Energy Efficiency and Infrastructure Resilience

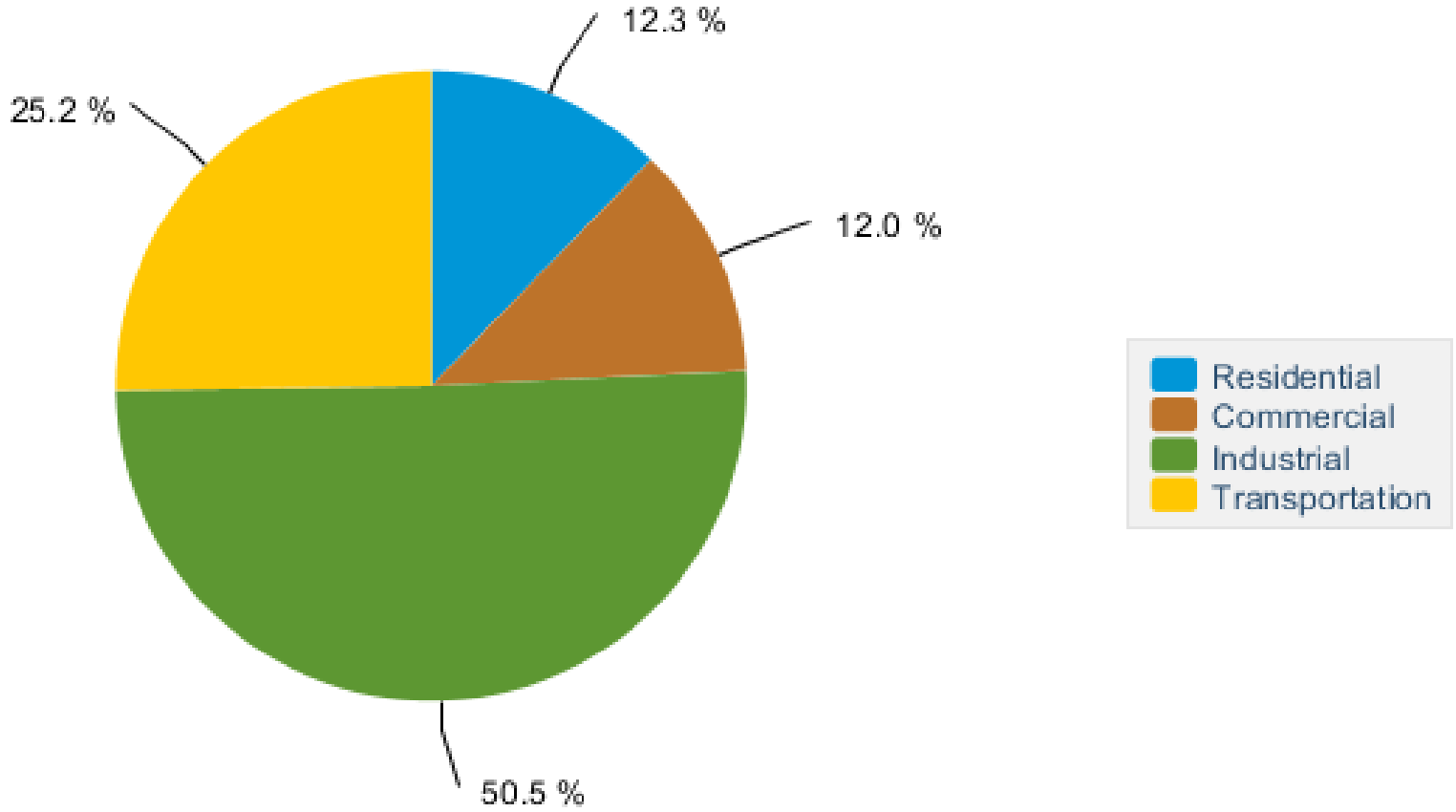
NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS

AUGUST 28, 2019

North Central Texas
Council of Governments

Texas Energy Consumption by End-User Sector, 2017

- Texas produces more electricity than any other state.
- Texas leads the nation in wind-powered generation and produced one-fourth of all the U.S. wind powered electricity in 2017.
- Texas is the largest energy-producing state and the largest energy-consuming state in the nation.

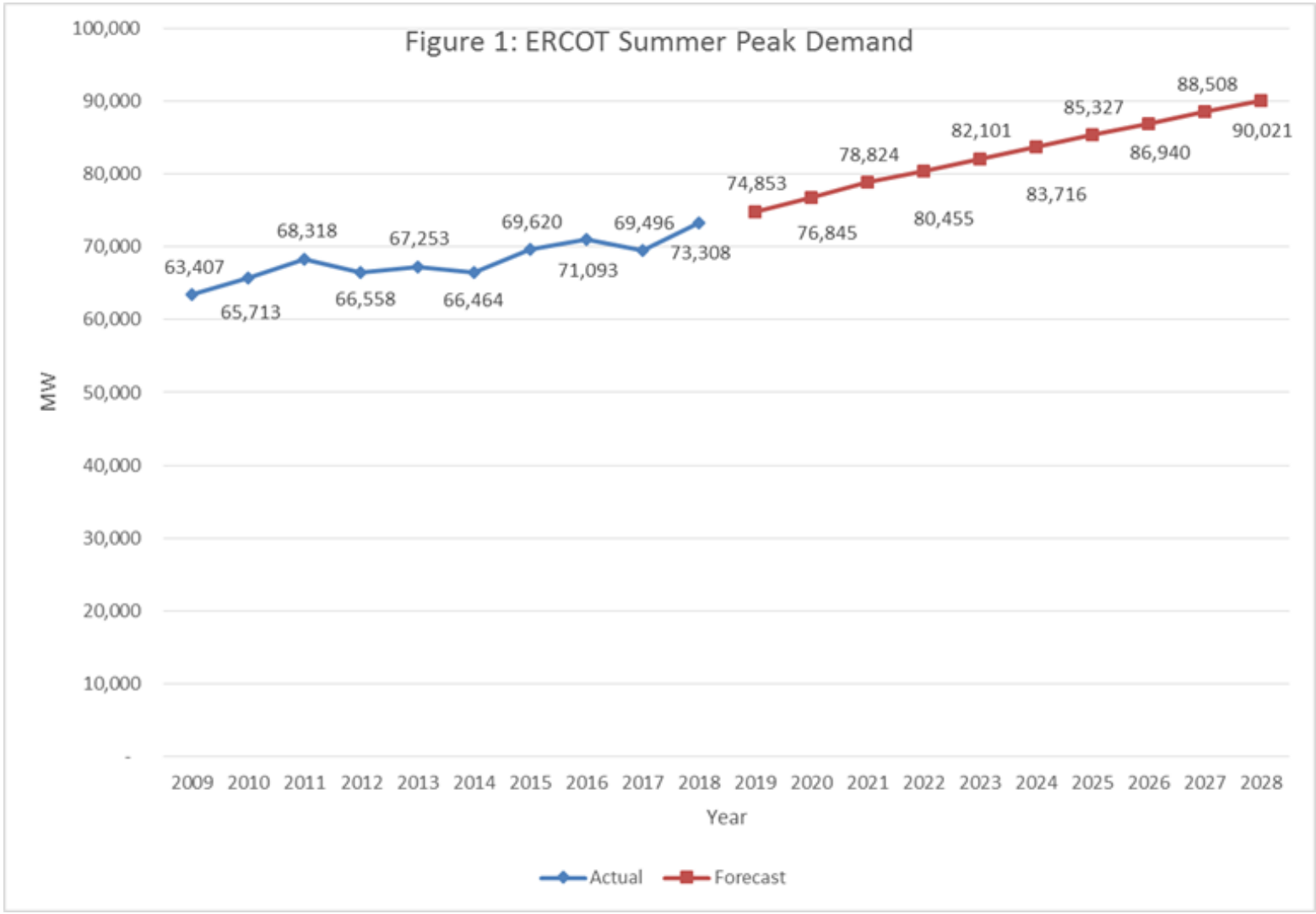


Source: Energy Information Agency
Last Updated: February 21, 2019

Source: Energy Information Administration, State Energy Data System

Electric Reliability Council of Texas
Projected Peak Demand

ERCOT schedules power on an electric grid that connects more than 46,500 miles of transmission lines and 650+ generation units.



https://youtu.be/9yKRz08buaA

Public Utility Commission of Texas
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News Release
August 13, 2019

Contact: Andrew Barlow [512-936-7048]

Public Utility Commission Urges Electricity Conservation

Austin, TX – The Public Utility Commission of Texas (PUC) urges Texans to conserve electricity this afternoon as record electricity demand meets higher than normal temperatures.

“When the energy demands of our state’s steadily growing population and booming economy intersect with hot summer temperatures, the supply of power can get a little tight, so we’re calling on Texans to help moderate demand for electricity with a few simple choices during the late afternoon hours this week," said DeAnn Walker, Chairman of the Public Utility Commission of Texas.

The PUC advises residential and business customers alike to reduce their electricity usage with simple adjustments like bumping air conditioning thermostats up at least two degrees and turning off unnecessary lighting. Customers are also asked to wait until after sunset to run dishwashing and laundry appliances.

Threats - Heat
Tuesday, August 13, 2019

- Electricity demand hit an all-time high of 74,531 megawatts as people blasted their air conditioners on Monday afternoon and totaled 74,310 megawatts at 4:34 p.m. local time Tuesday, according to ERCOT.
- Temperatures peaked at 103 degrees.
- “Extreme heat across the ERCOT region will continue to result in high loads,” ERCOT said in a statement. “We may set another new record today.”

Bloomberg

Power blows past $9,000 cap in Texas as heat triggers emergency

Christopher Martin and Naureen S. Malik 8/13/2019

Electricity prices briefly surged past a $9,000 a megawatt-hour price cap in Texas as extreme heat sent power demand skyrocketing and forced the state’s grid operator to declare an emergency.

As temperatures in Dallas climbed to 103 degrees Fahrenheit (39 Celsius), the Electric Reliability Council of Texas issued an emergency alert, calling on all power plants to ramp up and asking customers to conserve. At one point on

https://www.msn.com/en-us/money/markets/power-blows-past-dollar9000-cap-in-texas-as-heat-triggers-emergency/ar-AAFL62t

BRIEF

ERCOT calls 2 energy emergencies in one week, 3rd in 5 years

https://www.utilitydive.com/news/ercot-calls-2nd-energy-emergency-this-week-3rd-in-5-years/561065/

Threats - Heat
Urban Heat Island Effect

"The ramifications of urban heat adversely affect public health, longevity of infrastructure, public opinion, and our economy. With rising temperatures come higher costs for energy and a threat to our energy supply."

- Dallas Urban Heat Island Mitigation Study Website
https://www.texastrees.org/projects/dallas-urban-heat-island-mitigation-study/

Dallas Urban Heat Island Effect report released by Texas Trees Foundation

Dallas is hot, and getting hotter. The Texas Trees Foundation's findings in the 2017 Dallas Urban Heat Island Effect report show how cities affect heat waves. Surfaces like rooftops, parking lots and streets make up 35 percent of the city. In urban areas, these retain heat, making the area up to 15 degrees warmer than in rural areas. The Foundation's study revealed Dallas County is heating up quickly, and that planting trees can help reduce the heat and improve the health of community members.

Rising temperatures
average low of 80 fo

The Texas Trees Fou
and help prevent th
residential buildings

DFW Weather: Heat Advisory Continues, MedStar Responds To Dozens Of Heat-Related Calls

August 12, 2019 at 11:35 am Filed Under: DFW News, DFW Weather, heat, heat advisory, Hot Weather, MedStar, North Texas, Summer

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DFW Weather: Heat Advisory For A Week Straight, Relief In Sight For Wednesday

By Anne Elise Parks August 13, 2019 at 9:37 am Filed Under: DFW News, DFW Weather, heat advisory, Hot Weather, North Texas, Rain

(CBSDFW.COM) – Tuesday marks our seventh consecutive day under a heat advisory. Temperatures will once again soar to around 100 degrees with a dangerous heat index near 110 degrees.

But there's good news! A weak cold front is on the way and will provide a little relief by Wednesday.

http://www.dallascitynews.net/dallas-urban-heat-island-effect-report-released-texas-trees-foundation

Threats – Cyber Attacks

SECURITY

Experts assess damage after first cyberattack on U.S. grid

Blake Sobczak, E&E News reporter

Energywire: Monday, May 6, 2019

Reports of an unprecedented grid "cyber event" caused a stir last week in power sector and cybersecurity circles. Ian Muttoo/Flickr

Last week, the U.S. power sector marked a sober milestone: an anonymous Western utility became the first to report a malicious "cyber event" that disrupted grid operations.

The hack itself occurred two months ago, on March 5, when a "denial-of-service" attack disabled Cisco Adaptive Security Appliance devices ringing power grid control systems in Utah, Wyoming

https://www.eenews.net/stories/1060281821

Russians hacked into America's electric grid. Here's why securing it is hard.

April 11, 2018 6.44am EDT Updated July 24, 2018 12.47pm EDT

Hackers can interfere with everyday efforts to keep the lights on. pan denim/Shutterstock.com

Email
Twitter 21
Facebook 59
LinkedIn
Print

Hackers taking down the U.S. electricity grid may sound like a plot ripped from a Bruce Willis action movie, but the Department of Homeland Security has recently disclosed new details about the extent to which Russia has infiltrated "critical infrastructure" like American power plants, water facilities and gas pipelines.

This hacking is similar to the 2015 and 2016 attacks on Ukraine's grid. While DHS has raised the number of the Russian utility-hacking

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Disclosure statement

Theodore Kury directs of Energy Studies at the University of Florida's Public Utility Research

https://theconversation.com/russians-hacked-into-americas-electric-grid-heres-why-securing-it-is-hard-94279

Generic Interdependency Among Critical Infrastructure Sectors

(Sub)sector Generating the Service	(Sub)sector Receiving the Service				
	ONG 	Electricity 	Transportation 	Water 	Communication 
ONG 		Fuel to operate power plant motors and generators	Fuel to operate transport vehicles	Fuel to operate pumps and treatment	Fuel to maintain temperatures for equipment; fuel for backup power
Electricity 	Electricity for extraction and transport (pumps, generators)		Power for overhead transit lines	Electric power to operate pumps and treatment	Energy to run cell towers and other transmission equipment
Transportation 	Delivery of supplies and workers	Delivery of supplies and workers		Delivery of supplies and workers	Delivery of supplies and workers
Water 	Production water	Cooling and production water	Water for vehicular operation; cleaning		Water for equipment and cleaning
Communication 	Breakage and leak detection and remote control of operations	Detection and maintenance of operations and electric transmission	Identification and location of disabled vehicles, rails and roads; the provision of user service information	Detection and control of water supply and quality	

Source: IEEE

Planning a Resilient Power Sector

- The power system is at risk from an array of natural, technological, and man-made **threats** that can cause everything from power interruption to chronic undersupply.
  - **Natural:** long-term climatic changes, such as variations in precipitation patterns and changes in air and water temperatures, as well as severe weather events, such as storms, flooding, and storm surges
  - **Technological:** unpredicted equipment and infrastructure failures
  - **Human-caused:** Accidents and malicious events

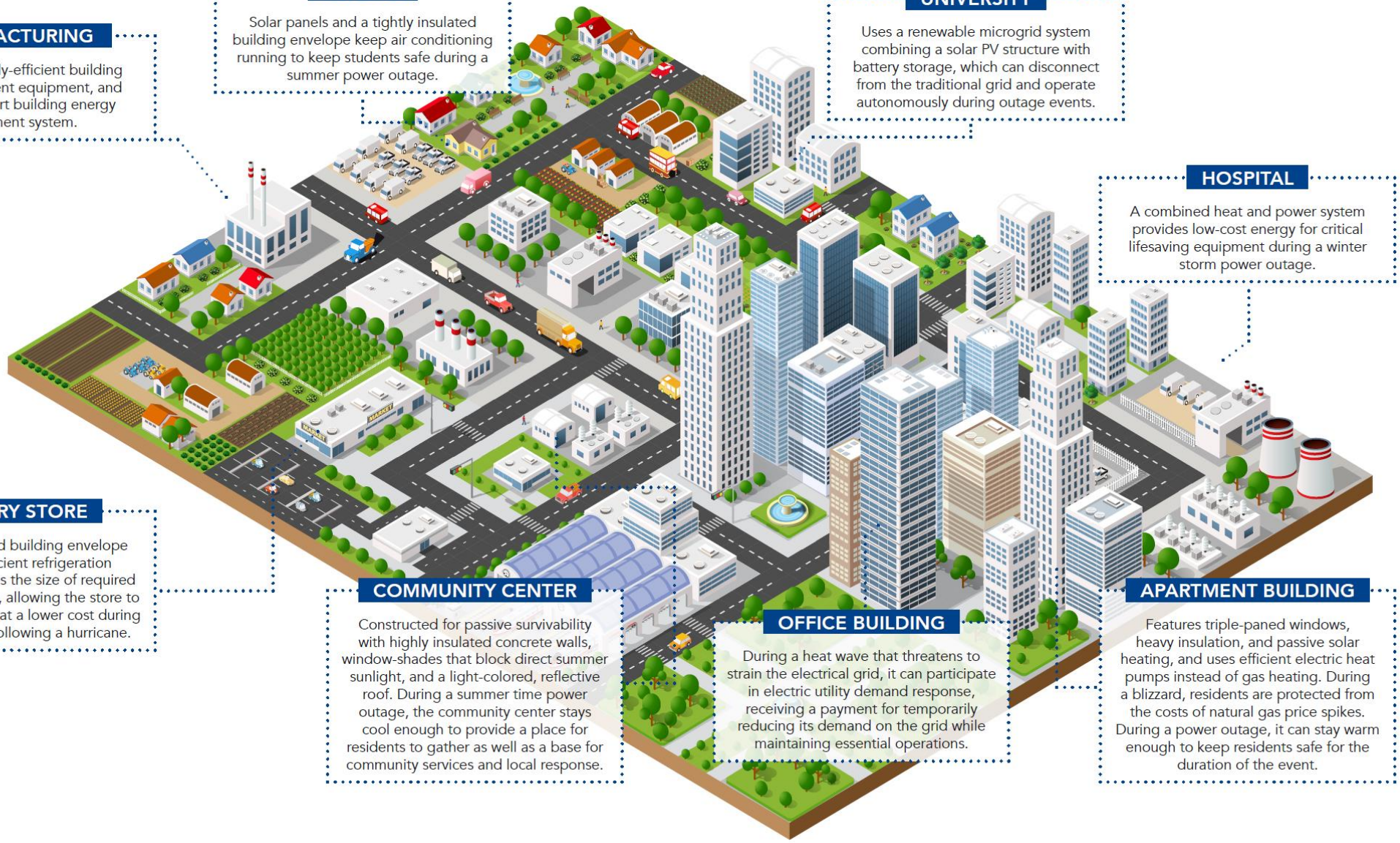
- Impacts from these threats include, but are not limited to:
  - Potential fuel supply shortages for transportation and energy generation,
  - Physical infrastructure damage (dam failure, faulty system equipment, etc.)
  - Shifts in energy demand
  - Disruption of electricity supply to the end user
  - System operations and targeting power control systems, generators, or critical data infrastructure

- It is critical for policymakers, planners, and system operators to safeguard their systems and plan for and invest in the improved resilience of the power sector
- Planning for power sector resilience can happen at different geographic scales (local, national, or regional) and should be incorporated into existing power sector planning and policies to ensure effectiveness

Source: https://www.nrel.gov/docs/fy19osti/73618.pdf

The Energy-Resilient City

Learn about the different ways a city can incorporate resilience:



SCHOOL

Solar panels and a tightly insulated building envelope keep air conditioning running to keep students safe during a summer power outage.

UNIVERSITY

Uses a renewable microgrid system combining a solar PV structure with battery storage, which can disconnect from the traditional grid and operate autonomously during outage events.

MANUFACTURING

Built with a highly-efficient building envelope, efficient equipment, and a state-of-the-art building energy management system.

HOSPITAL

A combined heat and power system provides low-cost energy for critical lifesaving equipment during a winter storm power outage.

GROCERY STORE

A tightly insulated building envelope and highly efficient refrigeration equipment reduces the size of required backup generators, allowing the store to preserve inventory at a lower cost during a power outage following a hurricane.

COMMUNITY CENTER

Constructed for passive survivability with highly insulated concrete walls, window-shades that block direct summer sunlight, and a light-colored, reflective roof. During a summer time power outage, the community center stays cool enough to provide a place for residents to gather as well as a base for community services and local response.

OFFICE BUILDING

During a heat wave that threatens to strain the electrical grid, it can participate in electric utility demand response, receiving a payment for temporarily reducing its demand on the grid while maintaining essential operations.

APARTMENT BUILDING

Features triple-paned windows, heavy insulation, and passive solar heating, and uses efficient electric heat pumps instead of gas heating. During a blizzard, residents are protected from the costs of natural gas price spikes. During a power outage, it can stay warm enough to keep residents safe for the duration of the event.

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Example Electrical Energy Infrastructure Performance Goals

- Provides functional categories within the electric power infrastructure system (generation, transmission, and distribution)
- Community stakeholders, including representatives from the utility providers, need to work together to determine the functions needed during recovery and the performance goals tailored to their community needs and energy systems.

NIST, Community Resilience Planning Guide for Buildings and Infrastructure Systems, Volume II
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1190v2.pdf

Communications Infrastructure	Support Needed[4]	Design Hazard Performance								
		Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term		
		Days			Weeks			Months		
		0	1	1-3	1-4	4-8	8-12	4	4-24	24+
Power - Electric Utilities										
Community Owned or Operated Bulk Generation										
Generation Requiring Fuel Transport (Coal, Gas, Oil fired)										
In Place Fueled Generation (Hydro, solar, wind, wave, compressed air)										
Storage (Thermal, Chemical, Mechanical)										
Community Owned or Operated Distributed Generation										
Generation Requiring Fuel Transport (Coal, Gas, Oil fired)										
In Place Fueled Generation (Hydro, solar, wind, wave, compressed air)										
Storage (Thermal, Chemical, Mechanical)										
Transmission and Distribution (including Substations)										
Critical Facilities										
Hospitals, Police and Fire Stations / Emergency Operations Centers										
Debris / recycling centers/ Related lifeline systems										
Emergency Housing										
Public Shelters / Nursing Homes / Food Distribution Centers										
Emergency shelter for response / recovery workforce/ Key Commercial and Finance										
Housing/Neighborhood										
Essential city services facilities / schools / Medical offices										
Houses of worship/meditation/ exercise										
Buildings/space for social services (e.g., child services) and prosecution activities										
Community Recovery										
Commercial and industrial businesses / Non-emergency city services										
Residential housing restoration										

Energy Efficiency's Role in Increasing Resilience

Energy efficiency can be a core strategy to reduce risks and enhance the resilience of the communities that energy systems serve.

Table ES1. Resilience benefits of energy efficiency

Benefit type	Energy efficiency outcome	Resilience benefit
Emergency response and recovery	Reduced electric demand	Increased reliability during times of stress on electric system and increased ability to respond to system emergencies
	Backup power supply from combined heat and power (CHP) and microgrids	Ability to maintain energy supply during emergency or disruption
	Efficient buildings that maintain temperatures	Residents can shelter in place as long as buildings' structural integrity is maintained.
	Multiple modes of transportation and efficient vehicles	Several travel options that can be used during evacuations and disruptions
Social and economic	Local economic resources may stay in the community	Stronger local economy that is less susceptible to hazards and disruptions
	Reduced exposure to energy price volatility	Economy is better positioned to manage energy price increases, and households and businesses are better able to plan for future.
	Reduced spending on energy	Ability to spend income on other needs, increasing disposable income (especially important for low-income families)
	Improved indoor air quality and emission of fewer local pollutants	Fewer public health stressors
Climate mitigation and adaptation	Reduced greenhouse gas emissions from power sector	Mitigation of climate change
	Cost-effective efficiency investments	More leeway to maximize investment in resilient redundancy measures, including adaptation measures

Table ES2. Energy efficiency measures that reduce vulnerability and increase capacity to cope

Energy efficiency measure	Resilience implications
CHP	Provides backup power, allows facilities receiving backup power to double as shelter for displaced residents, reduces overall net emissions, and potentially increases cost savings
Microgrids	May disconnect from grid during power outage, maintaining power supply; allows facilities receiving backup power to double as shelter for displaced residents; reduces overall net emissions; and potentially increases cost savings
Transportation alternatives	Multiple transportation modes that can be used during evacuations and everyday disruptions
District energy systems	Provides heating, cooling, and electricity using local energy sources and reduces peak power demand through thermal energy storage
Utility energy efficiency programs	Increases reliability and reduces utility costs
Energy-efficient buildings	Allows residents/tenants to shelter in place longer, reduces annual energy spending, and reduces overall net emissions. Can help vulnerable populations avoid dangerous and occasionally life-threatening situations in which weather and economics present a dual threat
Green infrastructure	Reduces localized flooding due to storms, reduces energy demand, and reduces urban heat island (UHI) effect in cities and electricity demand
Cool roofs and surfaces	Reduces UHI effect and electricity demand and reduces overall net emissions
Transit-oriented development	Increases economic development opportunities; provides transportation cost savings and reduces impacts of price volatility; and may improve air quality

FOR MORE INFORMATION

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