Resilient Florida Buildings:
Alternative Fuel Options for Maintaining Power During Outages

Electricity outages impact buildings as well as the fueling infrastructure that delivers energy resources for power generation and transportation. *A fueling infrastructure with minimal downtime during power outages is needed to increase the resiliency of buildings and the economy.*

FUELING INFRASTRUCTURE

The fueling infrastructure includes oil refineries, natural gas processing plants, pipelines, terminals, and refueling stations. This infrastructure is vulnerable to natural disasters, physical human threats, chokepoints, and interdependencies between the various systems.

The logistics of fuel transmission and distribution are a key factor in their reliability for disaster mitigation and recovery. The centralized nature of electricity generation and the vulnerability of electricity transmission (overhead power lines, transformers, etc.) contribute to the fact that during past hurricanes, electricity is most likely to be disrupted first, petroleum pipelines next, and then natural gas pipelines.

Resilient buildings need a backup source of power. *Regardless of fuel source, though, before considering the addition of backup electric generation, efforts to reduce energy load are strongly recommended.*

Energy Load Reduction

In commercial buildings, energy use is dominated by heating, cooling, and ventilation (HVAC) needs followed by lighting and office equipment. An energy audit can provide a roadmap to cost-effective ways to reduce a building's energy load.

RESILIENCE

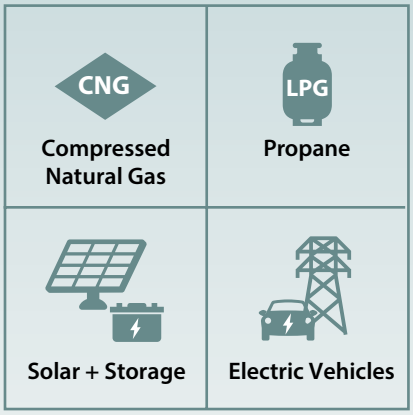
The ability to:

- *withstand small to moderate disturbances without loss of service*
- *maintain minimum service during severe disturbances*
- *quickly return to normal service after a disturbance.*

Emergency Preparedness *allows you to take matters into your own hands and help prevent daily life interruptions or losses.*

ALTERNATIVE FUEL OPTIONS

Alternative fuels to consider for a buildings resiliency plan are:



A resilient power backup system must be secured and protected from natural disaster events including wind forces, flooding, salt intrusion and proper ventilation where applicable.

A resilient power backup system may require a periodic maintenance schedule, including a monitor check and start-up.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Level 2 Audit provides the building owner with a detailed building survey and energy and water analysis.

A detailed fuel-use analysis is performed and the building is benchmarked to gauge overall performance.

Energy consumption is broken out by end-use to focus on which areas of operation may present the greatest opportunities.

Utility rates are analyzed to determine if there are rate change opportunities or if specific utility rate demand response programs are available to the building.

Building owners, managers, and occupants are interviewed to gain a thorough understanding of the operational characteristics of the building, to explore all potential problem areas, and to clarify financial and non-financial goals of the assessment.

Once the detailed site assessment is completed, an energy model and engineering calculations are developed in order to create a detailed and cost-effective scope of work.

The scope of work will include the cost and savings analysis of all practical measures that meet the owner's economic criteria, along with a discussion of any changes to operation and maintenance procedures and health and safety recommendations.

Refer to *Case Study 2* on the last page of this brochure to see an example of an ASHRAE Level 2 Energy Audits of municipal facilities that Florida Solar Energy Center conducted in 2019.

ALTERNATIVE FUEL OPTIONS

Alternative fuels to consider for a building's resiliency plan are: Natural Gas, Propane, Solar + Storage, and Electric Vehicles.

Propane and Natural Gas

The redundancy that has been built into natural gas pipelines and the logistics of propane delivery present opportunities to extend the use of these alternative vehicle fuels to emergency and backup power generation for facilities. Both propane and natural gas generators are available to replace diesel and gasoline generators.

Propane and natural gas pipelines are less likely to be impacted for a number of reasons.

Propane arrives via rail to Florida from Pennsylvania, West Virginia and Ohio.

- Propane can be stored indefinitely (it doesn't degrade) and accessed quickly
- Propane allows for mobile fueling
- Propane takes about the same amount of time to refuel as gasoline

The natural gas supply chain is relatively free of chokepoints due to the large amount of redundancy in the system:

- Transmission Pipeline—the loss of one compressor station would reduce flow 25%. Losing three stations in series could halt operation.
- Transfer from transmission to distribution takes place at the city gate. Most cities have six or more gates.
- Distribution lines are kept pressurized during hurricanes to avoid infiltration.

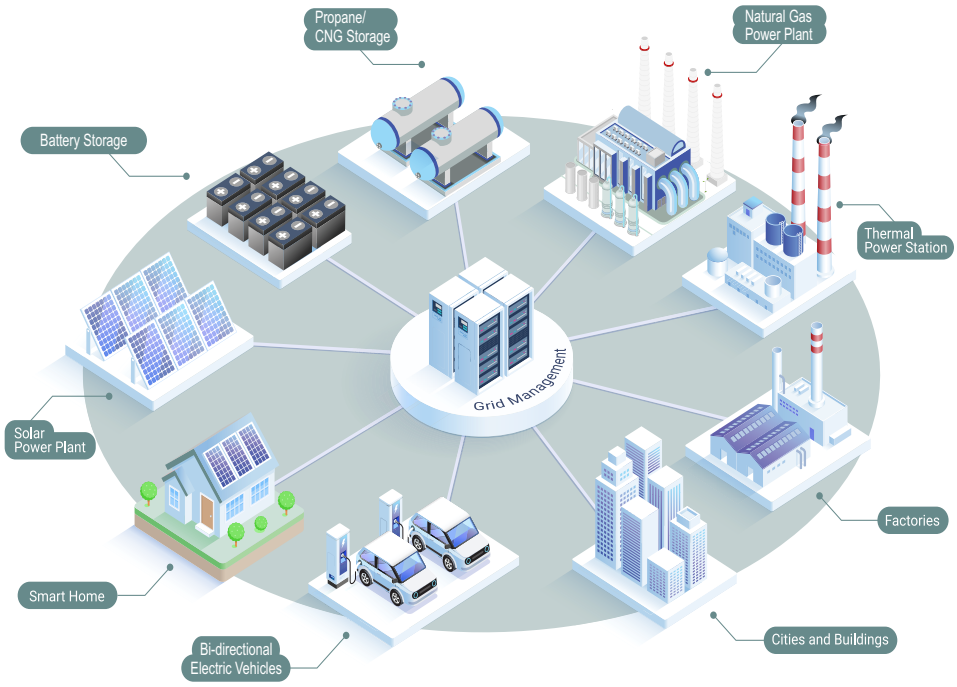
Choosing between propane and natural gas will largely depend on cost and availability of the fuel source.

Just as propane and natural gas are alternative fuels for transportation, they are also alternatives to gasoline and diesel for backup generators.

Propane can be stored on site, whereas access to a fuel line is needed for natural gas. This may not be an issue for commercial properties that are already using natural gas for other purposes. These generators can be dedicated to emergency use only, or designed to operate in tandem with the electric grid during normal operations.

Solar Electric Systems

Distributed resources, like solar electric systems (photovoltaics or PV), are a feasible and cost effective option. Most PV systems are designed to offset the average annual electric load for a building and are interconnected with the serving electric utility. However, the emergence of battery storage has led to an increase in systems operating in parallel with the grid during normal operations and independent of the grid when there is a power outage. Battery storage allows the PV system to charge the batteries during the day and provides energy to the building at night or during an interruption in utility service.



Identifying critical building energy loads and coupling them with solar + storage is one path to energy resilience. The SunSmart E-Shelter Schools Program did just that for over 100 educational facilities that serve as emergency shelters.

Electric Vehicles to Grid

Another emerging distributed resource is the electric vehicle battery. As the capacity of electric vehicle batteries has increased, the concept of harnessing the stored energy for use in buildings has become a reality. Bi-directional

CASE STUDY 1

SunSmart E-Shelter Schools

The SunSmart E-Shelter Schools Program was the first mass deployment of solar with battery back-up on schools that double as emergency shelters in the United States. More than 115, 10-kW photovoltaic (PV) solar systems are installed on the emergency shelter schools throughout Florida. The Florida Solar Energy Center® (FSEC®) coordinated the installations, which began in 2010. The SunSmart E-Shelter Program has added more than one megawatts (MW) of combined photovoltaic generating capacity to Florida using American-made components.

See a video about the SunSmart E-Shelter Program at https://vimeo.com/53626354.

CASE STUDY 2

New Smyrna Beach Energy Audit

Florida Solar Energy Center® conducted ASHRAE Level 2 Energy Audits of municipal facilities, assessing Lighting (LED and controls); Occupancy controls; High efficiency heating and cooling equipment (and duct sealing); HVAC set points, and Roofing materials (when re-roofing). An assessment of the potential for rooftop solar on those same facilities was also conducted. The team determined that solar PV had the potential to offset 40% of building electric energy use if installed on all available municipal building rooftops. If the City incorporated the Energy Conservation Measure (ECM) recommendations, the solar contribution would increase to 47%.

Learn more about the study at: https://publications.energyresearch.ucf.edu/wp-content/uploads/2020/07/FSEC-CR-2099-19-NSB-plus-ExecSum.pdf

This project funded by

charging, which allows an EV battery to both receive and discharge electricity, can provide backup power to a building, as well as help manage the building's electrical load during periods of high demand.

Electric vehicles rely on recharging stations to operate. Electric Vehicle Supply Equipment (EVSE) can be found in homes, workplaces, shopping centers, and a host of other publicly accessible locations. Solar energy can serve as a reliable source of power for EVSE, but in most cases, utility-generated electricity is the primary power source.

SUMMARY

Resilient electric power systems are gaining importance since recent hurricanes have caused power outages for long durations, thereby impacting critical needs and essential services such as refrigeration, water pumps, and pharmaceutical needs, grocery stores and gas stations. Resilient power systems must have a backup source of power and operate independently of the power grid until critical services can be restored. Non-petroleum-based fuels are less impacted during a natural disaster and should be considered as an alternative. In addition to considering alternative fuels for backup power, reducing energy loads is an important first step to increasing resilience.

RESOURCES

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