainability and Resiliency website provides links to a number of resilience initiatives relating to climate, energy and transportation (saratoga-springs.org/2410/ Sustainability-and-Resiliency).

Weed, California has resources including their Resilience Strategy that can be found at: resilience-weed.org

The City of St. Louis, Missouri provides links to its Sustainability Plan, Sustainability Ordinances and other sustainability information (stlouis-mo.gov/ government/departments/planning/sustainability/).

Kansas City metropolitan area's Climate Action Plan can be found at: mkccac.org

Skagway Alaska's has a Multi-Hazard Mitigation Plan that can be found at: skagway.org/sites/ default/files/fileattachments/community/ page/28411/multi-hazard_mitigation_plan.pdf Pittsburgh, Pennsylvania has a State of Sustainability Report that can be found at: apps. pittsburghpa.gov/redtail/images/7137_16_17_ sustainability_report_final.pdf

Peoria, Illinois's Sustainability Page provides publications and resources that include the city's Sustainability Action Plan and Year in Review (peoriaaz.gov/home/showdocument?id=4284).

Atlanta, Georgia has a Sustainability Plan that can be found at: www.rcc.city

The Florida Resilient Coastlines Program provides resources to and promotes collaboration between, the State's coastal communities as they address resilience planning and implementation (floridadep.gov/rcp/florida-resilient-coastlinesprogram).

The Minnesota Pollution Control Agency's Climate-Resilient communities webpage provides suggestions for communities to build resilience and provides links to resources inn a variety of resilience areas (pca.state.mn.us/air/climateresilient-communities).

Regional planning has unique challenges in coordination and relies heavily on partnership involvement. The U.S. Department of Housing and Urban Development's quarterly publication Evidence Matters discusses regional planning challenges in a 2015 article. "Partnerships and Planning for Impact," Evidence Matters, Summer/



Fall 2015, Office of Policy Development and Research, U.S. Department of Housing and Urban Development (huduser.gov/portal/periodicals/em/ fall15/highlight1.html#title).

Resilience Planning Resources

National Renewable Energy Laboratory produced a tool useful for multi-jurisdictional resilience planning with a variety of suggestions and considerations that are unique to planning, which involves multiple levels of government and other jurisdictions (nrel.gov/docs/fy19osti/73509.pdf).

The U.S. Climate Resilience Toolkit provides resources for state and local decision makers to make data-driven decisions related to resilience and hazards (toolkit.climate.gov/).

National Oceanic and Atmospheric Administration's Coastal and Waterfront Smart Growth website provides reports, strategies, resources and case studies (coastalsmartgrowth. noaa.gov/welcome.html).

Environmental Protection Agency Hazard Mitigation for Natural Disasters presentation for water utilities can be found here: epa.gov/sites/ production/files/2016-08/documents/160815-hazar dmitigationfornaturaldisasters.pdf

100 Resilient Cities (now Resilient Cities catalyst) was designed to encourage urban resilience. Their website provides various tools, publications, case studies, strategies and other information relating to resilience, and can be found here: https://www. rcc.city/ The U.S. Department of Housing and Urban Development's Sustainable Communities Initiative provides a clearing house of information promoting collaboration to coordinate housing, workforce, infrastructure and economic development (hudexchange.info/).

Stakeholders and Partners

Engagement

Literature review of partnership frameworks and characteristics. Marana, P., et al. (2018). A framework for public-private-people partnerships in the city resilience-building process. Safety Science. Vol. 110, Part C. 39. (sciencedirect.com/ science/article/pii/S0925753517303016).

There are a wide variety of stakeholder management and communications planning tools and guides available online that can help communities decide how to group stakeholders, prepare for engagement and determine the level engagement necessary. Examples include:

- How to Create Stakeholder Management and Communications Plans: smartsheet.com/ how-create-stakeholder-management-andcommunication-plans
- The Easy Guide to Stakeholder Management: creately.com/blog/diagrams/stakeholdermanagement-guide

Potential Partners

State and Territory Energy Offices are located through the National Association of State Energy Officials website can be found here: naseo.org/ members-states The Missouri state energy office is the Missouri Department of Natural Resources Division of Energy (energy.mo.gov/).

The Federal Emergency Management Agency's Office of Resilience's website can be found here: fema.gov/resilience.

National Association of Regulatory Utility Commissioners website provides links to state energy regulatory commissions and federal regulatory organizations (naruc.org/about-naruc/ regulatory-commissions/).

Community action agencies provide programs and advocacy for low-income families. Programs often include, among others, low-income weatherization activities, education and job training. The Community Action Partnership's website has an interactive map through which local and state Community action agencies a can be located (communityactionpartnership.com/find-a-cap/).

Missouri Community Action Network represents the State's nineteen community action agencies (communityaction.org/).

The Federal Emergency Management Agency's listing of State Emergency Management Agencies can be found here: fema.gov/emergencymanagement-agencies

The U.S. Department of Energy's Better Buildings Initiative provides information relating to potential financing partners (betterbuildingssolutioncenter. energy.gov/financing-navigator/allies).

State municipal leagues provide a variety of services to their member cities and counties of all



sizes including education, data and opportunities for collaboration. A directory of each state's municipal league is available online (nlc.org/statemunicipal-leagues).

The Missouri Municipal League represents communities throughout Missouri by providing technical assistance and advocacy in a variety of areas, including resilience efforts (mocities.com/).

The Government Finance Officers Association, with more than 20,000 members from local, state and federal government, provides a variety of resources relating to financial resilience and financing resilient infrastructure (gfoa.org/).

Missouri Association of Councils of Government represents the State's 19 regional planning organizations (macog.org/).

Midwest Energy Efficiency Alliance is a collaborative network advancing energy efficiency in the Midwest for sustainable economic development and environmental stewardship. The organization provides publications, trainings and toolkits relating to energy efficiency (mwalliance. org/).

A nationwide listing of utility associations is available by searching utilities here: directoryofassociations.com/browse.asp

The Municipal Public Utility Alliance is a non-profit organization representing municipally-owned utilities. The organization provides training, technical assistance, power supply planning and management, financing and mutual aid for its members (mpua.org/general/custom. asp?page=energy). Renew Missouri is an organization created to advance renewable energy and energy efficiency in the State of Missouri: renewmo.org

Resilience Standards

Appendix B contains resilience standards including descriptions and links.

Baseline Analysis

The Department of Energy publication, Performing Energy Security Assessments- A How-To Guide for Federal Facility Managers, provides information on identification of critical infrastructure and assets and how to perform an energy security vulnerability assessment. Although prepared to address federal facilities, the document is applicable to any critical facility (1.eere.energy. gov/femp/pdfs/energy_security_guide.pdf).

The University of North Carolina publishes a guidebook, Community based Vulnerability Assessment: A Guide to Engaging Communities Understanding Social and Physical Vulnerability to Disasters, for preparing an assessment of a community's physical and social vulnerability to disasters (mdcinc.org/wp-content/ uploads/2017/11/Community-Based-Vulnerability-Assessment.pdf).

Designed for coastal communities, the National Oceanic and Atmospheric Administration's Community Vulnerability Assessment website provides links to training, risk and vulnerability assessment checklists and a Coastal Flood Exposure Mapper to assess coastal hazard risks and vulnerabilities (coastalsmartgrowth.noaa.gov/ gettingstarted/community_vulnerability.html). U.S. Energy Information Administration's Flood Vulnerability Assessment Map is an interactive tool that has combined FEMA's flood hazard with the EIA's energy infrastructure layers to help assess which key energy infrastructure assets are vulnerable to flood, storm surges and rising sea levels (eia.gov/special/floodhazard/).

USDOE's Technical Resilience Navigator helps organizations identify energy and water-related resilience gaps in order to develop practical and implementable solutions (femp.energy.gov/ resilience/).

U.S. Department of Energy's Resilience Planning Guide uses a site screening tool and a resilience risk evaluation tool to aid users in determining practical applications of distributed generation within their critical infrastructure and resilience planning.

- Resilience Planning Guide: dg.resilienceguide. Ibl.gov
- CHP Site Screening Tool: dg.resilienceguide.lbl. gov//CHPscreener
- Resilience Risk Evaluation Tool: dg.resilienceguide.lbl.gov/resilience-riskevaluation-tool

Nevada City, California's baseline analysis and resilience planning process resulted in a goal matrix that can be found here: nevadacityca.gov/ files/documents/NevadaCitySustainabilityTeamGo als-Matrix1329042051101618PM.pdf

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Identify Innovative Funding Sources

General Grant/Loan Search Tools (not specific to program or agency)

Grants.gov allows grant seekers to find and apply for federal funding opportunities on one website (grants.gov/web/grants/search-grants.html)

The U.S. Climate Resilience Toolkit provides resources for state and local decision makers to make data-driven decisions related to resilience and hazards. Among other resources, the Toolkit presents a variety of financial resources on its Funding Opportunities page (toolkit.climate.gov/ content/funding-opportunities).

The Funding Wizard posts funding opportunity updates on a weekly basis. Users can search opportunities by funding type, category, eligibility, or key words (fundingwizard.arb.ca.gov/).

Grant/Loan Search Tools Specific to Agencies, Entities, or Programs

Several federal agencies provide grant and loan tools including:

- U.S. Department of Energy: energy.gov/energyeconomy/funding-financing
- U.S. Environmental Protection Agency: epa. gov/grants
- Small Business Administration: sba.gov/ funding-programs
- Federal Emergency Management Agency's Non-Disaster Grants: fema.gov/non-disastergrants-management-system

- National Endowment for the Arts: arts.gov/ grants
- FEMA Non-Disaster Grants Management System: fema.gov/grants
- Department of Housing and Urban
 Development Community Development Block
 Grants: hud.gov/program_offices/comm_
 planning/communitydevelopment

Robert Wood Johnson Foundation provides funding for Healthy Communities Initiatives which include resilience related activities (rwjf. org/en/how-we-work/grants-explorer/fundingopportunities.html).

Kresge Foundation provides funding in a variety of environmental and resilience areas (kresge.org/ opportunities).

Grant/Loan Resources Related to Specific Subjects

Energy Efficiency

The Financing Navigator is an online tool to assist public and private organizations in identifying financing solutions for energy efficiency and renewable energy projects (betterbuildingssolutioncenter.energy.gov/ financing-navigator).

The Database of State Incentives for Renewables and Efficiency (DSIRE) is a database for incentives that support renewable energy and energy efficiency which is searchable by state (dsireusa. org/).

The American Council for an Energy Efficient Economy (ACEEE) provides information on state and local energy efficiency financial incentives available in each state (database.aceee.org/).

Rural Energy Savings Program: Lower energy bills for rural families and businesses and alleviate barriers to investment in energy efficiency measures (rd.usda.gov/programs-services/ruralenergy-savings-program).

High Energy Costs Grants: Lower energy costs for families and individuals in areas with high perhousehold energy costs (rd.usda.gov/programsservices/high-energy-cost-grants).

The Rural Energy for America Program provides financial assistance for renewable energy systems, energy efficiency measures and energy audits:

- Renewable energy systems, energy efficiency measures: usda.gov/programs-services/ruralenergy-america-program-renewable-energysystems-energy-efficiency
- Energy audits: www.rd.usda.gov/programsservices/rural-energy-america-programenergy-audit-renewable-energy-developmentassistance

Renewable Energy

National Renewable Energy Laboratory provides information and tools related to community solar and low- and moderate-income solar programs (nrel.gov/state-local-tribal/lmi-solar.html).

U.S. Department of Energy Better Buildings Financing Navigator: Online tool to assist public and private organizations to identify financing solutions for energy efficiency and renewable energy projects (betterbuildingssolutioncenter. energy.gov/financing-navigator).



The Database of State Incentives for Renewables and Efficiency is a database for incentives that support renewable energy and energy efficiency which is searchable by state (dsireusa.org/).

Drinking Water/Wastewater

The Clean Water State Revolving Fund: Address states' highest priority water quality needs, includes funding for energy and renewable energy projects associated with treatment works or collection systems (epa.gov/cwsrf/ learn-about-clean-water-state-revolving-fundcwsrf#eligibilities).

The Drinking Water State Revolving Loan Fund addresses drinking water needs including funding for related energy efficiency and water conservation measures (epa.gov/dwsrf).

Special Evaluation Assistance for Rural Communities and Households provides assistance on proposed water and waste disposal projects (rd.usda.gov/programs-services/search-specialevaluation-assistance-rural-communities-andhouseholds).

Water and Waste Disposal Program provides financial assistance for water and wastewater systems, solid waste disposal and storm water projects (rd.usda.gov/programs-services/waterwaste-disposal-loan-grant-program).

Others

National Integrated Drought Information System provides information and services to mitigate short and long-term drought and provide relief and recovery support for drought impacts (drought. gov/drought/resources/recovery). Solid Waste Management Grants provide funding to reduce or eliminate pollution of water resources from landfills (rd.usda.gov/programs-services/solidwaste-management-grants).

Community Facilities Direct Loan and Grant Program provides affordable funding to develop essential community facilities in rural areas (rd. usda.gov/programs-services/community-facilitiesdirect-loan-grant-program).

Water and Waste Disposal Program provides financial assistance for water and wastewater systems, solid waste disposal and storm water projects (rd.usda.gov/programs-services/waterwaste-disposal-loan-grant-program).

Grant and Loan Application Education Resources

Grants.gov's Grants Learning Center provides a variety of education topics related to federal grant funding, including how to apply, grant terms, grating agencies and reporting (grants.gov/web/ grants/learn-grants.html).

National Oceanic and Atmospheric Administration Office for Coastal Management's Resources and Tips Page provides links to multiple grant writing guides (coast.noaa.gov/funding/resources-tips. html).

U.S. Department of Health and Human Services Tips For Writing & Submitting Good Grant Proposals addresses U.S. HHS funding opportunities specifically, but contains concise recommendations relating to application planning, grant writers, grant writing and budgeting that are applicable to any grant application (hrsa. gov/sites/default/files/grants/apply/writestrong/ grantwritingtips.pdf).

Other Financing Options

Property Assessed Clean Energy Financing

PACE Nation provides nationwide information relating to PACE financing and programs. State programs can be found at: pacenation.org/paceprograms/#

Entities and programs that offer PACE financing in Missouri:

- Missouri Clean Energy District: mced.mo.gov
- Show Me PACE Clean Energy District: showmepace.org
- Set the PACE St. Louis: setthepacestlouis.com
- Missouri Energy Savings Program (St. Louis County): mo-esp.com

Energy Savings Performance Contracts

An Energy Savings Performance Contracting Toolkit is available at: betterbuildingssolutioncenter.energy.gov/energysavings-performance-contracting-espc-toolkit

Tax Incentives

The Energy Star website sets forth a listing of tax credits and deductions available for renewable energy and energy efficiency projects at: energystar.gov/about/federal_tax_credits/2017_ renewable_energy_tax_credit and energystar.gov/ about/federal_tax_credits/renewable_energy_tax_ credits

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Public-Private Partnerships

A description of public-private partnerships can be found here: thebalancesmb.com/public-privatepartnership-types-845098

Government Financial Officers Association has developed a list of key considerations for public entities to analyze before entering into publicprivate partnerships (gfoa.org/public-privatepartnerships-p3).

Utility Rate Structures

Handbook developed by the Regulatory Assistance Project that gives an overview of the electric power industry and how it is regulated. The handbook includes descriptions of rate structures (raponline.org/knowledge-center/ electricity-regulation-in-the-us-a-guide-2).

National Association of Regulatory Utility Commissioner website provides links to state energy regulatory commissions and federal regulatory organizations (naruc.org/about-naruc/ regulatory-commissions).

Green Banks

Green and resilience banks offer financing for a variety of resilience-related infrastructure. The National Renewable Energy Laboratory provides description of green banks as well as links to some of the more active green banks in the U.S. (nrel. gov/state-local-tribal/basics-green-banks.html).

Quantitative and Qualitative Federal and National Lab Resources

Quantitative Tools

Solar Resilient estimates necessary parameters of grid-connected photovoltaic and battery energy storage to provide power for during power outages (solarresilient.org/).

U.S. Department of Energy's Technical Resilience Navigator helps organizations identify energy and water-related resilience gaps in order to develop practical and implementable solutions (femp. energy.gov/resilience/).

U.S. Department of Energy's Resilience Planning Guide uses a site screening tool and a resilience risk evaluation tool to aid users in determining practical applications of distributed generation within their critical infrastructure and resilience planning.

- Resilience Planning Guide: dg.resilienceguide. lbl.gov
- CHP Site Screening Tool: dg.resilienceguide.lbl. gov//CHPscreener
- Resilience Risk Evaluation Tool: dg.resilienceguide.lbl.gov//resilience-riskevaluation-tool

The Energy Management Information System provides a set of tools and resources to monitor energy use, identify efficiency opportunities and set energy-related goals to improve resilience (betterbuildingssolutioncenter.energy.gov/toolkits/ implement-energy-management-informationsystems-emis-your-building-portfolio).

Federal Emergency Management Agency uses a cost-benefit ratio approach to compare project costs with ultimate benefits from hazard mitigation for specific sites and initiatives and is required by FEMA in order to be eligible for FEMA hazard mitigation funding (fema.gov/benefit-cost-analysis).

Hazus software is a Federal Emergency Management Agency tool that estimates highrisk locations and potential physical, economic and social impacts from earthquakes, floods and hurricanes using Geographic Information Systems technology (fema.gov/hazus).

The Hazard Mitigation Cost Effectiveness Tool is a cost-benefit analysis for transit agencies and planners designed to enhance resilience in public transportation systems (transit.dot.gov/funding/ grant-programs/emergency-relief-program/ hazard-mitigation-cost-effectiveness-hmce-tool).

Energy Star Portfolio Manager is a building benchmarking tool to manage the energy and water usage of commercial buildings. The tool also allows users to set energy use targets and conduct comparisons with other buildings (energystar.gov/ buildings?testEnv=false).

Distributed Energy Resources Customer Adoption Model is a decision support tool for decentralized energy systems to optimize distributed energy resources (DERs) parameters for buildings and microgrids (building-microgrid.lbl.gov/projects/ der-cam).



The Interruption Cost Estimate Calculator allows electric reliability planners to estimate interruption costs and/or the benefits associated with reliability improvements (icecalculator.com/).

National Renewable Energy Laboratory provides the Renewable Energy Integration and Optimization Model Subset to support commercial building managers evaluate the economic viability of grid connected DERs and specific parameters needed to sustain critical load during outages (reopt.nrel.gov/tool).

The State and Local Planning for Energy database informs data-driven state and local energy planning by providing electricity and natural gas consumption data at jurisdictional levels (gds.nrel. gov/slope).

The PVWatts Calculator, developed by NREL, estimates energy production and energy costs of grid-connected photovoltaic energy systems (pvwatts.nrel.gov/).

Qualitative Tools

The State and Local Solution Center contains a collection of resources that provide guidance for public sector leaders to invest in energy efficiency and renewable energy technologies. Resources are organized by four actions: develop an energy plan, design and implement energy programs, pay for energy initiatives and access and use energy data (energy.gov/eere/slsc/state-and-local-solution-center).

The U.S. Department of Energy Guide for Resilience Planning is a report with stepwise guidance to develop a vulnerability assessment framework and subsequent resilience plan of electricity assets and operations (adaptationclearinghouse.org/resources/climatechange-and-the-energy-sector-doe-guide-forclimate-change-resilience-planning.html).

Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions report presents climate change impacts on the U.S. energy sector at the regional level with a focus on the impacts of extreme weather events and the connection to resilience planning (energy. gov/policy/downloads/climate-change-andus-energy-sector-regional-vulnerabilities-andresilience).

The Guide to Community Energy Strategic Planning is a 10-step guide for long-term energy visioning to support comprehensive futurefacing energy strategies (energy.gov/sites/prod/ files/2014/05/f15/cesp_guide.pdf).

U.S. Department of Energy's Climate Change and the Energy Sector: Guide for Climate Change Resilience Planning assesses system vulnerabilities to extreme and fluctuating weather and allows for the creation of planning-level documents that include specific energy mitigation action items (energy.gov/sites/prod/files/2016/10/ f33/Climate%20Change%20and%20the%20 Electricity%20Sector%20Guide%20for%20 Climate%20Change%20Resilience%20Planning%20 September%202016_0.pdf).

The State Energy Resilience Framework, from Argonne National Lab, enables states and local governments – in conjunction with energy utilities – to identify resilience concepts, challenges and vulnerabilities so they can implement proven and cost-effective resilience enhancement options (energy.gov/sites/prod/files/2017/01/f34/State%20 Energy%20Resilience%20Framework.pdf).

National Renewable Energy Laboratory's Resilience Roadmap provides guidance to federal, state and local entities for resilience planning with a focus on multi-jurisdictional approaches in the energy and water sectors (nrel.gov/resilienceplanning-roadmap/).

The Power Sector Resilience Planning Guidebook includes key concepts and steps to develop localized resilience plans with particular focus on the power sector (nrel.gov/docs/fy19osti/73489. pdf).

The Community Resilience Planning Guide from National Institute of Standards and Technology helps determine processes to set priorities and allocate necessary resources to manage and incorporate social and economic community considerations into planning (nist.gov/topics/ community-resilience/planning-guide).

National Oceanic and Atmospheric Administration's U.S. Climate Resilience Toolkit includes resources to identify climate risks, conduct risk assessments, case studies and other relevant tools to assist in resilience plan development (toolkit.climate.gov/). Information specific to electric utilities can be found at: noaa.maps.arcgis.com/apps/MapJournal/index. html?appid=e94f511d57cb459195f85d68c3e742a9

Strategies to leverage partnerships and relationships amongst electric providers and increase resilience to power outages can be found in Environment Protection

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Agency's Power Resilience Guide (epa.gov/ communitywaterresilience/increase-powerresilience-your-water-utility).

Environment Protection Agency's Local Energy and Environment Program assists local governments in reducing air emissions with energy strategies by providing tools for understanding local emissions and identifying and implementing effective policies and actions for reducing emissions and realizing co-benefits (epa.gov/statelocalenergy/ local-energy-and-environment-program).

The United States Global Climate Research Program- Fourth National Climate Assessment informs stakeholders of the effects of climate change on various regions in the United States, with particular focus on energy considerations and risk reduction (nca2018.globalchange.gov/).

Measure Success

Metric Examples

The National Institute of Standards and Technology's Community Resilience Planning Guide for Buildings and Infrastructure Systems, Volume II, describes and compares nine examples of community resilience assessment methodologies (nvlpubs.nist.gov/nistpubs/ SpecialPublications/NIST.SP.1190v2.pdf).

A federal workgroup, led by the Federal Emergency Management Agency and the National Oceanic and Atmospheric Administration, has developed a draft concept with wide ranging indicators and measures of community resilience utilizing federal data (fema.gov/communityresilience-indicators). A review of metrics for energy system reliance is found in Measuring the Resilience of Energy Distribution Systems, Henry H. Willis and Kathleen Loa, The Rand Corporation, 2015. rand.org/ content/dam/rand/pubs/research_reports/RR800/ RR883/RAND_RR883.pdf

Scholarly publication provides baseline indicators in a range of areas from which resilience can be measured. Cutter, S.L., Burton, C.G., Emrich, C.T. (2010). Disaster Resilience Indicators for Benchmarking Baseline Conditions. Journal of Homeland Security and Emergency Management. Vol. 7: Iss. 1, Article 51. 10.2202/1547-7355.1732. researchgate.net/publication/250147250_Disaster_ Resilience_Indicators_for_Benchmarking_Baseline_ Conditions

Measurement Data or Information for Benchmarking

Information regarding average community energy burden, including that for older housing stock, can be found on the Low-Income Energy Affordability Data Tool at: energy.gov/eere/slsc/maps/lead-tool

Degree days for the baseline and measurement periods. The Degree day calculator can be found at: portfoliomanager.energystar.gov/pm/ degreeDaysCalculator

The Energy Star Portfolio Manager allows building and facility benchmarking for energy and water consumption and cost (energystar.gov/buildings/ facility-owners-and-managers/existing-buildings/ use-portfolio-manager/learn-how-portfoliomanager). Most current International Energy Conservation Code is available at: codes.iccsafe.org/content/ document/998?site_type=public

A variety of social, economic, housing and demographic data, by community or census tract, is available through the U.S. Census Bureau's American Community Survey (census.gov/acs/ www/data/data-tables-and-tools/data-profiles/).

Community Walkscore, a measurement of the walkability of communities, is available at: walkscore.com

Other Energy Resources Related to Resilience

Energy Efficiency

The U.S. Department of Energy's Better Buildings Initiative has an abundance of information relating to building energy efficiency including fact sheets, toolkits, financing information and more (betterbuildingssolutioncenter.energy.gov/).

The American Council for an Energy-Efficient Economy works to advance energy efficiency policies, programs, technologies, investments and behaviors. It provides research, fact sheets, guides, national rankings and other tools related energy policy, behavior, finance, transportation, industry, buildings, utilities and industry (aceee.org/).

Distributed Energy

The U.S. Department of Energy has developed a guide to improving resilience in public buildings utilizing distributed energy (energy.gov/sites/prod/files/2019/10/f67/distributed-energy-resilience-public-buildingsv2.pdf).


Energy Policies

The Database of State Incentives for Renewables and Efficiency is a database for incentives and policies that support renewable energy and energy efficiency which is searchable by state (dsireusa. org/).

The American Council for an Energy Efficiency Economy's State and Local Policy Database provides information on state energy efficiency policies (database.aceee.org/).

The Building Energy Codes Program at U.S. Department of Energy provides information relating to the impacts of energy codes and provides support for the development and adoption of energy codes (energycodes.gov/).

Other

U.S. Department of Energy provides an abundance of information relating to the nation's energy resources, research, innovation, energy efficiency and many other energy related topics. Of particular note is U.S. Department of Energy's Local Solution Center that provides resources and tools in areas of interest to communities. Information available includes data use, program development information and funding opportunities (energy.gov/eere/slsc/state-andlocal-solution-center).

Partner Communities

The City of St. James

Information regarding the City of St. James may be found through:

- City of St. James: stjamesmo.org
- St. James Municipal Utilities: stjamesmo.org/ index.php/departments/municipal-utilities
- Meramec Spring Park: maramecspringpark.com
- St. James Winery: stjameswinery.com
- St. James Chamber of Commerce: stjameschamber.net

The City of Stockton

Information regarding the City of Stockton may be found through:

- City of Stockton: cityofstocktonmo.com
- Korth Senior Center: goaging.org/services/ local-centers/cedar-county-senior-center/ stockton-korth-senior-center; facebook.com/ korthseniorcenter
- Stockton Area Chamber of Commerce: stocktonmochamber.com
- Stockton Lake Association: stocktonlake.com

The City of Rolla

Information regarding the City of Rolla may be found through:

- City of Rolla: rollacity.org
- Rolla Municipal Utilities: rollamunicipalutilities. org
- Rolla Emergency Preparedness website: rollacity.org/emergency.shtml
- Missouri University of Science and Technology: mst.edu
- Rolla Area Chamber of Commerce: rollachamber.org
- Rolla Tourism: visitrolla.com



APPENDIX B: INVENTORY OF STANDARDS

Table 20. Inventory of Standards

STANDARD	DESCRIPTION	REFERENCE
Alliance for National and Community Resilience (ANCR)	Community resilience benchmarks. Two of 19 essential service benchmarks currently developed. Provides a mechanism for communities to evaluate their resilience status and identify actions to improve resiliency. (Created by ICC)	resilientalliance.org
American Public Power Association's Reliable Public Power Provider Program (RP3)	Rating system for municipal electric utilities based on proficiency in reliability (data, municipal aid agreements, disaster management plans, cyber and physical security) safety, workforce development and system improvement (stewardship, maintenance and planning). APPA also maintains the eReliability Tracker used by utilities to report, analyze and benchmark outage data.	publicpower.org/about/members/ reliability-recognition-tracking
American Society of Civil Engineers (ASCE)	Minimum design loads for buildings and other structures related to specific hazards. Design hazard levels are often incorporated into other standards or model codes.	asce.org/asce-7
American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Energy Efficiency Standards	Provides technical standards to improve building services engineering, energy efficiency, indoor air quality and sustainable development. ASHREA Standards 90.1 and 90.2 for building energy efficiency are often used in codes and other standards.	ashrae.org/technical-resources/ standards-and-guidelines
Building Code Effectiveness Grading System (BCEGS)	Evaluates the robustness of code adoption and enforcement particularly emphasizing requirements designed to mitigate losses from natural hazards.	isomitigation.com/bcegs
Building Resilience Rating Tool (BRRT)	Developed by the Insurance Council of Australia, it provides a simplified hazard risk rating tool for homes and suggests retrofits to decrease risk.	resilient.property
Draft Interagency Concept for Community Resilience Indicators and National-Level Measures	A federal workgroup, led by the Federal Emergency Management Agency and the National Oceanic and Atmospheric Administration, has developed a draft concept with indicators and measures of community resilience using federal data. Stakeholder feedback on the Draft Concept is currently being encouraged.	fema.gov/community-resilience- indicators

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STANDARD	DESCRIPTION	REFERENCE
Energy Star	Energy efficiency standards for products, assessments, equipment and buildings. Through the Energy Star Portfolio Manager, a building's energy and water use can be tracked and assessed against more than 100 metrics and benchmark its performance against those of similar buildings nationwide. Residential buildings can be evaluated using the Home Energy Score or other available Energy Star benchmarks.	energystar.gov
Enterprise Green Communities Criteria (EGCC)	Design and construction of new and existing affordable housing. Certification/rating system addressing risk/vulnerability assessments, energy efficiency, renewable energy, water conservation, liability, energy system flood proofing and community connectivity.	enterprisecommunity.org/ solutions-and-innovation/green- communities/2015-criteria
Envision	Evaluation criteria for public and private infrastructure projects. Provides a rating/ certification process using 64 sustainability and resilience indicators in five categories. Scorecard can also be used as a planning and design guidance tool.	sustainableinfrastructure.org/ envision/use-envision
Fortified Commercial	Standards and additional recommendations for community-based and light to moderate commercial structures to mitigate risk due to hurricane, hail and high wind events. Applications and measures must be approved by the IBHS with third-party verification of compliance.	fortifiedcommercial.org
Fortified Home	Standards, with three levels of performance, to mitigate the risks from hurricane, hail and high wind events for single- and two-family homes. Upon third party verification, homeowners in certain states may qualify for insurance discounts.	fortifiedhome.org
International Code Council (ICC)	Model codes and standards for safe, sustainable and resilient structures. Includes standards for energy efficiency, new and existing construction, plumbing, mechanical, electric and other types of systems and building components.	iccsafe.org
LEED Rating System	Certification criteria, including a number of resilience measures, of buildings, interiors, building operations and maintenance, cities and communities. Among others, criteria include community engagement, energy efficiency, GHG performance, water management, power access reliability and resiliency.	usgbc.org/leed
National Electrical Safety Code	Standards for safe installation, operation and maintenance of electric power and communication utility transmission and distribution systems.	standards.ieee.org/products- services/nesc/index.html
National Fire Protection Association (NFPA) Building Construction and Building Energy Conservation Codes	Model codes and standards used to regulate and control the permitting, design, construction, materials, use, occupancy and location of structures and certain equipment. NFPA 5000 also addresses natural and manmade hazard mitigation. The Building Energy Code (NFPA 900) is a standalone energy code for buildings and structures.	nfpa.org/Codes-and-Standards/ All-Codes-and-Standards/List-of- Codes-and-Standards

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STANDARD	DESCRIPTION	REFERENCE
Performance Excellence in Electricity Renewal (PEER)	Criteria for electrical systems of cities and utilities, campuses and transit with four levels of certification. Evaluation categories include reliability and resilience; operations, management and safety; energy efficiency and environment; grid services; innovation and exemplary performance; and regional priorities.	peer.gbci.org
Resilience Action List (RELi)	Rating system and certification for buildings, neighborhoods, homes and structures integrating resiliency criteria with design methods. Released for comment in 2014. Provides more than 190 resilience options from which to choose that will be assigned points toward certification levels when the system is finalized.	c3livingdesign.org/?page_ id=5110
Resilience-based Earthquake Design Initiative (REDi)	Evaluation of design and planning criteria to rate a building's resilience to seismic hazards. The three rating levels predict a buildings ability to allow continued operations, livable conditions, financial loss and likelihood of injury following or due to an earthquake.	arup.com/perspectives/ publications
Sustainable Sites Initiative (SITES)	A technical rating system to identify sustainable and resilient landscapes (without or without buildings) and measure performance in areas including stormwater management, water demand, ability to recover from hazard events, reduction in energy consumption and ability to sequester carbon and improve air quality.	sustainablesites.org
WaterSense	Water conservation and efficiency standards for products, homes and commercial businesses.	epa.gov/watersense



APPENDIX C: CATALOGUE OF METRICS

ACKNOWLEDGMENTS	ACRONYMS	EXECUTIVE SUMMARY	INTRODUCTION	DEVELOPMENT PROCESS	STAKEHOLDER ENGAGEMENT	BASELINE ANALYSIS	
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APPENDIX D: SUMMARY OF ENGAGEMENTS

Energy and Critical Facilities Infrastructure Workshop

The Energy and Critical Facilities Infrastructure Workshop focused on community energy generation and distribution and identified critical infrastructure and associated vulnerabilities within the partner communities.

AREAS OF EXPLORATION

- How resilience of critical facilities and infrastructure can be improved by resilience-focused planning efforts;
- Metrics to measure resilience in the context of energy for SMSC;
- Strategic partnerships between units of local government, state agencies and private businesses and how they can be leveraged to advance reliability and resilience;
- Resources such as innovative financial models and available opportunities to support grid modernization, energy efficiency and renewable energy projects

Communities were asked to identify their existing and planned critical energy facilities by mapping out assets and then identifying their vulnerabilities. Building upon this exercise, participants were then asked to break up into small groups and identify partnerships that could support building resilience for critical infrastructure with examples including community emergency planning and backup power supply as well as city departments, utilities, local businesses and local government. The groups were then asked to share criteria they currently use, or would think is helpful to use, to decide on implementation of infrastructure upgrades or technology. Based on this, communities were asked to discuss their current funding and financing mechanisms that they use.

KEY TAKEAWAYS

There were several commonalities among the three communities that emerged during this workshop. The communities had a lot of pride and awareness of their assets. They all cited safety, community support and natural beauty as some of their strengths that they hoped to leverage for improved resilience. Despite these, the communities cited a range of vulnerabilities that impacted their critical energy infrastructure.

Vulnerabilities:

- Extreme weather events (tornadoes, ice storms, flooding, etc.).
- Lack of funds for critical energy projects or plans.
- Electric energy generation is limited.
- Stigma associated with energy efficiency.
- Little system redundancy.
- Lack of public will to plan/fund critical energy projects.
- Inconsistent internet/cellphone service on the outskirts of town.
- Starting to experience impacts of opioid health crisis.

Future needs:

- Invest in preventative measures to sustain uninterrupted power.
- Revive economic centers.
- Infrastructure replacements and upgrades.

Infrastructure and Technology Wants:

- Advanced Metering Infrastructure that customers can interact with.
- Battery storage.
- Building energy codes.
- Combined heat and power.
- Electric vehicle charging infrastructure.
- Time-of-use rates.
- Solar.
- Microgrids.
- Electric vehicles.
- Education portals.

Existing partnerships:

- Church-based organizations.
- Social service networks (food pantry, thrift stores, etc.).
- Missouri Division of Energy Energy Loan Program.
- Local, county and state government officials.
- U.S. Army Corps of Engineers.
- Regional Planning Commissions.
- Missouri Public Utility Alliance (MPUA) services and mutual aid program.

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Potential partnerships:

- United States Department of Energy (USDOE).
- Missouri Department of Natural Resources (MoDNR).
- Missouri Department of Economic Development (MODED).
- Missouri Department of Transportation (MODOT).
- Missouri Department of Health and Senior Services (MODHSS).
- Community Action Agencies.
- United States Department of Agriculture (USDA).
- Local media outlets.
- State parks.
- Academic institutions (universities and colleges).
- Utilities.
- Manufacturing groups.

Potential Funding/Financing Sources:

- Missouri Public Energy Pool (MOPEP).
- MoDNR-DE Energy Loan Program.
- MoDNR Clean Water State Revolving Funds.
- Utility Rebates.
- Technical Assistance Partnerships.
- Delta Regional Authority.
- USDA Rural Energy for America Program (REAP).
- Energy Savings Performance Contracts (ESPC).
- Federal Emergency Management Agency (FEMA).

Criteria for investment decision-making:

- Cost.
- Source of funding.
- Benefit to the local community.
- Benefit to the local economy.
- Long term financial benefit.
- Visibility of investment to the public.
- Time before investment is realized in terms of benefit and value gained.

Economic Development and Growth Workshop:

The Economic Development and Growth Workshop focused on local workforce development and support of community business as well as business retention.

AREAS OF EXPLORATION

- Preservation of local communities and heritage through reinvestment and policies that stimulate revitalization.
- Financial incentives and grant opportunities that have the potential to improve economic vigor;
- Leveraging public incentives and assistance that supports education, post-secondary training and workforce development.

Communities were asked to present their economic strengths, leading industries, major employers and areas of opportunity in which they hoped to see future growth. After the individual community report-outs, small groups discussed the key concepts and takeaways found from the report-outs regarding economic development. Participants were then asked to use information presented by the Project Team regarding business retention and attraction and identify barriers to energy efficiency implementation and economic development in their communities. During this session, the concept of co-benefits was introduced to participants with focus placed on measuring resilience impacts comprehensively in ways that encourage equitable investment. Examples of concepts presented in this session included formally linking capital and community planning to increase the impact of infrastructure spending. Participants were then asked to discuss what existing financial incentives, resources and grants they could leverage to address identified barriers and improve community livability.

KEY TAKEAWAYS

While each of the three communities had economic strengths and potential opportunities for growth, barriers to economic and development opportunities outweighed their strengths and potential opportunities. Leading industries varied throughout each of the communities, but all communities are experiencing skilled labor shortages and difficulty attracting young professionals. Communities want to address this barrier through educational opportunities such as technical training, apprenticeship programs and certification programs as well as partnering with local schools to develop curriculum for needed workforce skills.

Economic strengths:

- Tourism.
- Low cost of living.

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Areas to Strengthen:

- Property values.
- Housing development.
- Increased attention from legacy landlords into energy efficiency measures for their investment properties.
- Increasing tourism.
- Attraction of young professionals.
- Retail.
- Small businesses.

Economic and Workforce Challenges:

- Labor shortage.
- Skills of workforce not always aligned with job opportunities.
- Limited land and development opportunities.
- Difficulty attracting developers.
- Unemployed workers are not skilled for most jobs.
- Drug use.
- Salaries are not as competitive as larger communities nearby.
- Transient renter population.
- Limited grant funding opportunities.

Potential Educational Opportunities:

- Technical training programs.
- Apprenticeship programs.
- Wastewater treatment certification.
- Working with local schools to develop needed skills in curriculums.

Potential Partnership Opportunities and Funding Sources:

- Chamber of Commerce.
- Missouri Department of Transportation (MODOT).
- Neighborhood Assistance Programs (NAP).
- Missouri Department of Higher Education and Workforce Development (MDHEWD)
- Missouri Division of Tourism.
- Department of Energy (USDOE).

Resilient Community Operations Workshop:

The Resilient Community Operations Workshop focused on community emergency planning and response, efficiency in operations and system redundancy and vulnerabilities.

AREAS OF EXPLORATION

- Leading practices in efficient and resilient community operations, including consolidation, coordination and personnel resilience.
- Financial stability including innovative financing mechanisms to support long-term planning;
- Emergency planning and response operations including coordination, available resources and reducing system vulnerabilities.

Many of the communities brought along their local law enforcement and disaster response officials to contribute to the discussion. Participants described how resilient they believed their community's operations were and specific areas of improvement. Breakout sessions focused on whether communities have ever outsourced any of their operations and long-term planning exercises to assess the future impact of revenue collection on operations and services. The workshop concluded with a discussion about emergency preparedness planning as a means to increase redundancy and resilience within communities.

KEY TAKEAWAYS

There were multiple sources of community operations vulnerability for each community related to aging infrastructure, reliance of electric grid, lack of emergency planning, siloed working structures and lack of staff capacity to take on new resiliency roles. Communities recommended increased consolidation, privatization and coordination to enhance operational efficiency. Communities also expressed a need for longterm financial planning that accounts for operational repairs and maintenance costs as well as future impacts of revenue collection on operations.

Community Vulnerabilities:

- Aged water and wastewater systems.
- Reliance on electric grid.
- Lack of formal plan development for emergency response.
- Lack of partnerships with surrounding communities and entities.
- Lack of marketing and targeted educational efforts.
- Human resources in terms of lack of staff capacity to take on additional roles within organizations, limited knowledge transfer between roles and capacity to offer interdisciplinary or collaborative training opportunities.

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Methods to Enhance Operational Efficiency:

- Consolidation.
- Privatization.
- Coordination.

Financial Considerations:

- Long-term forecasting and budgeting that accounts for repair/maintenance.
- Long-term planning to assess future impact of revenue collection on operations.
- Grants are helpful but not a long-term solution and most account for infrastructure and capital investments, but not operations and maintenance.
- Zoning considerations and updates.
- Privatization.
- Coordination.
- Funding needed for staff training and implementing/directing plans.

Energy Burden Workshop:

The Energy Burden Workshop focused on the interconnectedness of energy burden, energy efficiency and renewable energy.

AREAS OF EXPLORATION

- What energy burden is and how it can impact community manufacturers, businesses and residents.
- Methods to reduce community energy burden such as available programs, incentives and rebates, public policy and educational outreach.
- Meaningful partnerships that can provide opportunities for financial support, strategic partnerships and innovative practices.
- Development of metrics for benchmarking and quantifying sources.

Participants were asked to prepare a report out about existing energy burden in their communities and address specific populations and areas within their communities that were disproportionately energy burdened. The breakout sessions focused on strategies to address energy burden within communities and identifying resources needed to address community energy burden. Participants then discussed which partnerships and funding opportunities they have used in the past or would consider using in the future to address energy burden.

KEY TAKEAWAYS

Each of the three communities expressed that multiple members of their community experience energy burden, not just low-income customers and small businesses. Additionally, disconnect and penalty fees resulting from customer shutoffs create a financial burden for both utilities and customers. Communities identified barriers to energy efficiency to be addressed to lower energy burden for the community and avoid shut-off fees for utilities. Barriers included lack of energy efficiency educational resources and financing options for community members as well as availability of energy efficiency programs for residential, commercial and industrial customer classes. To address barriers, communities focus on providing energy efficiency education and programs to lower energy usage as well as on increasing financial opportunities for community members and businesses.

Community Perspectives about Energy Burden:

- All communities have customers that struggle to pay energy bills, but not all utility disconnections for non-payment are necessarily low income or fixed income customers.
- Higher percentages of shut-offs occur in rental properties.
- There is a pervasive sense among customers that their energy costs are too high.
- Many municipal energy providers cannot obtain income information from their customers, limiting their ability to comprehensively measure energy burden within customer demographics.
- Disconnect fees and penalty fees that apply after shut-offs can often wind up costing



utilities as well and many assistance programs do not kick in until after shutoffs have occurred, incurring additional costs to both customers and utilities.

- Small businesses can be especially energy burdened.

Barriers to Energy Efficiency:

- Education.
- Developing targeted programs for various customer segments (e.g., commercial, industrial, etc.).
- Financing energy efficiency improvements.
- Increasing customer participation in energy efficiency programs.
- Measurement and tracking of energy efficiency programs.
- Quantifying economic benefits of energy efficiency programs.
- Declining tax revenue for governments at federal, state and local levels.

Ways to Reduce Energy Burden:

- Increase household income.
- Increase business revenue.
- Reduce energy usage.
- Lower energy rates.
- Increase energy efficiency.
- Allowing new homeowners and tenants to understand a home's energy score before purchasing or moving in.
- Tenant education.
- Building codes.
- Landlord education.
- Robust energy assessments.