Best Management Practices for Incorporating Energy Resilience into Hazard Mitigation Planning

This publication was prepared by the North Central Texas Council of Governments with funding provided by the State Energy Conservation Office.

INTRODUCTION

This Best Management Practice (BMP) guide includes a menu of different actions local governments may want to consider as measures to increase their energy resilience and include in their Hazard Mitigation Plans when planning for future disasters or stresses brought on by the natural environment. While these actions are not quickly implemented fixes, investing the time and resources to implement them can bring greater energy resilience from disruptions and disasters in addition to providing long-term cost savings. Each action is introduced in the following sections to familiarize the reader with each area of potential action. Following these sections are tables outlining each energy resilience area, mitigation measures that can be taken, sample Hazard Mitigation language, and the addressed hazards of concern.

DEMAND SIDE ENERGY EFICIENCY

As the fifth largest energy consumer in the world, with nearly 40% of the total energy usage and 70% of the electricity usage going towards buildings, Texas is not short on opportunities for energy and cost savings through energy efficiency projects within the built environment[i]. A twin benefit of energy efficiency projects and programs is their positive impact on energy resiliency and overall grid stability. Energy efficiency measures also have associated short-term and long-term cost-savings or paybacks which help justify or pay for their implementation.

When on-site generation is paired with energy efficiency measures (through design, construction or retrofitting, and operations and maintenance of buildings) they are able to support both community and critical facility resilience. Energy efficiency can extend the supply of on-site power generation, whether by diesel generation or renewables, by reducing the total energy needed to power essential functions or critical facilities. This results in reduced on-site fuel storage needs and/or extended generator capacity, allowing for longer operations without grid-provided electricity. Stretching on-site generation during times of peak demand on the grid may also concurrently lower or provide a buffer against higher costs. When communities are able to operate under this extended capacity, it can relieve some of the burden placed upon emergency shelters or Emergency Management staff in implementing their contingency plans[ii].

Recommendations of energy efficiency projects can include lighting retrofits, installing lighting controls, LED retrofits, HVAC replacement, water efficiency retrofits, weatherization and tightening of the building envelope, cool roofs, cool pavement, etc.

To learn more on this topic, consider checking out this past NCTCOG webinar "Facility Retrofits to Reduce Overall Energy and Water Consumption" on the Conserve North Texas website. If your local government is considering taking the next step in assessing and implementing energy efficiency measures, the State Energy Conservation Office (SECO) offers local governments Preliminary Energy Audits (PEAs) and technical assistance to help provide customized, on-site, energy-related services across a broad spectrum, ranging from a basic consultation to feasibility studies.

ENERGY CONSERVATION

Closely aligned with energy efficiency measures are establishing strategies that help reduce energy waste, also referred to as energy conservation. These strategies require little to no capital investments making them quick wins when establishing and beginning an energy resilience strategy. Energy conservation can fall into one of two categories 1) Behavioral Practices or 2) Operations and Maintenance (O&M) Practices. These strategies are usually part of a larger Energy Management Policy and Energy Management Plan.

Behavioral Practices

These are practices that can be adopted by building occupants and staff. They may require education or training for building occupants on their importance and impact to facilitate voluntary cooperation. These practices include behaviors such as turning off lights when not in a room, turning off computer monitors at night or during non-working hours, using natural light when feasible, providing feedback on energy usage, or goal setting and prompts for occupants. Energy savings from behavior practices can vary based on the number and types implemented. Research on this topic is ongoing and energy savings vary based on the types and amount of behavioral changes that are implemented.

Operations and Maintenance Practices

These are practices that can be adopted by building custodians, operators, and managers. Benefits of an O&M Program include minimal comfort complaints by occupants, equipment which operates adequately until the end of useful life, and potential energy savings of 5%-20% of whole building energy use depending upon the building type, baseline, and use. Examples include adjusting temperature setpoints by even just 1 degree, maintaining weather stripping on doors, or scheduling HVAC operations based on building occupancy.

To learn more about these strategies, and establishing Energy Management Policies and Plans, please check out the webinar "Lowering Local Government Energy Consumption Through Energy Planning and Policies" on the Conserve North Texas website. If your entity is amenable or ready to begin implementing changes, the South-central Partnership for Energy Efficiency as a Resource (SPEER) offers a Building Operator Certification, a training and certification program for technicians and O&M staff, that provides energy-saving operational strategies.

CODES

Building codes are widely recognized as an effective planning tool in mitigating damage from natural disasters. The National Institute of Building Sciences in their Natural Hazard Mitigation Saves: 2019 Report revealed that adopting up-to-date building code requirements saves $11 for every $1 that is invested. They also have a direct positive impact on energy resilience when codes are kept up to date and take resilience into consideration.

The International Codes Committee (ICC) in their Whitepaper *The Important Role of Energy Codes in Achieving Resilience* show how buildings constructed to be energy efficient maintain temperatures longer and require less energy to provide heating or cooling, resulting in less stress on the grid. As a benefit, this may allow the grid, or on-site generation, to remain functional during extreme weather events, resulting in decreased overall impact to the entire community[iii].

As of the time of this report, adoption of the 2015 International Energy Conservation Codes are the minimum state mandated codes for commercial and industrial buildings[iv]. As a home rule state, however, Texas does allow local jurisdictions to adopt amendments to the codes. Local jurisdictions are responsible for building energy code implementation and enforcement.

In recognition that building safety codes and standards must adapt to address the challenges of a changing climate, the International Code Council through the Global Resiliency Dialogue, is seeking to foster global collaboration in addressing evolving climate risks through codes and standards. They are creating international resiliency guidelines and enabling collaborative research efforts which can aid

local jurisdictions across the globe to better prepare their buildings to withstand increasingly extreme weather events that have, and will continue to, increase in frequency and duration.

For training and educational assistance on adopting updated energy codes, please visit SECO's Energy Codes resources like the Training and Code Compliance or the Energy Code Adoption Process pages. Additionally, SECO has collaborated with the South-central Partnership for Energy Efficiency as a Resource (SPEER) to develop an Energy Code Adoption Toolkit which provides local governments with resources and support to adopt new, updated energy codes.

SOLAR + STORAGE AND MICROGRIDS

Diesel or natural gas backup generators, while widely used and effective, are often only used for short periods of time in a given year. When not routinely maintained, they can fail. The lines can be vulnerable to freezing or gumming up in extreme cold as was witnessed during the winter storm Uri. A longer-term strategy worth considering as part of a larger Energy Resilience Plan is determining the feasibility of installing a microgrid to power critical facilities in the event of black-outs or disasters that affect energy supplies or the stability of the larger grid. Because of their effectiveness, microgrids have been recognized for their ability to mitigate across all hazards.

A microgrid is a group of interconnected loads and distributed energy resources that are located within clearly defined electrical boundaries and are able to act as a single controllable entity with respect to the grid. Interconnected loads could consist of a group of buildings or even a Wastewater Treatment Plan. Examples of distributed energy resources (DERs) can include solar PV, battery storage, microturbines, combustion turbines, natural gas-fired Combined Heat and Power reciprocating engines, and propane fueled reciprocating engines.

A microgrid has the capability to connect and disconnect from the larger grid, allowing it to operate in both grid-connected or island-mode. A microgrid that can island from the larger grid and "black start" without power from the larger grid can bring stability to the larger grid in times of stress while supplying energy security and resilience to the loads on the microgrid. It is important to note that microgrids are custom solutions with each one being unique in its configuration and assets, level of sophistication and complexity.

When considering a microgrid, local governments will need to take into consideration issues of jurisdiction, connection to the larger grid, siting, and ownership, as well as the overall finances and economics of the project.

If regulatory or financial hurdles make a microgrid project not feasible, communities may wish to look at installing individual solar + storage projects at critical facilities as a more cost-effective resilience strategy. Solar + storage projects would ideally be combined with energy efficiency and demand response technologies at the individual facilities to help reduce peak usage and provide back-up power during times of outages. Solar + storage, couple with energy efficiency measures, provides benefits year-round by lowing energy demand and costs.

To learn more about microgrids, please consider visiting the following DOE resources.

- How Microgrids Work
- The Role of Microgrids in Helping to Advance the Nation's Energy System

COMBINED HEAT AND POWER (CHP)

Combined Heat and Power (CHP), also referred to as cogeneration, is a form of distributed generation that is located at or near a building or facility. It is an integrated system that can provide concurrent production of electricity or mechanical power, and useful thermal energy (for heating and/or cooling) from a single source of energy. CHP can use a variety of fuels (solar + storage, turbine, natural gas, etc.) to generate electricity or power at the point of use, allowing the heat that would normally be lost in the power generation process to be recovered to provide needed heating and/or cooling[v]. It is more efficient than separate heating/cooling and electricity generation systems, resulting in lower operational costs, and the ability to provide grid stability and energy resilience. CHP systems can be very small or large depending on the application and needs of the site. They can be used in a wide array of facility types such as hospitals, police and fire stations, and WWTPs to name just a few.

CHP systems do require a capital investment to install so local governments may want to explore funding mechanisms that can help offset the costs. The Department of Energy's CHP Technical Assistance Partnership (CHP TAPs) can help local governments explore the cost-savings and resilience of CHP, microgrids, solar + storage all at no cost. The CHP TAPs help by running early-stage critical infrastructure studies to see how resilient sites are and if there are opportunities for projects such as microgrids, solar + storage and/or CHP.

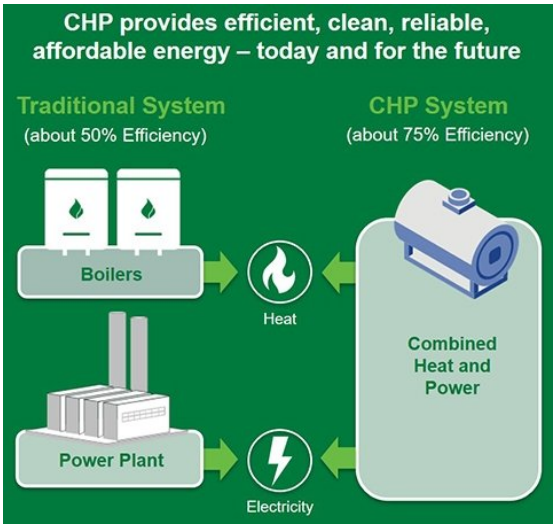

Figure 1 DOE EERE - Combined Head and Power Basics

To learn more about the basics of CHP, including how the CHP TAP can help determine if it is appropriate for your site,

An Important note for Local Governments on CHP:

Texas Government Code requires that entities responsible for all critical governmental facilities to formally consider the feasibility of implementing combined heat and power (CHP) technology prior to the construction, extensive renovation or replacement of major heating, ventilation and air conditioning equipment in critical buildings and facilities.

SECO has established a set of guidelines for evaluating critical government facilities for CHP purposes. Local governments are strongly encouraged to read and become familiar with the guidelines to see how they may be affected. A policy profile produced by the CHP TAP program, Texas Critical Infrastructure Policy for State Facilities, is also suggested reading to become familiar with the policy and guidelines.

Facility types impacted by this code include: Command and control centers, Prisons or jails, Hospitals, Communications or data centers, Hazardous waste storage facilities, Shelters, Police or fire stations, Water or wastewater facilities, Biological research facilities, Food preparation or food storage

please check out the following resources and websites. Key stakeholders to involve in discussions include Facilities, Finance, Community Leaders is including buildings such as churches, and local government departments that focus on Homeland Security.

The DOE's Combined Heat and Power Basics page provides a great starting point with definitions and descriptions of CHP and links to CHP resources and Fact Sheets created by DOE programs such as Better Buildings, Energy Efficiency and Renewable Energy,

The CHP Technology Fact Sheet series by the DOE EERE program is a series of 11 fact sheets that explain the fundamentals and characteristics of CHP, including common CHP technologies and applications such as: fuel cells, gas turbines, microturbines, reciprocating engines, steam turbines, absorption chillers, microgrids, district energy, thermal energy storage, and waste heat to power.

The Southcentral CHP Technical Assistance Partnership covers the states of Arkansas, Louisiana, New Mexico, Oklahoma, Texas. In addition to technical assistance, the TAP can help with end user engagement and stakeholder engagement.

Energy Resilience BMPs for Hazardous Mitigation Plans

Below are tables of energy resilience measures local governments may want to consider when reviewing and updating their Hazard Mitigation Plans. Each action area has resources, in addition to those listed above, to help educate and guide efforts in these areas. Sample language is provided for consideration of inclusion in Hazard Mitigation Plans. These are suggestions only and should be reviewed and considered with the input of the Hazard Mitigation planning team for any necessary local changes.

Action Area: Demand Side Energy Efficiency	
Suggested Measures	Implementation of an Energy Management Policy and Energy Management Plan if one does not already exist. Implementation of cost-effective, energy efficiency measures and programs at municipal facilities to reduce demand load which in turn helps stabilize grid or backup power generation and produce long-term cost savings. Suggested energy efficiency projects and programs can include: LED lighting retrofits, lighting controls, weatherization, cool roofs, and replacement of aging HVAC systems with energy efficient systems.
Resources	The DOE's Better Buildings Program website contains many resources and information on implementing energy efficiency measures and programs. Information and tools are searchable by sector, local governments.
Sample HazMAP Language	Identify potential actions to mitigate energy supply disruptions and provide greater energy resilience at critical facilities such as: A. Implementing Energy Management Policies and Plans. B. Implementing energy efficiency projects at critical facilities to provide demand stability and reduce demand load on backup power generation. C. Retrofit [vulnerable] critical facilities with energy efficiency projects and on-site generation. Harden these facilities to withstand future natural hazard events. Prioritized facilities include: [insert list of the prioritized facilities here]
Suggested Hazards of Concern	Drought, Earthquakes, Inland Flooding, Hurricanes, Tornados, Wildfires, Winter Storms

Action Area: Energy Conservation	
Suggested Measures	Provide education and training to building occupants and staff on behavioral practices that can reduce energy waste. Provide facility and maintenance personnel training on O&M practices that can reduce energy use and waste from equipment and building operations.
Resources	SPEER's Building Operator Certification training is offered at least once per year over the course of several months. DOE's Better Buildings Challenge offers resources for different sectors of the built environment, including local governments and K-12 schools.
Sample HazMAP Language	A. Educate staff on behavioral practices which can lower energy demand or reduce wasted energy such as turning off lights in unoccupied rooms, turning off equipment when not in use, reducing time delays on computers before power saving mode kicks in, and maximizing use of natural light. B. Provide training to maintenance and facility staff on O&M practices which can reduce energy waste such as scheduling HVAC operations based on building occupancy, maintaining weather stripping on doors, turning off vending machines over weekends, or adjusting temperature set points by even 1 degree.
Suggested Hazards of Concern	Drought, Earthquakes, Inland Flooding, Hurricanes, Tornados, Wildfires, Winter Storms

Action Area: Codes	
Suggested Measures	Adoption and enforcement of the latest published editions of international building codes and green building codes/standards. To find the latest Recommended Codes and Regional Amendments from NCTCOG's Regional Codes Coordinating Committee, visit the program website.
Resources	NCTCOG's Regional Building Codes program. The website houses tools and resources on how to update building codes, how to adopt a set of codes, and Recommended Codes and Regional Amendments. SPEER's Building Code Adoption Toolkit. This toolkit provides support to local governments adopting new energy codes as required by statute and to the building industry by developing information, resources, and tools.
Sample HazMAP Language	A. Periodically update and adopt the latest Building Standards Codes with local amendments to incorporate the latest knowledge and design standards, protecting people and property against fire, flood, extreme heat, and severe storm risks in both structural and non-structural building and site components. B. Implement energy efficient codes and ordinances for existing and new buildings to reduce energy use.
Suggested Hazards of Concern	Drought, Earthquakes, Inland Flooding, Hurricanes, Tornados, Wildfires, Winter Storms

Action Area: Solar + Storage/Microgrids	
Suggested Measures	Identify critical facilities that would benefit from a solar + storage or microgrid project. Preform a siting or feasibility analysis to lay groundwork for potential project installations. Research funding mechanisms to help pay for or off set installation costs.
Resources	The REopt Web Tool or Analysis Service by NREL can help local governments optimize planning of generation, storage, and controllable loads to maximize the value of integrated distributed energy systems for buildings, campuses, and microgrids.
Sample HazMAP Language	A. Identify potential actions to mitigate energy supply disruptions and provide greater energy resilience to critical facilities such as: [insert list of critical facilities here] B. Seek feasibility studies on installing a microgrid or solar + storage at or near critical facilities.
Suggested Hazards of Concern	Drought, Earthquakes, Inland Flooding, Hurricanes, Tornados, Wildfires, Winter Storms

Action Area: Combined Heat and Power Projects	
Suggested Measures	Consult with the Southcentral CHP Technical Assistance Partnership program on potentially desired energy resilience projects at critical facilities and initiate feasibility studies to examine if CHP projects are suited to site conditions and needs of community.
Resources	DOE Better Buildings Southcentral CHP Technical Assistance Partnership can provide no cost technical assistance to local governments wanting to explore CHP options.
Sample HazMAP Language	Identify potential actions to mitigate energy supply disruptions and provide greater energy resilience to critical facilities such as seeking feasibility studies on installing Combined Heat and Power projects at critical facilities.
Suggested Hazards of Concern	Drought, Earthquakes, Inland Flooding, Hurricanes, Tornados, Wildfires, Winter Storms

FUNDING RESOURCES

When looking at ways to increase energy resilience as part of a Hazardous Mitigation Plan, communities may want to consider seeking available funding through the below listed programs or funding mechanisms. Before applying for funding, time should be taken to become familiar the requirements and eligibility for each program.

LoanSTAR Program

Throughout the year, SECO announces various funding opportunities to support efficiency programs. The Texas LoanSTAR (Saving Taxes and Resources) revolving loan program is a funding program that provides low interest rate loans to assist Texas public institutions by financing their energy-related cost-reduction retrofit projects.

Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) programs provide low-cost, long-term financing for water and energy efficiency and conservation improvements to commercial and industrial properties. In 2013, the Legislature passed Senate Bill 385 (83R) allowing municipalities and counties to work with commercial lenders and property owners to pursue improvements using property assessments as a secure repayment mechanism[vi]. Learn more by visiting SECO's resource page for PACE. There are several PACE programs available such as the Texas PACE Authority, Lone Star PACE, and potential through a regionally or county-wide adoption program. Please check to see what options are available in your area.

Building Resilient Infrastructure and Communities (BRIC)

FEMA's Building Resilient Infrastructure and Communities (BRIC) program is another possible source of funding; however, applicants should ensure their activities and goals are aligned with the priorities of the BRIC program in order to be eligible for funding. Applicants should also consider which hazards and community lifelines their projects are most likely to address. Local governments can apply for BRIC funding through the Texas Division of Emergency Management (TDEM) during open funding cycles.

FEMA HAZARDS	
Winter Storms	Inland Flooding
Tornados	Wildfires
Earthquakes	Drought
Hurricanes	Costal Flooding
Tsunamis	Landslides

FEMA COMMUNITY LIFELINES		
Safety & Security	Food, Water, Shelter	Health & Medical
Energy (Power & Fuel)	Communications	Transportation
Hazardous Material		

The BRIC program provides an important shift away from a reactive approach to disasters to one that is proactive in mitigating damage from a disaster. The BRIC program has a list of priorities and ***encourages mitigation projects that meet multiple program priorities***. BRIC priorities include: Mitigating risk to public infrastructure; Mitigating risk to one or more community lifelines; Incorporation of nature-based solutions; Enhancing climate resilience and adaptation; Incentivizing adoption and enforcement of latest published editions of building codes; and Incentivizing resilient investments in disadvantaged communities, as referenced in EO 14008 Tackling the Climate Crisis at Home and Abroad.

In addition to existing activities which are still eligible under this program, **expanded BRIC eligible activities include**: Project scoping*; Building code activities; Pre-award costs; Additional activities for wildfire and wind implementation (DRRA Section 1205); and Earthquake early warning (DRRA Section 1233).

A note about Project Scoping: Project Scoping provides applicants resources they may need to help develop mitigation strategies and obtain data to prioritize, select, and develop complete mitigation project applications. This is a great opportunity if your community has identified a need but needs assistance scoping out details of the project. What types of activities may be eligible for Project Scoping? Engineering design and feasibility studies for larger or complex projects; hydrologic and hydraulic studies; obtaining staff or resources to develop cost-share strategy and identify potential match funding; evaluating facilities or areas to determine appropriate mitigation actions; incorporating environmental considerations early into program decisions; collecting data for benefit cost analyses, environmental compliance and other program requirements; evaluation of potential solutions; and project scoping across a wide variety of programs to incorporate sustainability, resilience, and renewable building concepts.

Resources:

[i] Texas Building Energy Code, https://comptroller.texas.gov/programs/seco/code/

[ii] ICC The Important Role of Energy Codes in Achieving Resilience, pp 12, https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf

[iii] ICC The Important Role of Energy Codes in Achieving Resilience, pp 12, https://www.iccsafe.org/wp-content/uploads/19-18078_GR_ANCR_IECC_Resilience_White_Paper_BRO_Final_midres.pdf

[iv] Local Ordinances, https://comptroller.texas.gov/programs/seco/code/ordinances.php

[v] DOE Combined Heat and Power Basics, https://www.energy.gov/eere/amo/combined-heat-and-power-basics

[vi] SECO Programs – PACE https://comptroller.texas.gov/programs/seco/funding/pace.php