Assessing Energy System Dependencies for

ENERGY ASSURANCE PLANNING

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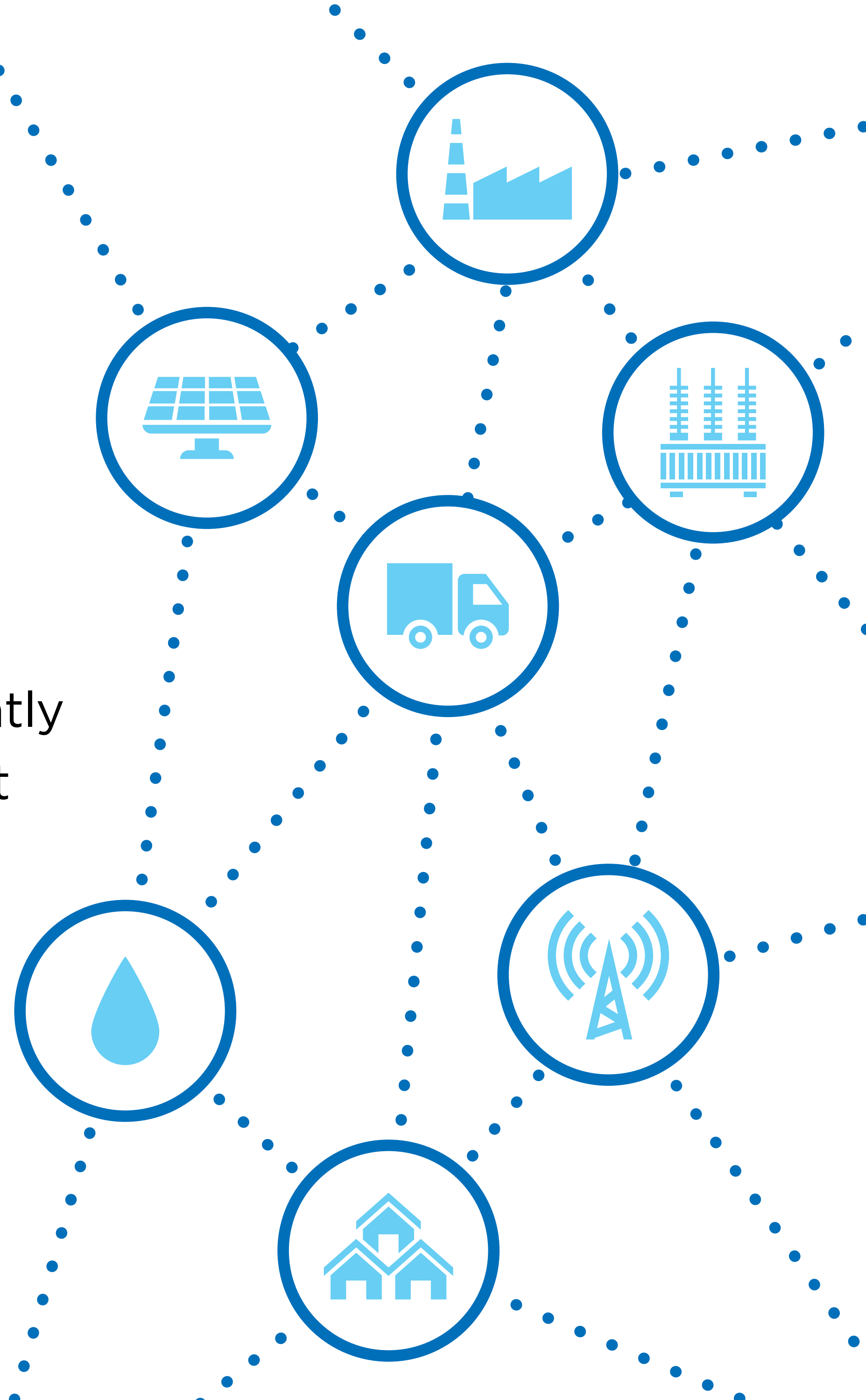
All energy systems are highly interdependent.

When one system changes, it inadvertently affects another, creating a domino effect that can impact multiple systems.



Energy assurance plans can prepare communities for power outages by helping them understand how systems are connected and effected by one another.

The information contained in these slides is designed to provide guidance on **identifying key infrastructure dependencies** that will inform the creation of such a plan.

WHAT HAPPENS WHEN THE POWER GOES OUT?

Immediately following a power outage, lights and other common appliances stop working, unless they have some form of backup power. As time goes on, even the backup natural gas or oil systems could fail, causing cascading issues that could go as far as keeping the water from flowing to your faucet.

LOSS OF ELECTRIC POWER SYSTEMS COULD AFFECT

- Financial transactions
- Transportation of fuel
- Emergency response services
- HVAC systems
- Traffic lights
- Communications
- Public transportation
- Water control and lift systems
- Sewage pumping and treatment

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LOSS OF NATURAL GAS OR OIL SYSTEMS COULD MEAN

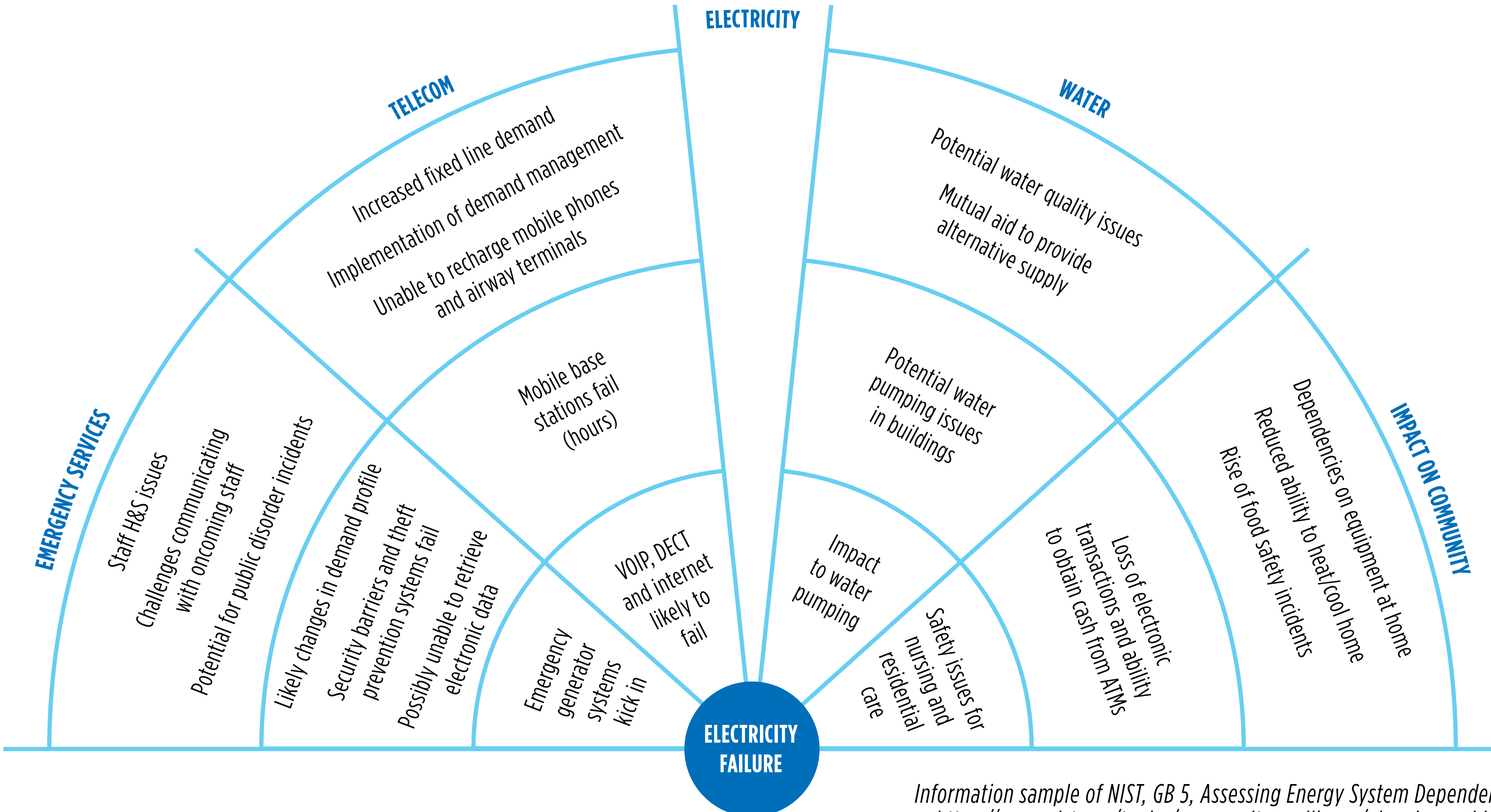
Loss of fuel for backup HVAC and generators for important facilities, such as sewage and government buildings

Loss of lubricants for vehicles, affecting transportation of fuels and materials

Loss of fuel for water treatment facilities and transportation

SYSTEM INTERCONNECTIONS

When the energy goes out, industry stops, stores close, stoplights fail and confusion reigns.

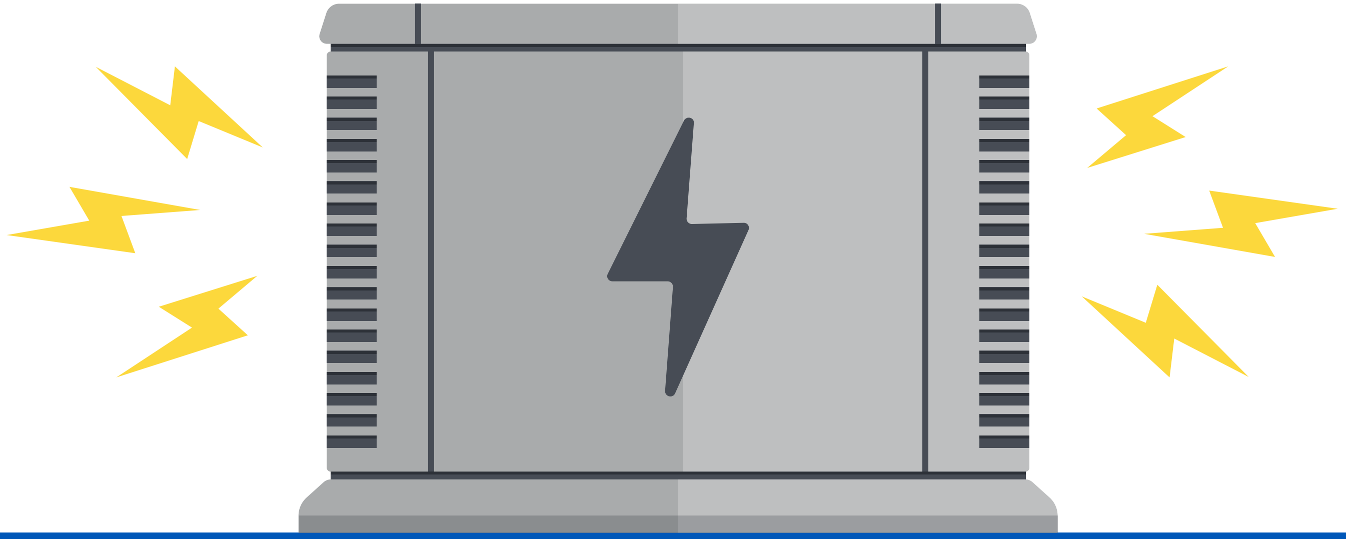


Information sample of NIST, GB 5, Assessing Energy System Dependencies — https://www.nist.gov/topics/community-resilience/planning-guide-briefs

The longer you go without energy, **the more capabilities throughout the community are lost**.

MANY COMMUNITIES HAVE BACKUP GAS GENERATORS

When they lose electrical energy, they fire up gas-powered generators.



But when communities lose access to natural gas,

they may lose the ability to restore electrical power

because energy is required to run the necessary repair equipment.

On one such occasion, a series of events led to a **mass power outage** for a region that lacked an energy assurance plan.

On the afternoon of September 8, 2011, the Pacific Southwest experienced a mass outage that eventually left some

2.7 MILLION CUSTOMERS WITHOUT POWER

An **11-minute disturbance** to the system was all it took to cause a cascading outage across parts of Arizona; Southern California; and Baja California, Mexico

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The disturbance occurred during rush hour on a business day,
causing a massive traffic gridlock


Schools and businesses closed


Flights and other public transportation were **disrupted**
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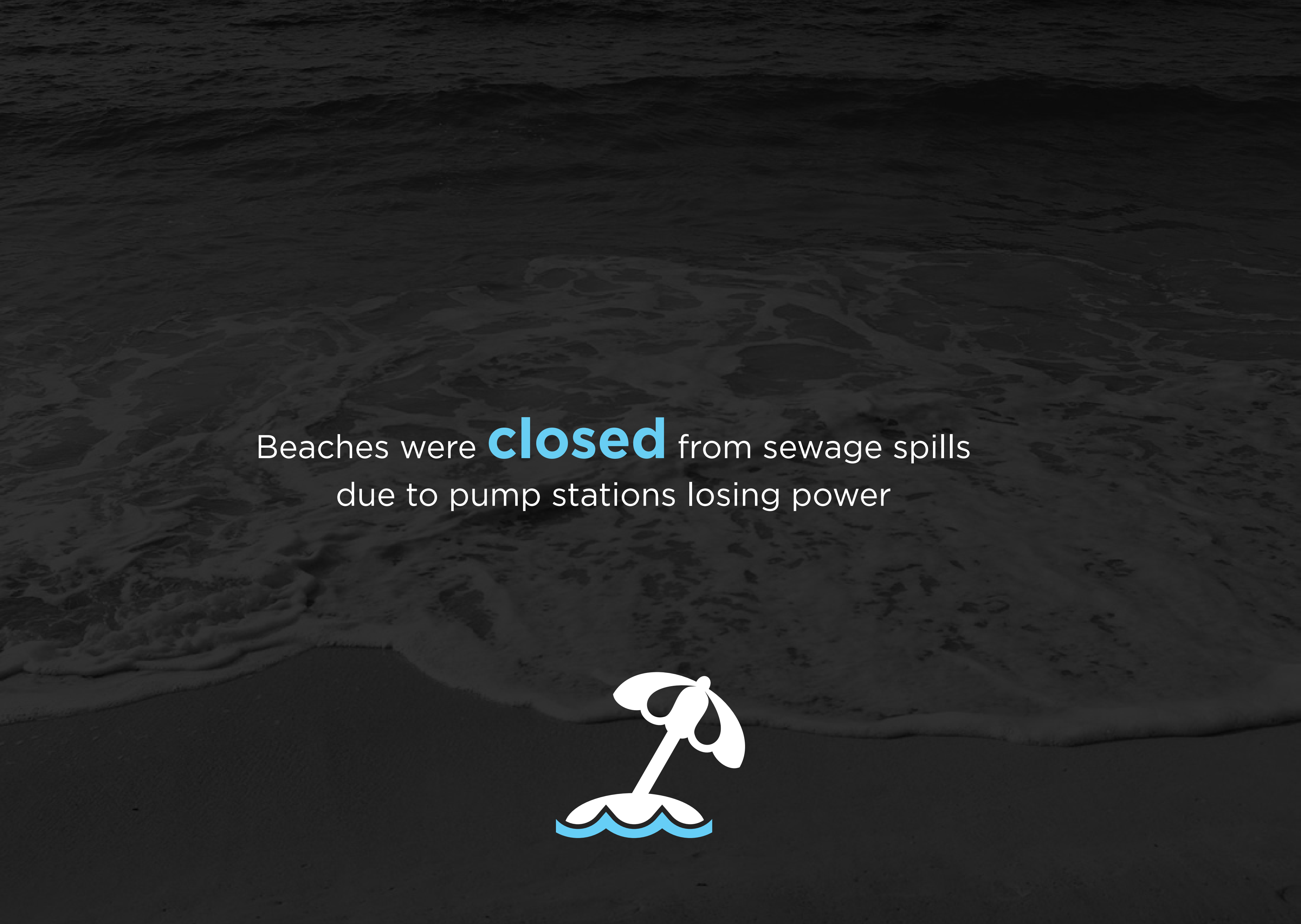

Beaches were closed from sewage spills
due to pump stations losing power


Millions were left **without air conditioning**

Improved planning and energy assurance evaluations were initiated in the region after the outage.

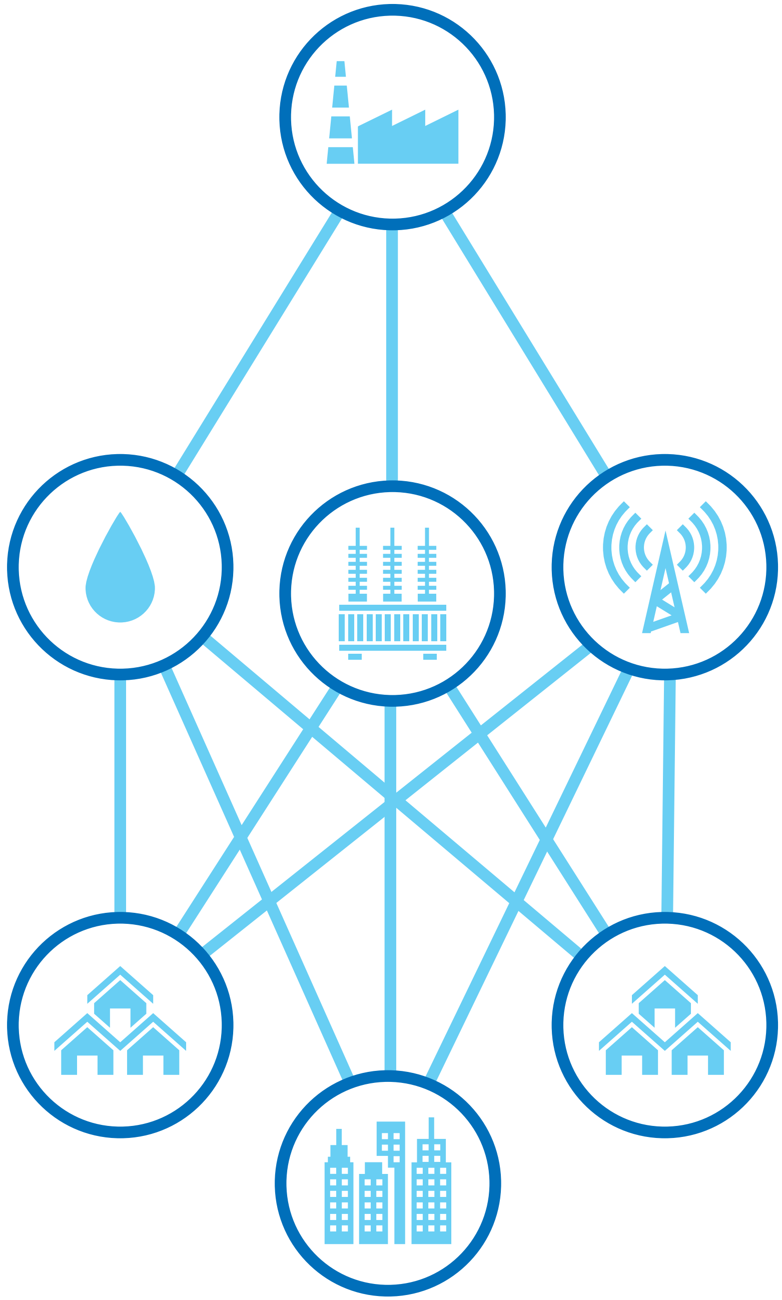
By identifying key assets and energy interdependencies, the region is prepared to avoid a similar event.

HOW TO IDENTIFY KEY ASSETS FOR DEVELOPING AN ENERGY PLAN

The series of steps and sample questions in the slides that follow will help you determine how energy resilient your community will be after a disaster.

At a high level, these questions can be discussed in a few minutes among your team. Specific details for each will take longer to determine but will allow you to better prepare for future disasters and focus your resources on your most critical vulnerabilities.

Outline the complete route of electricity from the generating plant to the local critical facilities and other building clusters.



- **Determine the number of independent routes from electric generation facilities to the community.**
  - Is each route capable of supplying the entire community?
  - Is the electric network fully interconnected?
- **Locate the key single points of failure in the electricity routes into the community.**
  - Are there critical spare routes available?

- **Determine the number of independent natural gas routes into the community.**
  - Is each one capable of supplying the entire community?
  - Are the gas and oil systems fully interconnected?
- **Locate the key single points of failure in the oil and gas network.**
- **Locate the routes of the major pipelines and determine if they cross near key resiliency facilities.**

Determine from where liquid fuels, such as gasoline and diesel, will be supplied.

- How much supply is stored locally?
- How much of each fuel is stored by the community?
- Do fuel storage facilities have backup electrical power sources?
- Are there any gravity-fed systems?

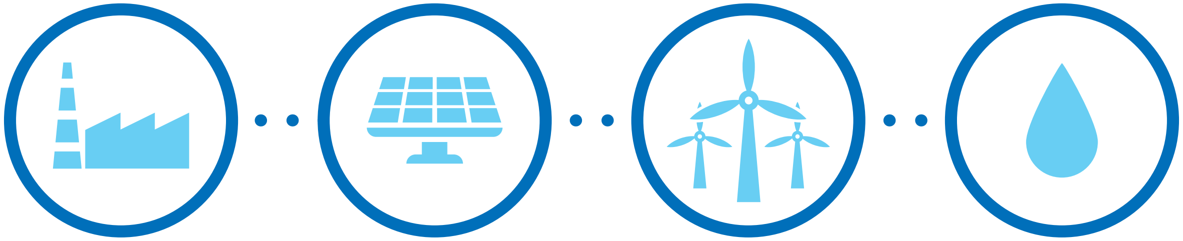
Outline the local major energy structure and the locations of each asset.

Is this information readily available?

Determine the local energy suppliers.

What types of energy are being supplied to local assets?

Who are the key contacts for each supplier?



THERE IS NO SINGLE APPROACH TO IDENTIFYING ENERGY INTERDEPENDENCIES

Mapping these connections in a visual way can be helpful to communicating the impact of energy failure among key players in the community, which is the starting point in developing an effective energy assurance plan.

For more info, contact

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With almost 40 years of experience in the energy and utility industry, Doug has been involved in projects in more than 70 countries. He is a leader in grid modernization thinking and was asked to author significant portions of the IEEE's GridVision 2050, DOE's QER, and to revise CEATI's Distribution Utility Technology Road Map. Doug is a NIST fellow and member of the GridWise Architecture Council where he had a hand in both the Smart Grid Interoperability Maturity Model and Transactive Energy. He has led the IEEE Power and Energy Society's Intelligent Grid Coordinating Committee and Emerging Technology Committee for the last five years and has developed more than 20 tutorials for grid modernization.

PLANNING FOR YOUR ENERGY FUTURE?

Diversify your energy sources to tackle evolving needs at **burnsmcd.com/ModernGrid**.

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