



LIQUID FUELS SHORTAGE PLANNING GUIDEBOOK

FOR PENNSYLVANIA HEALTHCARE FACILITIES

MARCH 2021





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INTRODUCTION

Healthcare facilities such as hospitals and long-term care facilities depend on energy for a number of essential functions, including maintaining operations for medical equipment, cooling, heating, ventilation, transportation, food refrigeration and preparation, water supply, sanitization, security systems, fire alarms and egress, electronic health records, lighting and access to medication or medical supplies that require keyless entry. For patients with acute or chronic conditions, electricity is particularly critical to power life-sustaining devices that maintain body temperature, aid respiratory functions, or provide other critical life support. Healthcare facilities typically meet their energy needs from the electricity grid but may also utilize onsite power/steam generation (e.g., combined heat and power (CHP), solar, boilers) and backup generators (e.g., diesel) during emergencies. In addition, healthcare vehicles, such as ambulances, typically rely on petroleum fuels that are purchased at retail fueling stations. Due to the importance of energy to healthcare facility operations, it is paramount that healthcare facility operators understand the risks of energy disruptions and develop plans to maintain energy supply or to mitigate the impacts of energy supply loss during emergency events.

The *Liquid Fuels Shortage Guidebook for Pennsylvania Healthcare Facilities* ("Guidebook") presents short-term and long-term approaches to increase healthcare facilities' fuels resilience, focusing primarily on liquid fuels used by backup power generators and emergency vehicles. There are many existing resources that help facilities plan for disruptions to their primary source of power. The Guidebook, however, is focused on planning for and responding to disruptions to facilities' secondary or backup power. After reading the Guidebook, healthcare facilities should understand the hazards that may impact the liquid fuel supply chain, and the steps that can be taken to minimize the impacts of a disruption.

With a changing climate, Pennsylvania expects an increase in the frequency and intensity of extreme weather events such as heat waves, hurricanes, and floods. Additionally, temperature increases are likely to cause increased demand for cooling in the summer months and an overall higher demand for electricity in the Commonwealth. As the climate changes, the balance of

energy demand shifts over time. Anticipating and addressing energy supply chain vulnerabilities will become ever more pressing.

PURPOSE

This Guidebook is designed to help healthcare facility managers anticipate, prepare for, and respond to events that severely disrupt the fuel supply chain and drastically affect fuel availability and/or regional demand. The Guidebook is developed for inpatient facilities regulated by the Pennsylvania Department of Health (PA DOH), including hospitals, hospice agencies, intermediate care facilities for persons with developmental disabilities, pediatric extended care centers, rehabilitation agencies, and skilled nursing facilities.¹ This document will refer to these facilities collectively as “healthcare facilities.”

The Guidebook focuses primarily on planning for medium-term fuel supply shortages lasting 1 to 3 days. This type of event could be precipitated by a widespread outage to the electrical grid that leads to a surge in demand for fuel for backup generators and, at the same time, can disrupt the ability to pump fuel at petroleum distribution terminals and retail filling stations. Although healthcare facilities typically have plans and procedures in place to handle short-term emergencies, facilities may not have contingencies or plans in place to minimize impacts from disrupted fuel markets. During long-term disruptions, County, Commonwealth, and Federal resources may be mobilized and deployed to provide aid to critical facilities, including healthcare facilities, but outside aid may be limited or simply take time to initiate and deliver. Healthcare facilities should develop plans to maintain fuel supplies or mitigate the impacts of energy losses during such events.

The Guidebook is laid out as follows:

Section 1 outlines the requirements for healthcare facilities to have backup power generation.

Section 2 discusses key contacts and the roles they play in addressing energy issues at healthcare facilities.

Section 3 prompts planners to anticipate emergency fuel needs at healthcare facilities and to plan for these needs during emergency events.

Section 4 discusses response activities and provides a checklist for healthcare facility planners to use during events.

Section 5 introduces long-term strategies to strengthen fuel resiliency and mitigate the impacts of fuel shortages.

The Guidebook is accompanied by the *Fuel Shortage Planning Template for Healthcare Facilities* (“Template”), which is a Microsoft Excel® spreadsheet designed to help facility managers organize information about their facility’s emergency fuel demand, fuel resources, and fuel distributors operating in the area.

The Guidebook is a follow-on to the Pennsylvania Department of Environmental Protection (PA DEP) [Liquid Fuels Shortage Guidebook for Pennsylvania Local Governments](#) (2020), a guide for county planners and emergency managers to help plan for and respond to liquid fuels shortages at the county level. Although the Guidebook is designed to be a standalone document sufficient for healthcare facilities’ needs, readers interested in learning more about broader fuels planning principles and county-level responsibilities should refer to this document.

SECTION 1

SECTION 1. BACKUP POWER REQUIREMENTS FOR HEALTHCARE FACILITIES

Backup power requirements for healthcare facilities are primarily regulated by standards developed by the Centers for Medicare & Medicaid Services (CMS),^{vi} National Fire Protection Association (NFPA),^{vii} and accrediting organizations. These standards require regulated facilities to have backup power systems and develop plans for emergency situations. The standards also provide specific requirements regarding the location, operation, and testing of generators for backup power systems. However, these requirements do not necessarily specify how much fuel must be stored onsite and what contingencies facility operators should plan for during fuel supply disruptions.

The CMS [Emergency Preparedness Requirements for Medicare and Medicaid Participating Providers and Suppliers](#) establishes requirements for Medicare- and Medicaid-participating healthcare providers.^{viii} In addition to requiring facilities to meet several NFPA standards, CMS requires that all hospitals develop and maintain an all-hazards-focused emergency preparedness plan, reviewed and updated every two years. Check the most recent CMS regulations for up-to-date information about energy requirements.

According to CMS:

- **Hospitals** are defined as institutions "primarily engaged in providing, by or under the supervision of physicians, inpatient diagnostic and therapeutic services or rehabilitation services."ⁱⁱ
- **Critical access hospitals (CAHs)** are defined as small, rural facilities that have 25 or fewer acute care inpatient beds and are generally located more than 35 miles from another hospital.ⁱⁱⁱ CAHs are certified under separate standards than hospitals.
- **Long-term care (LTC) facilities** are defined as skilled nursing facilities and nursing facilities, such as residential nursing homes for the elderly.^{iv}

CMS regulates other healthcare facilities, including ambulatory surgery centers, community mental health centers, end stage renal disease facilities, intermediate care facilities for individuals with intellectual disabilities, clinical laboratories, psychiatric hospitals, psychiatric residential treatment facilities, inpatient rehabilitation facilities, rural health clinics, and religious nonmedical healthcare institutions. CMS does not have backup power requirements for these facilities.^v Despite the lack of federal regulation, fuels shortage planning would still be beneficial for these facilities.

NFPA is a nonprofit whose standards regarding electrical requirements are adopted extensively in CMS guidance. In particular, [NFPA 99^{ix}](#), [NFPA 99 Tentative Interim Amendment \(TIA\) 12-3^x](#), and [NFPA 110^{xi}](#) address emergency power requirements for healthcare facilities and contain generator requirements.^{xii} Although CMS has adopted specific editions, NFPA also periodically publishes updates to these standards. Check CMS guidance and the most recent NFPA standards for up-to-date information about energy requirements and recommendations.

There are multiple resources to help healthcare facilities understand their regulatory requirements. Assistant Secretary for Preparedness and Response Technical Resources, Assistance Center and Information Exchange (ASPR TRACIE) has published consolidated review documents that combine information from the CMS Final Rule, Interpretive Guidelines, revisions to the Interpretive Guidelines, and additional statutes, regulations, and policy materials. The review documents provide a user-friendly summary of requirements, and the ASPR TRACIE documents provide an overview for [hospitals and critical access hospitals](#).^{xiii}

For essential electrical system power sources in which the failure of equipment could result in loss of human life or serious injury, power must be restored within 10 seconds of a disruption, although there is no NFPA-designated minimum time that the system must run without refueling. The minimum required run time may instead be specified by other codes or another authority having jurisdiction. However, in locations where there is a high probability of interruption of off-site fuel supplies, generators must maintain a store of an alternate fuel source onsite.

CMS also requires that hospitals, CAHs, or LTC facilities “that maintain onsite fuel sources (e.g., gas, diesel, propane) to have a plan to keep the essential electric system (EES) operational for the duration of emergencies as defined by the facilities’ emergency plan, policy and procedures, unless it evacuates.”^{xiv} ASPR TRACIE explains that “This would include maintaining fuel onsite to maintain generator operation or it could include making arrangements for fuel delivery for an emergency event. If fuel is to be delivered during an emergency event, planning should consider limitations and delays that may impact fuel delivery during an event. In addition, planning should ensure that arranged fuel supply sources will not be limited by other community demands during the same emergency event. In instances when a facility maintains onsite fuel sources and plans to evacuate during an emergency, a sufficient amount of onsite fuel should be maintained to keep the EES operational until such time the building is evacuated.”

Please defer to your accrediting body and surveyor as needed for a full and up-to-date list of federal regulations.

COMMONWEALTH OF PENNSYLVANIA

Commonwealth regulations related to backup generation at healthcare facilities align with the federal CMS regulations. The Commonwealth regulations related to emergency power at healthcare facilities are outlined in 28 Pa. Code 151.41 and simply require that facilities adopt NFPA standards. Chapter 151 of the PA DOH hospital regulations^{xv} requires that the emergency electric power sources and associated equipment align with NFPA standards.^{xvi,xvii} Additionally, 28 Pa. Code 101.42a requires that hospitals must meet NFPA 101 and all applicable appendices.^{xviii}

Additional Best Practices: ASPR Health Care Preparedness and Response Capabilities

ASPR published [2017–2022 Health Care Preparedness and Response Capabilities](#)^{xix} to help healthcare delivery systems prepare for and respond to emergencies. The document outlines capabilities, goals, objectives, and activities for healthcare delivery systems, and several of these best practices address the importance of maintaining power and ensuring liquid fuels availability.

Capability 1. Foundation for Health Care and Medical Readiness, Objective 2. Identify Risk and Needs, Activity 2. Assess Regional Health Care Resources: Healthcare coalition (HCC) members should identify resources vital for the continuity of healthcare delivery during and after emergencies. ASPR lists power among the critical infrastructure that should be addressed in this assessment.

Capability 3. Continuity of Health Care Service Delivery, Objective 1. Identify Essential Functions for Health Care Delivery: Utilities—including electricity, gas, and fuel—are healthcare functions that should be continued during an event and should be prioritized for restoration when disrupted.

Capability 3. Continuity of Health Care Service Delivery, Objective 3. Maintain Access to Non-Personnel Resources During an Emergency, Activity 1. Assess Supply Chain Integrity: HCC members should examine supply chain vulnerability and assess access to critical supplies, quantities available regionally, and potential alternate delivery options in case access or infrastructure is compromised. ASPR includes fuel suppliers in its list of factors to consider in the supply chain assessment. ASPR's suggestions for mitigation, such as establishing secondary vendors and developing pre-event disaster supply procedures, are also relevant to liquid fuels resilience.

SECTION 2

SECTION 2. IDENTIFYING AND COORDINATING WITH FUEL CONTACTS

Healthcare facility managers are responsible for maintaining continuity of operations. Their work involves identifying and communicating with contacts that will support continuity of energy supply before, during, and after a fuel disruption. Facility managers should proactively engage with these key contacts to address concerns and understand expectations and anticipated limitations during emergency events. In the event of a fuel shortage, relationships with these contacts will help the healthcare facility make informed decisions faster.

Emergency Operations Plans (EOPs)

The [Commonwealth of Pennsylvania Emergency Operations Plan](#) (June 2019) requires the PA DOH to ensure that hospitals and skilled nursing facilities have developed emergency plans.^{xx}

Exhibit 1 illustrates the relationships between the healthcare facility's key contacts. In general, facilities should coordinate first and foremost with their local and/or county governments to request resources and other assistance. If a facility's needs exceed local authorities' capacity to address them, then local and county governments will contact Commonwealth officials on the healthcare facility's behalf.

The [Response Checklist](#) in Section 4 includes specific actions that the healthcare facility should follow to engage each contact.

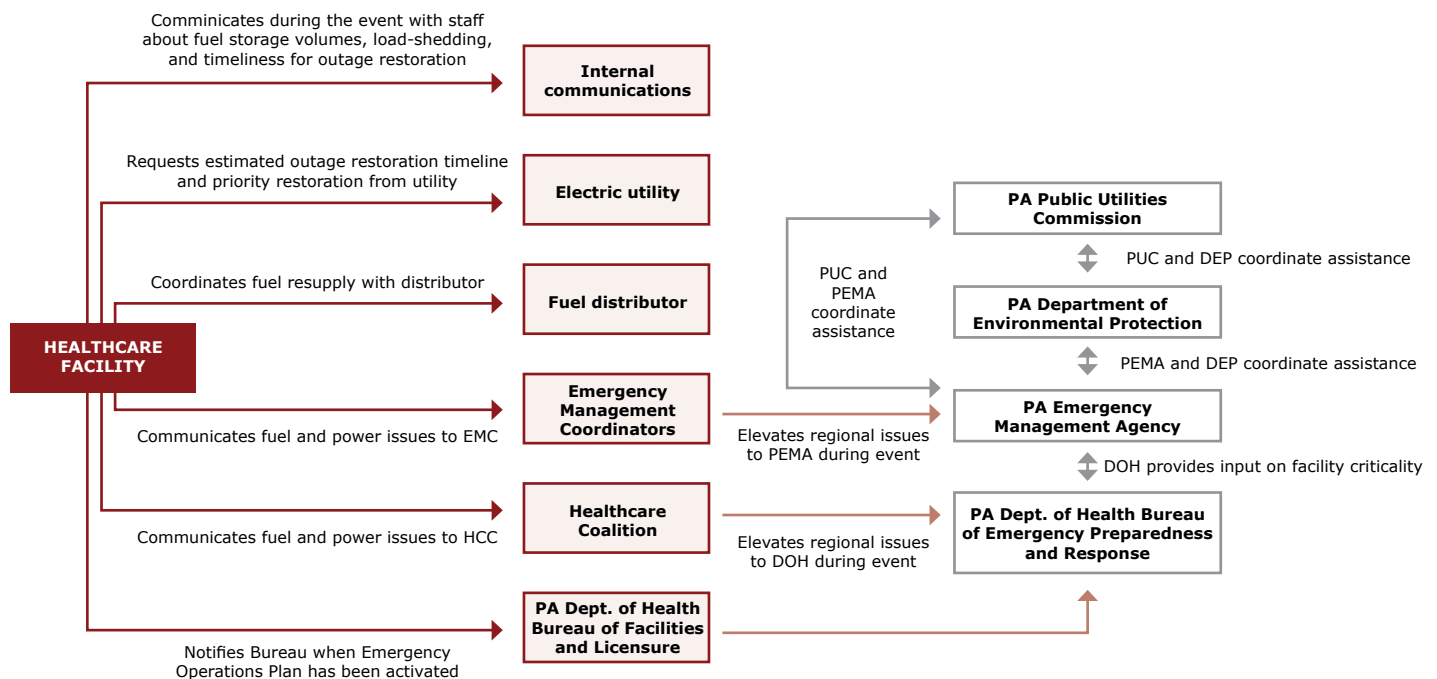


Exhibit 1: Key Healthcare Contacts for Healthcare Facilities

PRIMARY CONTACTS

The following six entities are considered primary contacts for healthcare facilities. Facilities should communicate directly with some or all of these contacts when preparing for and responding to an event.

Healthcare facility: Prior to an event, facility managers should ensure that staff understand which facility functions should receive backup power, as well as priorities for load-shedding during an outage event. This can be done through formal documentation and training and exercises.

During a power outage at facilities with backup power systems, generators will automatically switch on to power a subset of facility functions in accordance with the facility's emergency planning. When this happens, healthcare facility managers should share information with other facility employees about the volume of fuel remaining in storage, potential load-shedding prioritization to conserve fuel, timelines for power restoration, and other considerations related to the fuel storage and generator use of the building. This information will factor into decision making surrounding patient care and patient evacuation and relocation.

Electric utility: Healthcare facility managers should maintain updated contact information for their primary utility and establish a relationship with a customer service representative. Healthcare facility managers should confirm that their utility knows that the facility is in the healthcare sector and understand where the facility stands on the priority restoration list.

The healthcare facility's electric utility is also an important contact for situational awareness during a power outage. Understanding estimated timelines for restoration can help inform the facility manager's decisions related to liquid fuels conservation, refueling, and when to request assistance to fulfill unmet needs.

Fuel distributors: Healthcare facility managers should maintain updated contact information for their primary fuel distributor and should communicate with them to understand how they prioritize customers. Facilities should also have their distributor top off fuel storage tanks in advance of any known severe events, such as predicted snowstorms.

During a power outage, the healthcare facility's fuel distributor is responsible for restocking fuel. In some cases, fuel tanks have indicators that distributors can monitor remotely and observe when supply dips below a set level. Depending on the contract arrangement, this may automatically trigger an order to refill the tank. In other cases, fuel tanks need to be actively monitored and the healthcare facility must place a resupply request when supply runs low.

During emergency situations, distributors should also communicate whether their delivery capabilities are affected or will be affected by power outages, inclement weather, road restrictions, or driver availability. This information can help healthcare facilities gauge timelines for fuel refill and distributor reliability and decide whether they will need to call on another distributor to help meet their ongoing fuel needs.

Resource Toolkit: Distributors List

A list of fuel distributors serving Pennsylvania is included in the "Fuel Distributors" sheet of the Template and can be filtered by county, ZIP code, Pennsylvania Emergency Management Agency (PEMA) region, fuel type, and other distinguishing factors for ease of use.

Emergency management coordinators: Municipal- and county-level emergency management coordinators (EMCs) are a healthcare facility's primary government contacts and often have insight into regional issues impacting others in the sector. The EMCs may assist a facility directly, or they may elevate an issue to be resolved at the regional or Commonwealth level if needed.

Facility managers should alert EMCs if they can no longer acquire fuel for the facility or are anticipating an imminent shortage. EMCs may assist in finding and delivering additional fuel to the facility or may be able to provide assistance if fuel distributors cannot access the healthcare facility due to debris or other transportation issues.

Facilities that need backup generators should communicate their needs to their EMC and provide them with the [PEMA generator request form](#)^{xxii} (included in [APPENDIX C](#)). The healthcare facility should first submit this form to its EMC, which will forward the request to PEMA if a generator is not available locally.

Healthcare coalitions: Pennsylvania's seven healthcare coalitions (HCCs) are a collaboration between healthcare organizations, emergency medical service agencies, emergency management organizations, public health organizations and other public and private partners, focusing on regional emergency planning and coordinated communication and information sharing in an incident response.^{xxiii} HCCs are multi-county entities that can organize support across healthcare facilities and channel information up to Commonwealth agencies. Facilities should alert their HCC when they are experiencing any power or fuel issues.

HCCs should be able to coordinate mutual aid requests across partner facilities, such as arranging for fuel transfers between facilities or helping to coordinate patient evacuation and relocation when needed. HCCs should know whether neighboring facilities are also affected by a power outage or fuel shortage and can coordinate accordingly. When the severity of a disruption exceeds the HCC's ability to coordinate local solutions, the HCC will elevate issues to the PA DOH, which in turn can coordinate with other Commonwealth entities to address issues.

Pennsylvania Department of Health (PA DOH) Bureau of Facility Licensure and Certification: The Bureau of Facility Licensure and Certification licenses and regulates inpatient and outpatient healthcare facilities in the Commonwealth.^{xxiv} Healthcare facilities are required to notify the Bureau when they have activated their Emergency Operations Plan.

County Contact List

PEMA maintains a list of [emergency management coordinators](#) and their contact information for every county in the Commonwealth.^{xxi} Use this list to facilitate communication with the officials relevant to your healthcare facility.

SECONDARY CONTACTS

Once healthcare facilities have reached out to their primary contacts during an event, these contacts, in turn, may coordinate with each other and with additional contacts to share information and prioritize aid. In most cases, it is not necessary for healthcare facilities to reach out to these contacts directly. After unmet needs have been elevated up the chain, these additional contacts generally respond as follows:

- 1) EMCs contacted by healthcare facilities reach out to PEMA to fulfill unmet need requests that cannot be resolved at the county level, which may include fuel or generator needs.
- 2) PA DOH Bureau of Emergency Preparedness and Response coordinates preparedness and response planning and manages PA DOH's response and recovery activities.^{xxv} PA DOH Bureau of Emergency Preparedness and Response may be notified through the healthcare coalitions or PEMA and can provide contextual information on the criticality of the facilities requesting assistance. This ensures that the most critical healthcare facilities receive priority access to liquid fuels, generators, power restoration, and other assistance.
 - a) PA DOH is the lead organization for Emergency Support Function (ESF) #8, Public Health and Medical Services, and oversees coordinating medical care and public and mortuary services.^{xxvi}
- 3) PEMA provides PA DOH's input to the Pennsylvania Department of Environmental Protection (PA DEP) and the Pennsylvania Public Utilities Commission (PUC).
 - a) PA DEP is the lead organization for ESF #12, Energy, and oversees monitoring, maintaining, and restoring the supply of energy and energy distribution infrastructure within Pennsylvania.^{xxvii}
 - b) The PUC regulates utilities in the Commonwealth, including electricity, natural gas, and pipeline transmission utilities.^{xxviii} The PUC has the authority to direct jurisdictional utilities (the 11 investor-owned utilities that serve the vast majority of electric customers in the Commonwealth) to perform priority restoration as system conditions allow. This is typically requested by PEMA or the Governor's Office. Note that the PUC does not regulate rural electric cooperatives but can reach out to the Pennsylvania Rural Electric Association (PREA) as needed.
- 4) PA DEP coordinates the logistics of the response, working with the PUC on power restoration as needed.

SECTION 3

SECTION 3. FUEL SHORTAGE PLANNING

Fuel shortages at healthcare facilities may result from widespread electric grid outage events, which can occur suddenly and are often associated with major storms. Although each event is unique, understanding and preparing for potential disruptions ahead of time can help healthcare facility managers mitigate an event's impact and reduce the scale of the necessary emergency response measures.

Preparing for fuel shortages involves knowing your building's energy needs, identifying and communicating with fuels contacts, understanding the liquid fuels supply chain, and developing plans on how to address potential problems. This section of the Guidebook discusses the importance of planning and the steps that healthcare facilities should be taking.

UNDERSTANDING THE LIQUID FUELS SUPPLY CHAIN AND VULNERABILITIES

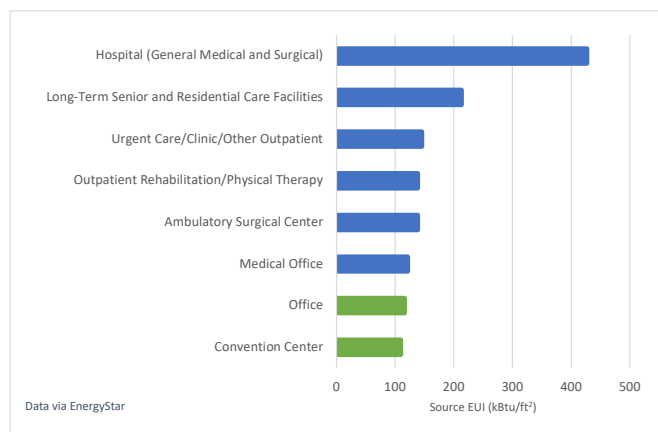


Exhibit 2: Energy Use Intensity (EUI) of Healthcare Facilities
Exhibit 2 note: Source energy use intensity is the recommended unit for comparison of energy use across buildings, as it accounts for the energy use in the building plus any losses from production, transmission, and delivery.^{xxxix}

Healthcare facilities are major users of energy, including grid-supplied electricity. This is especially true for hospitals, which under normal, non-emergency conditions, consume more energy per square foot than most other commercial buildings.^{xxx} Healthcare facilities, and hospitals in particular, are large energy users due to patient and employee needs. These facilities are often open 24 hours a day, need sophisticated HVAC systems, and require energy for a variety of applications including lighting, food refrigeration and preparation, water supply, sanitization, and electronic health records.^{xxxi}

Exhibit 2 shows the relative source energy use intensity (EUI), or energy use per square foot, for different medical facilities compared to the EUI of two nonmedical facilities.

Exhibit 3 shows the relative uses of electricity within healthcare facilities, with 41% of electricity in inpatient facilities used for cooling and ventilation. When grid power is lost, healthcare facilities rely on backup power generators, primarily diesel generators, to fulfill critical needs. Offsite services such as information technology services or data servers located separately from the main healthcare facility may also rely on diesel-powered generators as their backup power option.^{xxxii}

According to the Energy Information Administration's (EIA) Commercial Buildings Energy Consumption Survey (CBECS), an estimated 23,000 inpatient and outpatient healthcare facilities used approximately 3.4 million barrels (142 million gallons) of fuel oil,^{xxxiii} or about 145 barrels (6,074 gallons) per building.^{xxxiv,xxxv} Approximately 56% of fuel oil used in the healthcare sector is used for space heating.^{xxxvi} Inpatient healthcare facilities consumed over 80% of the total fuel, or approximately 326 barrels (13,711 gallons) per building.^{xxxvii,xxxviii}

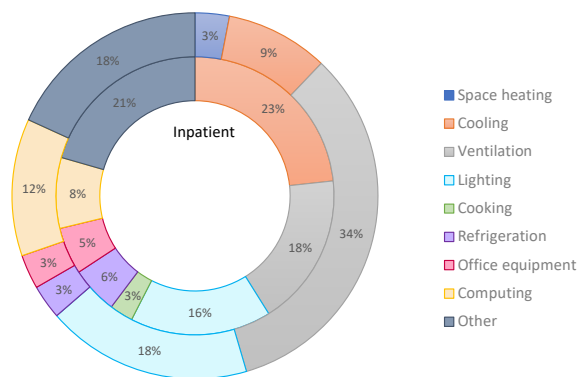


Exhibit 3: Healthcare Electricity Consumption
 (Percentage of Electricity Used Per End Use)
 Source: Commercial Buildings Energy Consumption Survey (CBECS) 2012

Additionally, on-road fuels such as gasoline and diesel fuel may be used in vehicles owned directly by the healthcare facility or in vehicles owned by local companies that provide ambulance services, evacuation services, etc.

FUELS SUPPLY CHAIN

Given the critical need for energy in healthcare facilities, facility managers should have a basic understanding of the liquid fuels supply chain and how disruptions to that supply chain can impact fuel supply to the healthcare facility.

In general, fuels are refined into useable products in refineries and then transported by pipeline to Pennsylvania. Pipelines serving Pennsylvania originate in the Midwest, Gulf Coast, and New York. Fuel from pipelines is stored temporarily in terminals, from which fuels are trucked to retail stations, onsite storage at healthcare facilities, and other end users. Exhibit 4 depicts the liquid fuels supply chain from refining to end use.

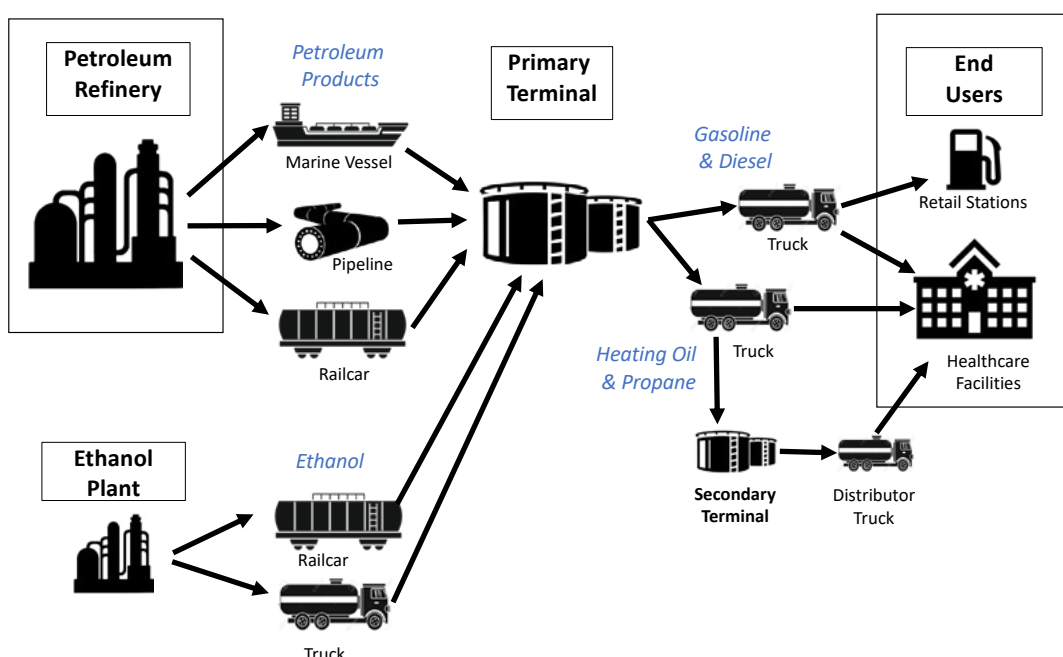


Exhibit 4: Diagram of the Liquid Fuels Supply Chain

Widespread power outages, which are primarily caused by weather events, pose one of the largest threats to liquid fuels availability. This is because every link in the fuel supply chain—refineries, pipelines, terminals, and retail stations—is dependent on electric power to operate. A widespread outage event that disrupts electric supply to a healthcare facility and forces that facility to run on a backup generator is also likely to impact the fuel distribution network that is needed to refuel those generators and healthcare vehicles. Furthermore, demand for liquid fuels often spikes during widespread power outage events as critical and noncritical facilities turn on backup generators. Fuel deliveries may be further disrupted by impeded roadways, driver hour limitations, and general driver limitations during and after inclement weather.

There are many potential causes of widespread power outages. Historically, these events have been caused by weather events, including hurricanes, summer storms, tornadoes, and blizzards. Situations involving malfunctioning equipment and high demands, such as the 2003 Northeast Blackout, can also cause power loss to large segments of the grid. In recent years, cyberattacks also pose an increasing threat to the electric grid, and there is increasing awareness of the threat posed by manmade or natural electromagnetic pulse (EMP) events.

ANTICIPATING THE IMPACT OF POWER OUTAGES ON HEALTHCARE FACILITIES

Power outages can affect healthcare facilities' primary operations. Like all major commercial spaces, healthcare facilities depend on electricity for basic building systems, such as elevators, keyless locks, lighting, and fire alarm and suppression systems. Power outages may also cause communications system outages crucial for patient care, such as patient signaling and call buttons. Medical equipment supporting vulnerable patients, such as ventilators and monitoring equipment, is electricity dependent, and digital data and IT systems may also be inaccessible during an outage.

Loss of power to HVAC systems can create unsafe conditions for vulnerable patients during very cold or very hot weather, as the pumps and fans required to distribute heat and air conditioning cannot function without backup power. Loss of temperature control in storage spaces can threaten medical supplies such as vaccines, medications, and other pharmaceuticals. A power outage also affects supporting services such as food preparation and storage and laundry services. Exhibit 5 demonstrates that in addition to relying on power for facility functions, health systems also depend on supporting critical infrastructure sectors, which have their own vulnerabilities to extreme weather and power outages.

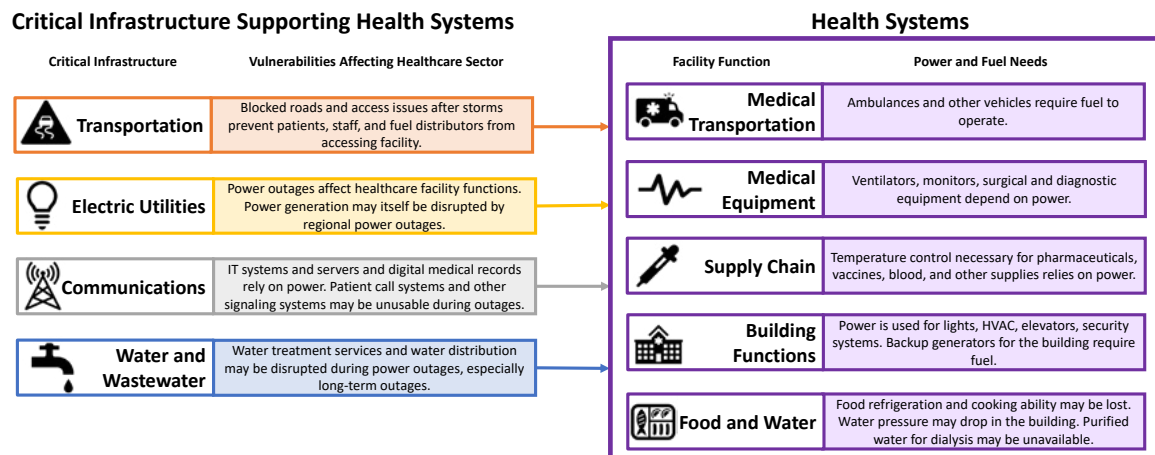


Exhibit 5: Energy Dependencies in the Healthcare Sector

Following relevant NFPA and CMS guidelines, healthcare facilities must consider which critical facility functions will be covered by backup generators in the event of a power outage. Part of this planning should include a listing of which specific facility functions will not be supplied by generator power, in accordance with CMS regulations and other best practices, to ensure that all functions have been considered. For example, the Federal Emergency Management Agency (FEMA) states the following functions may not be covered by generators, although actual coverage will vary by facility: air conditioning; environmental control for server rooms; diagnostic equipment, including radiology; morgue; lab; blood bank; transfusions service; human tissue storage; food preparation areas; elevators; and pharmacy/floor prescription dispensaries.^{xxxix}

Facilities should also consider that additional load shedding—such as turning off some lighting or adjusting temperatures—may be necessary to conserve fuel or in the event of a partial failure of the emergency power system. Energy-efficient buildings are better able to mitigate the impacts of load shedding because they are designed to use less energy during normal operation. [Section 5](#) provides information on resources and incentives for facilities interested in investing in energy efficiency.

In addition to planning for localized outages, facilities should also prepare for widespread, regional power outages, which may increase regional fuel demand, lengthen restoration times, and limit options for patient evacuation and relocation.

ASSESSING AND DOCUMENTING FUEL NEEDS AND SUPPLY

Once facilities have identified the essential functions that will be powered by backup generation, they can begin to assess their total fuel needs. Total fuel needs for the facility comprise fuel used for backup generation, fuel used for boiler systems or other heating, and vehicle fuels for facility-owned fleets. To prepare for liquid fuels shortages, facility managers must assess fuel needs during both routine use and anticipated emergency events.

FILLING OUT THE TEMPLATE

The Template is designed to help healthcare facilities assess fuel needs and collect and maintain all relevant information. The Template contains two main tabs to store data on 1) building fuel use (backup generators and heating) and 2) vehicle fuel use. Contact information for fuel distributors operating in and near Pennsylvania is also included in the Template for users' reference.

After they have entered facility information into the Template, users should also feel free to edit the Template itself to suit their needs. For example, users may prefer to shuffle around sections so that the "Building Fuel Use" tab is categorized by generator, rather than by building. Once they have entered the relevant information, users should also feel free to use data filters to sort the information for ease of reference.

A short worksheet for completing the Template is included in [APPENDIX A](#). This worksheet collects all the same information as the Template but provides additional instruction on the data collection process.

MAINTAINING AND UTILIZING THE COMPLETED TEMPLATE

The completed Template serves as a reference document that facility managers can use to both prepare for an event and reference during an event. Facility managers should periodically revisit this Guidebook and the Template to review procedures and check whether key elements (number of generators, etc.) have changed. In particular, planners should verify annually that contact information for distributors is current and that estimates of the facility's emergency demand are accurate.

After completing the Template, facility managers should review the facility's inputs and consider whether the amount of stored fuel is sufficient to meet anticipated emergency needs.

PLANNING CHECKLIST

The Planning Checklist that follows recommends actions facility managers can take to prepare for liquid fuel shortages. The list is divided into three main sections: generators, fuel, and key contacts. The checklist includes blank columns to fill in the contact information and record notes. Facility managers should also feel free to edit the checklist in the Template by adding activities specific to their facilities.

Using the Template To Guide Emergency Planning

The following questions may be helpful to guide your facility's emergency planning:

- *Is the estimated run time calculated in the "Building Fuel Use" tab appropriate for the building, given its function, patient population, and other factors?*
- *What load could be shed from a generator if needed to extend its run time in a fuel shortage? When would you consider shedding it? What building functions would be turned off to achieve this, and how many additional hours would be gained by doing this?*
- *Should the fuel storage associated with the backup generators be increased to allow generators to run longer during emergencies?*

PLANNING AND PREPAREDNESS CHECKLIST FOR FACILITY MANAGERS

Actions	When?	Responsible Party Contact Information	Notes
Generators			
Identify essential facility functions and minimum electricity needs.	Once, and update as needed		
Test generators and perform maintenance as needed.	Monthly, per NFPA guidance		
Maintain a list of key spare parts for your emergency power system, and stock parts as needed.	Once, and update as needed		
If generator is serviced by outside contractor(s), have contract for servicing generator. Understand contractor's capacity to provide service during emergencies when demand for servicing is high.	Once, and update as needed		
Prepare a written protocol with steps to take when transitioning to generator power and safety protocols. Review safety procedures with staff electricians and other facility managers annually.	Annually		
Fuel			
Calculate backup fuel needs and determine schedule for refueling, coupled with what threshold in tank would trigger the resupply of fuel.	Once, and update as needed		
Establish agreements with your primary fuel distributor for emergency service.	Once		
Establish will-call contract or other agreement with one or more backup fuel distributors.	Once		
Determine whether contractors responsible for ambulance services, facility evacuation, or other activities requiring transportation fuel have established procedures for fuel shortages.	Once		
Have your fuel vendor test the fuel in large storage tanks annually, including testing fuel from the bottom, middle, and top of each tank.	Annually		
Top off fuel tanks if there is advance warning of an emergency event.	1-3 days before the event		
Top off service vehicles' fuel tanks if there is advance warning of an emergency event.	1 day before the event		
Discuss fuel vendor contracts with other healthcare coalition members and neighboring facilities to help assess regional fuel supply chain integrity.	Annually		
Key Contacts			
Confirm contact information for the following: - Facility manager - Electric utility - Fuel distributor - County emergency planning office - Healthcare coalition regional manager	Annually		
Coordinate with facility administrators and medical staff to ensure that all contacts understand the clinical impacts of load shedding during a power outage. Communicate and coordinate which facility functions will continue with generator power and which will cease.	Annually		

SECTION 4

SECTION 4. RESPONDING TO LIQUID FUELS SHORTAGES

This section discusses actions healthcare facilities should take to respond to a fuel shortage event.

The primary role of a facility manager during a liquid fuels shortage is to continuously evaluate the available stock of fuel, adjust the fuel demand where possible to reduce the burn rate, and to acquire additional fuel when needed.

RESPONSE CHECKLIST

Below is a checklist of emergency response activities that healthcare facility managers may perform during a fuel disruption. The checklist is divided into four sections: healthcare facility, electric utility, fuel distributor, and government. The activities within each section have differing timelines: Some actions should be performed once at the outset of the event and repeated only as necessary, while other activities, such as monitoring facility fuel needs and coordinating with certain parties, are best performed continually throughout the event. Facility managers should feel free to personalize the checklist to their facility's needs by adding in or editing activities and using the checklist's blank columns to document contact information and notes.

Please note that this checklist addresses the liquid fuels portion of a facility's emergency response only. It is *not* designed to manage the entire power outage emergency and should be used in conjunction with the facility's existing emergency operations plan.

PLANNING AND PREPAREDNESS CHECKLIST FOR FACILITY MANAGERS

Actions	When?	Responsible Party Contact Information	Notes
Healthcare Facility			
Activate emergency operations plan.	Once initially and as necessary		
Maintain awareness of facility operations, including: - Monitor generator(s) status. - Monitor facility power needs and prioritize needs. - Monitor fuel in storage for backup generation.	Continually		
Ensure that there is communication capability between patient care units and incident command to ensure patient safety through primary or redundant communications systems and platforms.	Continually		
Ensure that the facility has an executable plan in place to evacuate or transfer patients, should the situation warrant. Communicate to staff any potential power delays or curtailments necessary. Inform staff of refueling concerns, estimated restoration times from your utility, and any other factors that would affect the decision to shelter in place versus evacuate.	Continually		
Verify that safety protocols are being followed, including: - Emergency power systems do not feed power back to the grid. - Utility lines connecting to the facility have not been removed.	Continually		
Activate Recovery Plan - Have plan to phase out backup generators as power comes back online. - Identify mechanism to ensure resupply from fuel distributor. - Conduct after-action review and determine lessons learned. - Conduct thorough testing of building systems before coming back online, and ensure that no damage occurred while operating on generator power.	Continually		
Electric Utility			
Notify your utility of the power outage, using the utility's outage reporting system.	Once initially and as necessary		
Follow up with utility liaison/customer manager to receive information on estimated restoration times.	Once initially and as necessary		
Fuel Distributor			
Contact your primary fuel distributor to request a resupply if needed. Initiate contact with your backup fuel distributor if needed.	Once initially and as necessary		
Inquire about estimated delivery times and regional demand. Understand if there are any issues, such as roadway incidents, that may delay deliveries.	Once initially and as necessary		
Government/Regulatory			
Engage municipalities and county emergency management officials.	Once initially and as necessary		
Engage county or municipal health department (if applicable).	As necessary		
Engage health care coalition regional manager.	As necessary		
Engage state health department.	As necessary		
Notify your regulators and/or accrediting agency.	As necessary		
Submit generator request questionnaire to PEMA if needed.	As necessary		

SECTION 5

SECTION 5. FUEL RESILIENCY STRATEGIES

The previous sections of this Guidebook discuss planning activities that can be executed in the short term to better prepare Pennsylvania healthcare facilities for fuel shortage events. Over longer time horizons (and subject to available funds), facilities should consider implementing additional planning and investment options to improve resilience. These activities generally fall into three categories:

- 1) Fuel supplier resiliency strategies
- 2) Electric generator resiliency strategies
- 3) Energy demand management strategies

The last part of this chapter discusses planning and financing considerations for implementing resiliency investments.

FUEL SUPPLIER RESILIENCY STRATEGIES

Facilities increasing their fuel supplier resiliency take resiliency considerations into account when selecting a primary fuel supplier, including opening redundant accounts with other suppliers as a contingency. These actions can be completed on shorter timelines than the longer-term improvements discussed later in this chapter.

DISCUSS RESILIENCE WITH FACILITY FUEL DISTRIBUTOR

When selecting a primary fuel distributor, healthcare facilities should consider the ability of the distributor to maintain fuel supply during events that disrupt the electric grid or the fuel supply chain. Generally, this means selecting larger fuel distributors that have more trucks and drivers, serve a wider geographic market, and have access to a larger number of fuel distribution terminals. Among other topics, healthcare facilities should ask fuel distributors how they prioritize fuel deliveries when supply and delivery capabilities are strained and determine whether they are priority customers.

Suggested Questions for Distributors

Key Questions

1. *Do you consider my facility to be a priority customer?*
2. *How do you manage supply shortages? What is your allocation process?*
3. *How many trucks and drivers do you have? How many additional trucks and drivers can you contract with during an emergency?*
4. *Do you anticipate any single point of access issues with the transportation routes between your fuel supply and my facility? How do you plan to deliver fuel if highway restrictions or closures are enacted?*
5. *Are there any formal contracting structures that would help increase my facility's access to fuel during an event?*

Additional Questions

6. Do you provide fuel testing services and routine maintenance of storage tanks?

Fuel cannot be stored indefinitely, as the fuel's quality will deteriorate and become unusable over time, even with stabilizing additives. Stored fuel for generators must thus be tested and rotated out periodically. A playbook developed by the Rhode Island Emergency Management Agency and Department of Health in conjunction with Powered for Patients recommends that facility managers have their fuel vendor annually test their stored fuel, making sure that the vendor tests the fuel at three different levels within the tank (bottom, middle, and top) to ensure that an accurate assessment is made.^{xi}

7. Are you licensed as an interstate or intrastate company?

Commercial vehicles are licensed as either interstate or intrastate trucks, depending on their routes. The U.S. Federal Motor Carrier Safety Administration regulates interstate licenses and states regulate intrastate licenses.

8. At which terminals are your drivers credentialed and carded? How far away can you access fuel terminals?

Terminal operators require that fuel truck drivers who load at their terminals be credentialed to ensure that they have received training on the terminal's specific loading procedures. Only these "carded" drivers who have completed training at the terminal can load product at the terminal. Fuel distributors with drivers that are credentialed at many terminals have access to more terminals, likely across a wider region, during a disruption.

9. How many suppliers do you have?

Fuel suppliers own the fuel stored at terminals and sell it to distributors. Fuel distributors are also better able to manage shortage situations if they have relationships with multiple suppliers.

10. Does your primary source terminal have a backup generator or a backup power plan for emergencies sufficient to power truck loading operations?

Without backup power, terminals cannot load fuel to trucks during a power outage.

Please see the [Liquid Fuels Shortage Planning Guidebook for Pennsylvania Local Governments](#)^{xii} (February 2020) for additional context on the liquid fuels supply chain.

Some distributors specifically market themselves as providers of emergency supplies of fuel. Emergency management services are often established as "on-call" contracts; however, customers should initiate accounts in advance so that they can be activated, as needed, during an event. Note that some distributors may also be able and willing to provide some or all of these services, even if they do not specifically market themselves as providing emergency fuel services.

Spotlight on Distributors With Emergency Fuel Management Services

Emergency fuel management services may include:

- *24/7 emergency communication with customers via email, text, and phone, and guaranteed 24/7 service during emergencies*
- *Fuel for aboveground and belowground storage tanks*
- *Fuel for emergency response fleets, including onsite refueling and access to temporary fueling locations*
- *Access to vehicles designed for adverse weather conditions, including off-road and high-water transport vehicles*
- *Established contracts with fuel suppliers in neighboring states to ensure access during an event*

OPEN REDUNDANT ACCOUNTS WITH MULTIPLE FUEL DISTRIBUTORS

Healthcare facility managers should consider identifying one or more backup distributors that can be contacted if the primary distributor is unable to access fuel during an emergency. Many fuel distributors allow prospective customers to open “will-call” contract accounts: accounts that are free to open and are not used during normal circumstances, but which can be activated as needed during fuel shortages. Opening backup accounts in advance helps streamline the sale of fuel during emergencies, as payment processes and credit checks will have been established and completed. Distributors may require periodic (typically annual) credit checks on dormant accounts.

TRANSITION VEHICLES TO ALTERNATIVE FUELS

To reduce dependence on diesel fuels, facilities that maintain a fleet of vehicles may consider transitioning fleets to alternative fuels. A vehicle fleet that runs on compressed natural gas (CNG) or propane would not be vulnerable to a shortage of gasoline and diesel. However, these alternative fuels may have their own vulnerabilities during emergencies, particularly if CNG or propane compression relies on electric power. Vehicles that use hydrogen, while not widely available today, may also be subject to fuel interruptions depending on how their fuel stations are powered. Furthermore, there are fewer CNG, propane, or hydrogen filling sites compared to diesel and gasoline filling stations. This means that it may be difficult to fill vehicles at alternate sites if the fleet’s primary filling site is disrupted.

ELECTRIC GENERATOR RESILIENCY STRATEGIES

Healthcare facility managers should consider several potential investments to harden electric generation equipment against potential threats and to reduce their reliance on liquid fuels. Exhibit 6 presents several of the technologies discussed in this section and discusses their ability to meet goals for utility cost and environmental impact reduction, as well as emergency response and load management improvements.

Technology	Potential Benefits			
	Utility Cost Reduction	Environmental Impact Reduction	Emergency Response Benefit	Load Management Benefit
Energy-Efficient Lighting	Using less electricity overall reduces electricity costs.	Lowers overall electricity use and associated air pollution and greenhouse gases.	Does not actively contribute to emergency response.	Lowers overall electric load, freeing available power supply for other uses, but does not respond dynamically to load conditions.
Energy-Efficient Building Controls	Using less electricity overall reduces electricity costs.	Lowers overall electricity use and associated air pollution and greenhouse gases.	Does not actively contribute to emergency response.	May be programmed to adjust building conditions in response to load conditions.
Combined Heat and Power (CHP)	Can reduce electricity costs if cost of operating CHP plant is less than cost of grid-supplied power and heat (provided by power, gas, or oil).	Reduces wasted electricity by cutting out transmission and distribution losses. May increase air pollutants and greenhouse gas emissions depending on configuration and regional generation sources.	May provide emergency response benefit if CHP system is configured to generate power during a grid-level outage.	May be able to increase or decrease onsite generation in response to load conditions depending on CHP configuration.
Microgrids	Microgrids coupled with local generation allow facilities to utilize utility grid or microgrid power depending on pricing.	May reduce environmental impacts if microgrid generation source is cleaner than regional grid alternative.	Generates power during utility grid-level outages.	Can isolate from utility grid in response to load conditions and generate local power.
Battery Systems	Batteries may be used to avoid drawing grid power during peak price periods.	May reduce environmental impacts if the battery system reduces the amount of power drawn from the grid and the battery charging source is greener than regional generation sources.	May provide power during a grid outage depending on the battery configuration.	Battery use and charging are typically arranged to respond to load conditions.
Solar Photovoltaic Systems	Onsite power generation reduces amount of power purchased from grid.	Air pollution free and greenhouse gas-free electricity generation.	May generate power during grid-level outages depending on configuration (requires battery system).	Does not lower overall electric load and does not respond dynamically to load conditions.

Key		
High potential for benefit	Some potential for benefit, depending on configuration	Minimal or no potential for benefit

Exhibit 6: Potential Benefits of Various Technologies

FLOOD-PROOF GENERATORS AND GENERATOR SITING

Healthcare facilities in flood-prone areas should consider the potential impact of flooding and storm surge on power systems, generators, fuel tanks, and supporting electrical infrastructure and consider elevating or otherwise floodproofing key elements. Although generators are usually elevated in flood-prone regions, fuel storage tanks, fuel vents, and fuel pumps may still be vulnerable.^{xlii}

During Hurricane Sandy, backup power systems at several major New York City hospitals failed because support equipment such as fuel pumps and transfer switches were located on lower levels that flooded in the storm surge.^{xliii} At New York University's Langone Medical Center, the underground vault holding generator fuel tanks flooded due to storm surge, automatically shutting off the fuel pumps.^{xliv} At Bellevue Hospital, fuel pumps flooded and failed despite heavy submarine doors intended to prevent flooding, and staff spent half a day carrying fuel containers upstairs to power a generator on the 13th floor of the hospital.^{xlv,xlvi}

Resource Toolkit:

[Primary Protection: Enhancing Health Care Resilience for a Changing Climate](#)

The U.S. Department of Health and Human Services (HHS) publication [Primary Protection: Enhancing Health Care Resilience for a Changing Climate](#) (December 2014)^{xlvii} is a valuable resource for facilities assessing their resilience to a variety of extreme weather risks. Case studies highlight preparedness, response, and recovery efforts undertaken by hospitals nationwide. The document also includes recommendations and best practices to increase the resilience of both current and future healthcare infrastructure.

With respect to flood-proofing power systems, HHS states that even in cases in which floodproofing is not mandated, it is often best practice. HHS also states that infrastructure supporting generators should be included in this planning: "For example, many hospital generators in coastal areas are elevated. However, fuel storage tanks, fuel vents, and fuel pumps may be vulnerable if they remain below flood elevations. In addition, power, emergency power, and water are all necessary to support a shelter-in-place situation, and investments in infrastructure resilience are needed to minimize future evacuation risk."^{xlviii}

CONVERT BACKUP GENERATORS AND VEHICLES TO RESILIENT FUELS

Although backup generators are typically designed to run on diesel fuel, some generators do use fuels that have supply chains that are less vulnerable to power outages. This is particularly true for natural gas generators. Natural gas transmission and distribution systems in Pennsylvania—which primarily consist of underground pipelines and compressors that run on pipeline gas—typically are not affected by weather events and are less likely to be impacted by power outages. Natural gas systems have a high degree of reliability, especially in urban areas, although they can still experience interruptions from curtailment programs and earthquakes. (Curtailment occurs when utilities interrupt natural gas service to customers due to supply shortages.)

In addition to natural gas generators, natural gas fuel cells can provide another mechanism for power. Natural gas-based fuel cells convert natural gas to hydrogen to produce electricity via chemical reaction, producing only water and heat as byproducts.^{xlix,l} Facilities can reduce their carbon emissions by supplying the natural gas system with biogas or renewable natural gas (RNG).

Backup generation at healthcare facilities can also be complemented by the use of battery systems or solar battery systems. Battery and solar battery systems have become more economical and can serve as a standalone system or as part of a microgrid (discussed further below). These systems can be arranged many ways and can serve as a complementary system on their own, or a more robust solution that functions in coordination with fossil backup generation sources or onsite solar photovoltaics (PV).

COMBINED HEAT AND POWER

Natural gas-driven combined heat and power (CHP) projects are increasingly popular for critical facilities, as they produce both electricity and heat at high efficiencies. CHP, or "cogeneration," projects use natural gas engines or microturbines to generate electricity. The exhaust waste heat from these systems is captured and used to generate additional electricity or hot water/steam for use in the facility. CHP systems are particularly effective in facilities that operate continuously, and healthcare facilities are an especially good fit for CHP due to their high and level electricity loads and their hot water demand for laundry and other uses.

PA Case Studies: Combined Heat and Power (CHP) Systems

Traditionally, healthcare facilities receive electricity from the grid and produce hot water via an onsite boiler. Combined heat and power (CHP) systems, also called cogeneration systems, instead generate electricity onsite and use the resulting waste heat for heating and cooling.

CHP systems use a variety of fuels for electricity generation, including renewable energy sources. Capturing and using waste heat means that CHP systems are more efficient than conventional systems, which reduces emissions and can reduce energy costs. And because CHP systems are located onsite, they can increase a facility's resilience during grid outages. There are 93 CHP installations in Pennsylvania, including at least 15 hospital and 4 nursing home installations.

Resources: The U.S. Environmental Protection Agency's (EPA) provides resources for organizations interested in implementing CHP, including detailed information about CHP in hospitals. The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy also maintains a hub with information and resources related to CHP. The website includes links to fact sheets on common CHP technologies (fuel cells, gas turbines, microturbines, reciprocating engines, steam turbines, and absorption chillers) and a map of all CHP systems in the country. DOE's website also links to a database of successful CHP installations.

Penn State Health Milton S. Hershey Medical Center, Hershey, PA, installed a 7.5 MW natural gas-fired CHP plant in 2018. The system generates 54% of the hospital campus power usage and 96% of its steam usage. In addition to significantly decreasing the campus's carbon emissions, the system also has black start capabilities that support hospital islanding operation and allow the facility to maintain power during grid outages. The project received \$1.44 million in incentives through the PA Department of Community and Economic Development and PPL, the local utility.

Allegheny Health Network Wexford Hospital, Wexford, PA, will include a 2 MW natural gas-fired CHP system to meet all of the facility's electricity, heat, chilled water, hot water, and steam needs. Early in the process, AHN's leaders determined that it was in their best interest to evaluate a variety of system types based on their experience operating older existing facilities. Leadership was interested in evaluating Combined Heat and Power (CHP) to improve reliability and create redundant systems. AHN's facilities are 24/7 operations and tend to be energy intensive requiring power, hot water, and chiller water at their facilities. A CHP system was evaluated by the group's energy, operations, engineering and construction team and the decision was made to move forward. CHP provides several benefits for AHN. During normal operations, the CHP system provides a utility cost and greenhouse gas reduction and during a grid interruption event, it can provide power, heat and chilled water for the hospital. The CHP system provides resiliency beyond specific life safety. Wexford Hospital is scheduled to open in summer 2021. The CHP project received a \$1.8 million grant from the PA Department of Community and Economic Development through the Alternative and Clean Energy (ACE) program.

MICROGRIDS

Microgrids are relatively small, independently controlled power systems that can be operated in concert with, or apart from, the local distribution and transmission system. Microgrids can run on renewables, diesel, or natural gas-fueled generators (including CHP systems), or emerging fuel sources. Power generation can be onsite or offsite and can help to lower carbon emissions by using cleaner electricity sources. They can serve as a platform for multiple facilities and electricity generation sources to operate in a connected and coordinated way that is capable of functioning independent of the larger electricity grid for periods of time. Entities pursue microgrids to improve the resiliency of critical buildings and facilities and to integrate distributed energy resources, such as solar PV systems, combined heat and power systems, and battery systems together. Increasingly, microgrid systems save customers money by minimizing their energy costs.

Resource Toolkit: Microgrids

A number of online resources provide information on microgrid use at healthcare facilities.

The Bloom Energy report [Microgrids for Hospitals and Healthcare](#) describes how microgrids can be configured to fulfill different purposes.^{li} For example, a microgrid made of a diesel generator and a controller creates a source of backup power that can be islanded from the grid, whereas microgrids that are designed to increase a facility's sustainability may be more complex and contain technology to adjust the microgrid's output in response to weather, electricity prices, and grid voltage fluctuations. The document also discusses different business models for microgrid installation and provides examples of microgrid use at hospitals nationwide.

*A report prepared for the DEP, **CHP-Enabled Renewable Energy Microgrids in Pennsylvania: A Guidance Document for Conceiving Feasible Systems**, is available at the [Penn State at the Navy Yard's website](#).^{lii} The document discusses "hybrid" fossil fuel and renewable energy CHP systems in which natural gas-fueled electric and thermal generation is combined with renewable energy resources such as solar panels or battery storage systems. The document addresses the benefits of microgrids at the building, campus, and municipal scale, as well as potential business models, economics, and financing.*

[A Novel, Renewable Energy Microgrid for a California Healthcare Facility](#), published by the California Energy Commission (CEC), provides a detailed case study of the first renewable energy microgrid for a California hospital at the Kaiser Permanente Hospital in Richmond, CA.^{liii} As of April 2019, the installation had reduced at least 140 kW of the facility's energy demand (20–25% of peak load), with plans underway to add additional components that would reduce the original peak demand by 75%. The installation reduced gross facility utility costs by 15% through solar generation and energy management (including time-shifting of use and demand reduction). The project was funded by a \$4.78 million grant from the CEC. The report provides lessons learned, as well as detailed information about the project specifications, design process, installation, components, and results.

SOLAR GENERATION

It is a common misconception that grid-connected solar panels alone can improve a facility's resilience to power disruptions. Solar panels cannot operate during a grid-level power outage unless they are designed to "island," or operate independently from the grid.

However, solar arrays can improve the sustainability of a facility by generating clean, carbon-free power. Solar panels integrated into a microgrid (capable of islanding) generate clean power *and* increase the facility's resilience to grid-level power disruptions.

Case Studies: Solar in Pennsylvania Healthcare Facilities

The [Geisinger Medical Center's Janet Weis Children's Hospital](#) in Danville installed 144 rooftop solar panels in 2014. The facility used a \$100,000 grant from the West Penn Power Sustainable Energy Fund to help finance the project.^{[liv](#)}

Susquehanna Valley Medical Specialties (Columbia County), Bangor Medical Center (Northampton County), and Intermountain Medical Group (Luzerne County) are also examples of medical facilities that receive power from solar arrays.

ENERGY DEMAND MANAGEMENT STRATEGIES

ENERGY MANAGEMENT TECHNIQUES

While some type of backup generation source will always be needed, there are a variety of energy management programs and techniques that can help healthcare facilities reduce their load requirements to use their systems and equipment as effectively as possible. Strong energy management programs also support an organization's Environmental, Social, and Governance (ESG) criteria, sustainability goals, and climate action plans by lowering greenhouse gas emissions and enhancing resiliency.

Hospitals and other medical facilities are among the most energy-intensive facilities in operation. Strong energy management programs allow healthcare facilities to better manage costs and drive down the load and need for generation sources. Energy efficiency can be one of the most cost-effective solutions available for facility managers and should be aggressively pursued to support energy resiliency.

There are a variety of investments that facility managers should pursue, but lighting and building controls provide a number of benefits. Investments in lighting retrofits and conversions to LED lighting can pay for themselves in short periods of time. Building controls can also serve as a cost-effective energy efficiency investment and give flexibility in the operations of facilities. Building HVAC and lighting controls allow facility managers to prioritize energy systems and triage which locations have the largest need for energy services.

Energy-efficient facilities support energy resiliency in several ways. First and foremost, facilities that use energy more efficiently allow backup sources to last longer, conserving the amounts of fuel needed and increasing resiliency. Further, efficient buildings can hold and maintain thermal temperatures for longer periods of time, allowing facilities the potential to stay comfortable without power or fuel.

Healthcare facilities can participate in utilities' load and energy management programs to generate savings and reduce strain on the local or regional grid. Load management programs vary, but in their most basic form, facility managers shed electricity load (via changes to controls or by generating onsite electricity) at peak times with the goal of reducing capacity and distribution costs. Sophisticated energy management programs manage and monitor demand to ensure costs associated with demand remain low. Large energy users can employ the services of a curtailment service provider (CSP) to support their participation in load management programs. In Pennsylvania, through [a qualified CSP](#), large energy users can participate in the PJM emergency load response program to generate revenue (PJM is the regional transmission organization that coordinates the movement of wholesale electricity). Costs savings and revenue opportunities from load management programs can be in the millions annually for large energy users. Professional curtailment service providers are typically engaged to ensure that program benefits are maximized. In addition to voluntary load management activities and PJM's load management programs, many utilities offer similar load management programs that provide compensation for facilities able to either shed load or run their generators in times of peak demand.

ENERGY EFFICIENCY RESOURCES

Nonprofit organizations and government agencies provide many informational resources for healthcare facilities looking to make energy efficiency improvements. Below are brief descriptions of several programs from federal and Commonwealth agencies and organizations within the healthcare industry. Most, although not all, of the resources are free to access.

RESOURCES FOR ENERGY EFFICIENCY IMPROVEMENTS

Resource Name	Associated Organizations	Description
ENERGY STAR	Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE)	<p>ENERGY STAR provides resources for facilities to manage their energy use and increase their facilities' energy efficiency.^{lx} Eligible healthcare facilities^{lxi} can also use the ENERGY STAR Portfolio Manager^{lxii} tool to calculate a rating for their building's energy performance and, if the score is high enough, receive ENERGY STAR certification.</p> <p>Additional resources include a datasheet on energy usage in hospitals^{lxiii} and a Treasure Map,^{lxiv} which is a checklist that can help identify opportunities for energy efficiency improvements in lighting, the building envelope, HVAC systems, etc.</p>
Better Buildings	DOE	<p>Better Buildings^{lxv} partners with commercial, public, industrial, and residential organizations to share case studies and tools to increase energy efficiency. For the healthcare sector, Better Buildings offers a variety of showcase projects in which healthcare facilities implemented energy efficiency projects, as well as presentations, toolkits, and other materials to help facilities implement similar projects.^{lxvi}</p> <p>For example, the University of Pittsburgh Medical Center (UPMC) is profiled on the Better Buildings website in its role as a Better Buildings Challenge Partner.^{lxvii} The case study includes information about UPMC's energy use, energy savings goals, specific actions taken to reduce energy use, and cost savings estimates. The case study also includes information on how UPMC has financed its energy efficiency projects.^{lxviii}</p> <p>In addition to its case studies and other tools, Better Buildings also offers webinars on aspects of energy efficiency implementation and has a library of past webinars available on demand.^{lxix}</p>
Practice Greenhealth	None	<p>Practice Greenhealth is a membership organization for healthcare providers that provides information, tools, data, and technical support on sustainability initiatives.^{lxx} Although membership is required to access most services, some materials are available for free on Practice Greenhealth's website.</p>
Energy to Care	American Hospital Association (AHA)	<p>The Energy to Care program helps facility managers track, manage, and communicate energy savings.^{lxxi} The Energy to Care Dashboard Tool allows facility managers to upload data related to their facility to easily monitor the facility's energy use and calculate energy savings.^{lxxii} The Dashboard Tool is designed to complement the Energy Star Portfolio Manager.</p> <p>The American Society for Health Care Engineering (ASHE) also hosts Energy to Care Treasure Hunts, which bring together healthcare professionals to identify and learn to implement energy savings opportunities.^{lxxiii} The website also profiles educational tools such as on-demand webinars that may be useful to facility managers.^{lxxiv}</p>
Sustainability Roadmap for Hospitals	The American Society for Health Care Engineering, the Association for the Health Care Environment, and the Association for Healthcare Resource & Materials Management of the American Hospital Association	<p>The Sustainability Roadmap website provides free tools and resources to help healthcare facilities integrate sustainable practices.^{lxxv}</p> <p>The website's resource library provides links to databases, tools, programs, and publications, such as links to The Climate Registry, a database of state incentives for renewables and efficiency, publications on retrofitting existing facilities, and references on sustainable design and construction.^{lxxvi} The website's Strategies^{lxxvii} and Implementation^{lxxviii} sections also provide information on topics such as financial strategies to fund sustainability improvements, energy management planning, and performance improvement metrics.</p>
Resources for Hospital Campuses	Pennsylvania Department of Environmental Protection (PA DEP)	<p>This resource for healthcare and other campuses provides information on energy savings, with an emphasis on reviewing the campus building envelope and building an "energy team" to assist with communication and implementation. The website provides information on lighting improvements;^{lxxix} building envelop tightening, including checking for water leaks and examining wall insulation;^{lxxx} and cleaner transportation fuels;^{lxxxi} among other energy opportunities.^{lxxxii}</p>

IMPLEMENTING LONG-TERM RESILIENCY STRATEGIES

PLANNING CONSIDERATIONS

Long-term planning processes are established to meet a variety of organizational needs. As hospitals review capital and strategic investments, there are opportunities to consider undertaking investments to enhance energy resiliency during emergencies. A like-for-like generator or boiler replacement may be simple; however, healthcare facility owners may want to consider if they can meet broader goals through their energy system investment. Some of the options available provide more services or benefits than traditional backup equipment. The table below outlines a sampling of considerations that can be taken while planning:

Planning Considerations	
Lifecycle Costs	When investing in new generation equipment, lifecycle costs should be considered. Lifecycle costs consider not only the initial investment cost but also the ongoing fuel costs, Operation & Maintenance (O&M) costs, and the equipment life and durability.
Utility Cost Savings and Revenue Possibilities	If permitted, a facility's backup generators can participate in grid operator and utility electricity load management and demand response programs that can generate savings and revenue for the facility. In addition, microgrid, battery systems, and onsite solar photovoltaics can provide a myriad of financial benefits that may influence the economics of long-term resiliency planning.
Space Requirements	Some backup generation equipment and fuel storage require a significant space footprint. Understanding space availability is crucial for proper planning. Facilities can also pursue multiple substation connections for redundancy.
Emissions Controls, Air Quality Permitting, and Noise	Diesel backup generators require air permits in many jurisdictions to ensure that their emissions controls and noise profiles match their planned operations. Facility managers should evaluate how the equipment is intended to function to ensure that proper permits are obtained.
Environmental, Social, and Corporate Governance and Climate Action Plans	Diesel backup generators require air permits in many jurisdictions to ensure that their emissions controls and noise profiles match their planned operations. Facility managers should evaluate how the equipment is intended to function to ensure that proper permits are obtained.

FINANCING FOR ENERGY IMPROVEMENTS

There are many funding opportunities for projects that work toward sustainability goals. Per the PA PUC, Pennsylvania has four sustainable energy funds that were created as a result of five electric companies' restructuring.^{[lxviii](#)} The following table provides information on these funds and other financing programs for which healthcare sector facilities are eligible.

RESOURCES FOR FINANCING ENERGY IMPROVEMENTS

Resource Name	Associated Organizations	Description
Pennsylvania Energy Development Authority (PEDA)	PEDA	<p>PEDA is an independent public financing authority that funds clean, advanced energy projects in the Commonwealth.^{lxxix} DEP states that "Pennsylvania projects that could potentially qualify for funding from the Authority include solar energy, wind, low-impact hydropower, geothermal, biomass, landfill gas, fuel cells, integrated gasification combined cycle, waste coal, coal-mine methane, and demand management measures." Funding is available via grants, loans, and loan guarantees.</p> <p>PEDA has funded at least two projects in the healthcare sector in recent years: 1) The Aria Health System in Philadelphia County installed a new 1.1 MW combined heat and power system on its Torresdale Campus, and 2) the Robert Packer Hospital in Bradford County saved nearly \$400,000 annually through demand-side efficiency improvements.^{lxxx}</p>
Pennsylvania Green Energy Loan Fund (GELF)	Reinvestment Fund; PA DEP; DOE	<p>GELF finances projects that result in at least a 25% reduction in energy consumption.^{lxxxi} It supports these projects through low-interest loans in amounts generally between \$100,000 and \$2.5 million.^{lxxxii} The project is managed by Reinvestment Fund and supported by DEP and DOE.</p> <p>GELF funding was used to finance energy conservation measures during the construction of the Punxsutawney Health Center.^{lxxxiii} The conservation measures included roof and exterior wall insulation, energy-efficient doors and windows, HVAC and lighting systems and control, a white roof, and water-saving plumbing fixtures.</p>
Building Resilient Infrastructure and Communities (BRIC)	Federal Emergency Management Agency (FEMA)	<p>FEMA's BRIC program^{lxxxiv} supports projects seeking to reduce or eliminate risk and damage from future natural hazards.^{lxxxv}</p> <p>Applicants at the state and territory level determine mitigation priorities, and FEMA states that "Entities interested in creating BRIC subapplications may contact town/city/county managers, planning, and/or emergency management offices within local governments, including cities, townships, counties, special district governments, and tribal governments."^{lxxxvi}</p> <p>Beginning in 2020, BRIC replaces the Pre-Disaster Mitigation Grants formerly supported by FEMA. FEMA profiles several energy-related projects that have previously received mitigation funding, including a microgrid installation providing low-carbon backup power to the Blue Lake Rancheria Reservation; storm mitigation measures at LaGuardia Airport, including installing larger and more efficient backup generators; rebuilding a Joplin, MO, hospital to include a hardened central utility plant and backup generators; and strengthening electrical infrastructure in Kansas and Nebraska against winter storms and ice.^{lxxxvii}</p>
Commercial Property Accessed Clean Energy (C-PACE)		<p>C-PACE is a financial tool for property owners to obtain low-cost, long-term financing for energy-efficient equipment, renewable energy, and water conservation projects. It was enabled in the State of Pennsylvania in 2019 and the program has since been adopted by many counties throughout the state. C-PACE lending can provide financing for project costs by placing a special voluntary assessment on the property that repays the costs of the upgrades, including equipment, labor, and soft costs.</p> <p>C-PACE lending programs are still relatively new in Pennsylvania; however, C-PACE lending has already been used by several organizations to install solar panels and energy efficiency in several Philadelphia commercial buildings. Organizations can learn about C-PACE lending and availability in their county at https://pennsylvaniaacpace.org.</p>
Alternative and Clean Energy (ACE) Program	PA Department of Community and Economic Development (DCED) and PA DEP	<p>The ACE Program provides grants, loans, and guarantees to businesses, economic development organizations, and political subdivisions (municipalities, counties, and school districts) for alternative or clean energy projects.^{lxxxviii} Not-for-profit entities are considered businesses and are eligible for this program.^{lxxxix} The Allegheny Health Network's Wexford Hospital CHP project received funding from the ACE Program.</p>
Pennsylvania Sustainable Energy Finance Program (PennSEF)	Foundation for Renewable Energy and Environment (FREE); PA Treasury Department; West Penn Power Sustainable Energy Fund	<p>PennSEF was established by FREE in partnership with the PA Treasury Department and with support from the West Penn Power Sustainable Energy Fund.^{xc} PennSEF provides "technical and legal assistance, as well as low-cost capital, for energy improvement projects by municipalities, universities, schools and hospitals."^{xcii} Participating hospitals receive free energy audits and receive bonds to finance improvements that are projected to pay for themselves through cost savings. Eligible projects include electrical and lighting upgrades, renewable energy, HVAC improvements, building envelope upgrades, and water conservation measures.^{xcii} PennSEF specifically seeks projects involving at least \$2 million in capital cost for retrofits, although the program also funds a limited number of smaller projects of around \$500,000.^{xciii}</p>

Sustainable Energy Fund (SEF)	None	<p>SEF offers several financing options, including social impact loans, stipulated energy savings agreements for commercial entities, and investments by SEF in sustainable companies.^{xciv} SEF also provides commercial loans for projects that reduce energy consumption or replace fossil fuel generation with cleaner energy sources.^{xcv}</p> <p>Recent projects in the healthcare sector include evaluating the energy use of the Pleasant Valley Manor nursing home in Stroudsburg, PA, and recommending energy efficiency upgrades.^{xcvi} SEF also entered into a Nonprofit Energy Savings Agreement with Pleasant Valley Manor and partner organization Reynolds Energy to perform the recommended upgrades. In addition to electricity savings, the upgrades are also estimated to save over 6,000 gallons of fuel oil annually.</p> <p>SEF also recently gave \$70,000 in financing to the Jewish Home of Greater Harrisburg, a senior living community, to replace T8 and metal halide lights with LEDs.^{xcvii}</p>
West Penn Power Sustainable Energy Fund (WPPSEF)	West Penn Power	<p>WPPSEF finances programs benefitting West Penn ratepayers^{xcviii} that focus on renewable energy and clean power production, energy efficiency and conservation, and public outreach and education.^{xcix} WPPSEF offers conventional financing in the form of loans typically ranging from \$25,000 to \$1 million. WPPSEF also offers ACT 129 Energy Micro Loans of \$10,000 to \$50,000 to commercial, industrial, and institutional entities, and some limited grantmaking through a request-for-proposal process.^c</p> <p>Previously, WPPSEF has funded energy audits for several Excelsa Health hospitals,^{ci} provided funding for a 38-kV solar photovoltaic system on the Janet Weis Children's Hospital in Danville, PA,^{cii} and worked with the Elk Regional Health Center to expand its biomass heating system for the Pinecrest Manor long-term care facility.^{ciii}</p>
Metropolitan Edison Company (Met-Ed)/ Pennsylvania Electric Company (Penelec) Sustainable Energy Fund	Met-Ed/Penelec	<p>The Met-Ed/Penelec Sustainable Energy Fund provides grants, loans, and equity investments to projects that promote renewable energy, energy efficiency and conservation, sustainability, and the environment.^{civ} Projects receiving funding must be located within the Met-Ed and Penelec service territories.^{cv}</p> <p>Boyertown Lions Ambulance and Blacklick Valley Foundation & Ambulance were awarded grants in 2015 to perform energy audits.^{cvi}</p>
Sustainable Development Fund (SDF)	None	<p>SDF finances for-profit companies, nonprofits, and local government entities for a variety of projects that address energy conservation, energy-efficient equipment, demand-response solutions and electric storage, and clean energy generation.^{cvi} Financing mechanisms include commercial debt, subordinated debt, lease financing, and energy performance contract financing. SDF does not provide grants or equity investments.</p>
Other utility programs	Multiple Pennsylvania utilities	<p>Pennsylvania utilities also offer energy efficiency programs. PA PUC is in charge of implementing Act 129 of 2008, which directed the Commonwealth's seven largest electric distribution companies to provide energy efficiency and conservation programs. More information about these programs is available via the PA PUC^{cvi} or utilities' websites.</p>

Resource Toolkit: Database of State Incentives for Renewables & Efficiency®

The [Database of State Incentives for Renewables & Efficiency® \(DSIRE\)](#) maintains a comprehensive list of financial incentives for renewable energy available by state.^{cix} As of 2020, there are 80 programs available within Pennsylvania. The federal, state, and commercial incentives on the list include loans, grants, rebates, and tax credits for a variety of renewable energy and energy efficiency activities. DSIRE is funded by DOE and is operated at North Carolina State University.

APPENDIX

APPENDIX A. WORKSHEET FOR TEMPLATE

The Template, a Microsoft Excel® spreadsheet, is designed to store fuel-related information on healthcare facilities' buildings and vehicles. This information should be stored in a location that is accessible and known by all parties that may have a role during a fuel-related emergency. It may be useful to print a copy of the completed Template so that it can be referenced if computer systems are offline.

Facilities may opt to use the Template as is, incorporate the information into other emergency planning workbooks, or use the following simplified worksheet to guide data collection. The worksheet in this appendix includes additional explanation and instruction beyond what is provided in the Template.

No matter which way a facility chooses to store the information, having it on hand can help a facility respond quicker to an emergency and request assistance more accurately.

Name of person filling out form: _____

Contact information: _____ Date: _____

BUILDING WORKSHEET

Fill out one sheet for each building in the healthcare facility.

Building Name: _____

Address: _____ Primary building uses: _____

POINT OF CONTACT FOR BUILDING

Name: _____ Title: _____

Phone: _____ Email: _____

Description of facility energy needs (Egress lighting, temperature control, medical equipment, ventilation, transportation, food refrigeration and preparation, water supply, sanitization, security systems, fire alarms, electronic health records, access to medication, etc.)

Does this building have a backup generator? ☐ Yes, one ☐ Yes, multiple ☐ No

If yes, answer the following questions for each generator:

GENERATORS AND GENERATOR FUEL

Description of patient care and critical services supported by the generator:

What fuel does it use? ☐ Diesel ☐ Other: _____

How does it power on? ☐ Automatically ☐ Manually

Generator capacity: _____ kW

Identifying generator capacity: Your generator will likely have two capacities listed in its specifications: a maximum and the rated wattage. The maximum represents the largest amount of electricity a generator can produce. In practice, however, generators cannot be run at full capacity for extended periods of time. For a more realistic estimate for power generation, record the rated power, which is the amount of power that the generator can produce for long periods of time.

Est. burn rate (full load): _____ gallons per hour

Estimating burn rate: The U.S. Department of Health and Human Services ASPR Technical Resources, Assistance Center, and Information Exchange (TRACIE) has compiled [a list of resources](#) to help with burn rate estimation. These tools vary in complexity but generally take inputs on the generator capacity and load under which the generator is operating to estimate burn rate. Generators burn more fuel per hour under higher loads. A simple table for estimating the burn rate by capacity for diesel generators is available [here](#).

Emergency demand for fuel: _____ gallons per day

Estimating emergency demand for generator fuel: To estimate the daily demand, simply multiply the burn rate by 24 hours to estimate emergency demand under constant load. For a more granular approach accounting for varying loads, use the [ASPR resources](#) to estimate the volume of fuels used in 24 hours under multiple load conditions.

Total fuel storage capacity: _____ gallons

Average fuel storage volume: _____ gallons

Total fuel storage capacity vs. average fuel storage volume: Storage tanks are not typically filled to their maximum capacity on a given day under normal operations. Estimate the average volume in the storage tank on a normal day, as distinguished from the total fuel storage capacity of the tank. A simple estimation for facilities that lack storage volume data is to estimate the available storage as halfway between the threshold the facility has negotiated with the distributor for when the storage tank should be refilled and the volume immediately after a fuel delivery (typically full).

If applicable: **Frequency of fuel delivery:** _____ days between deliveries

Estimated fuel reserve duration: _____ hours

Estimating fuel reserve duration: Divide average available storage capacity by the emergency demand. Then multiply by 24 to find duration in hours.

Estimated generator run time: _____ hours

Estimated generator run time: Divide the average available inventory of stored fuel by the estimated burn rate.

Does this building use other fuel not associated with generators? ☐ Yes ☐ No

If yes:

NON-GENERATOR FUELS

Fuel type: _____

Emergency demand for non-generator fuel: _____ gallons per day

Estimate emergency demand for non-generator fuel: Review recent fuel bills to understand peak demand. If the facility has a submeter monitoring real-time fuel use, this data may also be helpful.

Total fuel storage capacity: _____ gallons

Average fuel storage volume: _____ gallons

Total fuel storage capacity vs. average fuel storage volume: Storage tanks are not typically filled to their maximum capacity on a given day under normal operations. Estimate the average volume in the storage tank on a normal day, as distinguished from the total fuel storage capacity of the tank. A simple estimation for facilities that lack storage volume data is to estimate the available storage as halfway between the threshold the facility has negotiated with the distributor for when the storage tank should be refilled and the volume immediately after a fuel delivery (typically full).

Frequency of fuel delivery: _____ days between deliveries

Estimated fuel reserve duration: _____ hours

Estimating fuel reserve duration: Divide average available storage capacity by the emergency demand. Then multiply by 24 to find duration in hours.

FUEL DISTRIBUTOR FOR FACILITY

Primary Distributor Name: _____

Account number: _____

CONTACT INFORMATION

Name: _____ Phone: _____

Email: _____

Fuel(s) supplied: ☐ Diesel ☐ Heating oil ☐ Other: _____

Notes on contract (Emergency fuel delivery contract established, credit limit, etc.)

Secondary Distributor Name: _____

Account number: _____

CONTACT INFORMATION

Name: _____ Phone: _____

Email: _____

Fuel(s) supplied: ☐ Diesel ☐ Heating oil ☐ Other: _____

Notes on contract (Emergency fuel delivery contract established, credit limit, etc.)

Name of person filling out form: _____

Contact information: _____ Date: _____

VEHICLE WORKSHEET

Fill out one sheet for each type of vehicle owned by the healthcare facility.

Company: _____

Vehicle type: _____ Vehicle count: _____

POINT OF CONTACT FOR VEHICLES:

Name: _____ Title: _____

Phone: _____ Email: _____

VEHICLES AND VEHICLE FUEL USE

What fuel does the vehicle type use? ☐ Gasoline ☐ Diesel ☐ Other: _____

Emergency demand for vehicle fuel: _____ gallons per day

Estimating emergency demand for vehicle fuel: This value should represent the total amount of fuel used by all vehicles of this type. Facilities can estimate this by:

1. Estimating on average how many miles the vehicles travel daily and then convert to a gallon equivalent using average fuel economy.
2. Alternately, consider how frequently the vehicles refuel (weekly, for example) and then divide the tank size by the number of days. Multiply the final number by the number of vehicles.

Total fuel storage capacity: _____ gallons

Average fuel storage volume: _____ gallons

Total fuel storage capacity vs. average fuel storage volume: These fields are intended to estimate onsite fuel storage used for storing vehicle fuel, as well as fuel stored within vehicles. In most cases, total fuel storage capacity is the fuel tank capacity for the vehicle type, multiplied by the number of vehicles. In contrast, the average fuel storage volume is the amount of fuel actually available for use on a given day. This number will necessarily be a rough estimate. If all vehicles are refueled at the end of the day, this number might be close to the total fuel storage capacity. However, if vehicles are used less frequently, tanks may typically be about half full.

Estimated fuel reserve duration: _____ hours

Estimating fuel reserve duration: Divide average available storage capacity by the emergency demand. Then multiply by 24 to find duration in hours.

Percentage of vehicle fuel needs met by offsite filling locations/retail stations: _____ %

If onsite fueling occurs: Frequency of delivery: _____ days between deliveries

FUEL DISTRIBUTOR FOR VEHICLES

Primary Distributor Name: _____

Account number: _____

CONTACT INFORMATION

Name: _____ Phone: _____

Email: _____

Fuel(s) supplied: ☐ Gasoline ☐ Diesel ☐ Other: _____

Notes on contract (Emergency fuel delivery contract established, credit limit, etc.)

Secondary Distributor Name: _____

Account number: _____

CONTACT INFORMATION

Name: _____ Phone: _____

Email: _____

Fuel(s) supplied: ☐ Gasoline ☐ Diesel ☐ Other: _____

Notes on contract (Emergency fuel delivery contract established, credit limit, etc.)

APPENDIX B. RESOURCES

Organization	Title	Description	Link
PA Department of Environmental Protection	Liquid Fuels Shortage Planning Guidebook for Pennsylvania Local Governments	This document is referenced in this Guidebook and provides more details of liquid fuel supply chain in Pennsylvania.	http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/EnergyAssurance/20-PADEP-EAEP_Guide_digital_FINAL_02_03_20.pdf
PA Department of Environmental Protection	Energy Assurance and Resiliency	This website provides additional resources on energy assurance planning	https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/Energy-Assurance.aspx
PA Emergency Management Agency	PA Emergency Operations Plan	The Commonwealth's Emergency Operations Plan	https://www.pema.pa.gov/Preparedness/Planning/Documents/Commonwealth-Emergency-Operations-Plan-2019.pdf
U.S. Federal Emergency Management Agency and U.S. Department of Health and Human Services	Healthcare Facilities and Power Outages: Guidance for State, Local, Tribal, Territorial, and Private Sector Partners	Contains generator descriptions, definitions, and vulnerabilities; Description of emergency power needs in facilities; Steps to assess emergency power needs; Overview of the current emergency preparedness regulations on hospitals; Table with info on fuel requirements by facility type	www.fema.gov/sites/default/files/2020-07/healthcare-facilities-and-power-outages.pdf
U.S. Department of Health and Human Services	Planning for Power Outages: A Guide for Hospitals and Healthcare Facilities	Useful checklist for healthcare facilities preparing for power outages	https://www.phe.gov/Preparedness/planning/cip/Documents/healthcare-energy.pdf
PA Department of Health	PA DOH Hospital Regulations	Pennsylvania regulations for healthcare facilities	https://www.health.pa.gov/topics/facilities/hospitals/Pages/Regulations.aspx
Powered for Patients	Emergency Power Reliability Considerations for Hospitals and Skilled Nursing Facilities Treating Coronavirus Patients	Useful template for generator parts and fuel consumption rates; Guidance for critical healthcare facilities whose emergency power system relies on a single generator; Detailed checklist on generator checks and emergency preparedness; Detailed checklist on generator operation during an event; a checklist for after an event	https://www.poweredforpatients.org/wp-content/uploads/2020/03/Emergency-Power-Guidance-with-Resilience-Checklists-for-Facilities-Treating-Coronavirus-Patients.pdf
Powered for Patients	Protecting Patients When Disaster Strikes: A Playbook for Safeguarding Emergency Power Systems for Rhode Island's Critical Healthcare Facilities During Extended Power Outages	Tips on engagement with fuel vendors and the importance of annual inspections on fuel stocks; Tips for increasing electricity resilience; Steps for facility managers to take to increase electricity resilience; Steps for fuel providers to follow.	https://www.poweredforpatients.org/wp-content/uploads/2017/09/Powered-for-Patients-Rhode-Island-Playbook-on-Emergency-Power-8.23.17.pdf

Powered for Patients	Powered for Patients Emergency Power System Vulnerability Survey for Rhode Island Long-Term Care Facilities, Dialysis Centers and Other Non-Hospital Healthcare Facilities	A survey designed to help Long-Term Care facilities, Dialysis Centers and other non-hospital medical facilities assess potential vulnerabilities with emergency power supply systems	https://www.poweredforpatients.org/wp-content/uploads/2017/09/Powered-for-Patients-Non-Hospital-Emergency-Power-Vulnerability-Assessment-Survey-8-23-17.pdf
Centers for Medicare and Medicaid Services	Medicare and Medicaid Programs; Emergency Preparedness Requirements for Medicare and Medicaid Participating Providers and Suppliers	CMS regulations for emergency planning	https://www.federalregister.gov/documents/2016/09/16/2016-21404/medicare-and-medicare-programs-emergency-preparedness-requirements-for-medicare-and-medicare
National Association of State Energy Officials	Guidance for States on Petroleum Shortage Response Planning	Information on fuel contracts	https://naseo.org/data/sites/1/documents/publications/Petro%20Shortage%20Planning%20Feb%202018.pdf
Texas A&M Health Science Center	Hospital and Healthcare Facilities Preparedness Project: Final Report	Example checklist for hospital generators	https://www.poweredforpatients.org/wp-content/uploads/2015/06/Texas-Dept-of-State-Health-Services-Hospital-and-Health-Care-Preparedness-Final-Report.pdf
Massachusetts Department of Public Health and Harvard School of Public Health	Essential Functions and Considerations for Hospital Recovery	Approach to planning that is focused around “triggers”; Graphic of stakeholders; Coordination with local officials	https://www.poweredforpatients.org/wp-content/uploads/2015/06/Harvard-School-of-Public-Health-Hospital-Preparedness-Report.pdf
U.S. Department of Health and Human Services	Primary Protection: Enhancing Health Care Resilience for a Changing Climate	Several case studies of interest; Discussion of long-term sustainability and resilience	https://www.poweredforpatients.org/wp-content/uploads/2015/06/HHS-2015-Primary-protection-enhancing-health-care-resilience-for-a-changing-climate.pdf
U.S. Environmental Protection Agency	CHP for Hospitals: Superior Energy for Superior Patient Care	Info on combined heat and power (CHP) as a method to reduce fuel usage and lower reliability on grid power	https://www.epa.gov/chp/chp-hospitals-superior-energy-superior-patient-care
Bloom Energy	Microgrids for Hospitals and Healthcare	Discussion of microgrid projects in hospitals	https://microgridknowledge.com/wp-content/uploads/2020/05/MGK-Report-Microgrids-Hospitals-Healthcare-v3.pdf
California Energy Commission	A Novel, Renewable Energy Microgrid for a California Healthcare Facility	Detailed case study of California’s first renewable energy microgrid at a hospital	https://ww2.energy.ca.gov/2019publications/CEC-500-2019-034/CEC-500-2019-034.pdf

American Society for Healthcare Engineering (ASHE) and the Heath research and Educational Trust (HRET)	Environmental Sustainability in Hospitals: The Value of Efficiency	Discussion of energy efficiency improvements in in hospitals and four case studies (none in Pennsylvania) of hospitals implementing energy efficiency projects	https://www.aha.org/system/files/hpoe/Reports-HPOE/ashe-sustainability-report-FINAL.pdf
InfraGard EMP Resource Center	Strengthening Healthcare and Public Health Resilience in Advance of a Prolonged and Widespread Power Outage	Best practices and recommendations for hospitals to protect against all hazards to power disruptions, with a focus on electromagnetic pulse (EMP) threats. Includes an example checklist for hospitals to review in advance of an event.	https://www.empcenter.org/wp-content/uploads/2017/09/CF_Resilient_Hospitals_Handbook_edits-cm_Version3b2.pdf
California Emergency Medical Services Authority	Incident Planning Guide: Utility Failure	Useful planning checklist for hospitals to prepare for a utility failure	https://ems.ca.gov/wp-content/uploads/sites/71/2017/07/Utility-Failure-IPG.pdf
Energy Star	Treasure Map for Hospitals	Checklist for hospitals considering energy efficiency improvements	https://www.energystar.gov/sites/default/files/tools/14336%20ES%20Treasure%20Hunt%20checklist%20HOSPITAL%20v05.pdf
U.S. Department of Health and Human Services	ASPR TRACIE Training and Technical Assistance	Links to fuel calculators for facilities	https://files.asprtracie.hhs.gov/documents/aspr-tracie-ta-generator-fuel-calculator.pdf
U.S. Department of Health and Human Services	Hospital (and Transplant Program) Requirements CMS Emergency Preparedness Final Rule	Explanation of CMS requirements for hospitals and transplant programs	https://files.asprtracie.hhs.gov/documents/aspr-tracie-cms-ep-rule-hospitals-transplant-ctr-requirements.pdf
U.S. Department of Health and Human Services	Critical Access Hospital Requirements CMS Emergency Preparedness Final Rule	Explanation of CMS requirements for critical access hospitals	https://files.asprtracie.hhs.gov/documents/aspr-tracie-cms-ep-rule-cah-requirements.pdf
The Pennsylvania State University	CHP-Enabled Renewable Energy Microgrids in Pennsylvania: A Guidance Document for Conceiving Feasible Systems	Discusses “hybrid” fossil fuel and renewable energy CHP and discusses benefits of microgrids, as well as potential business models and financing	https://navyyard.psu.edu/energy-research/distributed-energy-and-smart-grids

APPENDIX C. PEMA GENERATOR REQUEST QUESTIONNAIRE

Facility Name: _____

Physical Address: _____

Facility Phone #: _____

Contact Name: _____

Name of Electric Utility Company: _____

Has electric supplier been contacted? ☐ Yes ☐ No

Estimated Restoration Time? _____

What is the size of the incoming electric service (in amps)? _____

Has the facility had an assessment of power requirements? ☐ Yes ☐ No

If an assessment was done, what is the maximum generator size needed? _____

Does the facility have an existing standby/backup generator? ☐ Yes ☐ No

What is the size of the existing generator? _____

Is there an automatic or manual transfer switch? _____

Type of fuel supply for existing generator?

☐ Diesel Fuel ☐ Natural Gas ☐ Propane ☐ Gasoline ☐ Other: _____

Does the generator power the entire facility or only certain critical areas? _____

Is this request for a generator, to supplement the existing generator or because the existing generator has failed? _____

Cause of existing generator failure (if known)? _____

Repair service contacted? (name) _____

Estimated time for completion of repairs? _____

How will the generator be connected to the facility?

If plug connection, what is the type and size? _____

Will generator be hard-wired to the facility?* _____

**If it will be hard-wired, a facility-provided licensed electrician will be required to make the connection.*

Name: _____ Phone Number: _____

If a plug connection exists, does the facility have the connector(s) to hook to the generator wire? _____

What is the distance from where a tow-behind generator can be placed to where the facility connections are located? _____

Does the facility have access to diesel supplier to maintain fuel supply? ☐ Yes ☐ No

Name: _____ Phone Number: _____

Internal Distribution:

☐ PUC ☐ DEP ☐ ESF 6/8 ☐ Infra Branch ☐ DGS ☐ Other: _____

Generator Supplied? ☐ Yes ☐ No

Size: _____ Source: _____

PEMA Mission Assignment # _____

- i <https://www.health.pa.gov/topics/facilities/Pages/Facilities-Licensing.aspx>
- ii <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandCompliance/Hospitals>
- iii <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandCompliance/CAHs>
- iv <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/GuidanceforLawsAndRegulations/Nursing-Homes>
- v <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertEmergPrep/Downloads/EP-Rule-Table-Provider-Type.pdf>
- vi <https://www.cms.gov/>
- vii <https://www.nfpa.org/>
- viii <https://www.federalregister.gov/documents/2016/09/16/2016-21404/medicare-and-medicaid-programs-emergency-preparedness-requirements-for-medicare-and-medicaid>
- ix <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=99>
- x <https://www.nfpa.org/Assets/files/AboutTheCodes/99/TIA99-12-3.pdf>
- xi <https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=110>
- xii <https://www.federalregister.gov/documents/2016/09/16/2016-21404/medicare-and-medicaid-programs-emergency-preparedness-requirements-for-medicare-and-medicaid#p-1829>
- xiii <https://files.asprtracie.hhs.gov/documents/aspr-tracie-cms-ep-rule-cah-requirements.pdf>
- xiv <https://files.asprtracie.hhs.gov/documents/aspr-tracie-cms-ep-rule-hospitals-transplant-ctr-requirements.pdf>
- xv <https://www.health.pa.gov/topics/facilities/hospitals/Pages/Regulations.aspx>
- xvi <https://www.health.pa.gov/topics/facilities/hospitals/Pages/Regulations.aspx>
- xvii https://www.health.pa.gov/topics/Documents/Facilities%20and%20Licensing/028_0151.pdf
- xviii <http://www.pacodeandbulletin.gov/Display/pacode?file=/secure/pacode/data/028/chapter101/chap101toc.html&d=reduce#:~:text=%C2%A7%20101.42a.&text=A%20hospital%20shall%20meet%20the,enforced%20by%20the%20Federal%20government.>
- xix <https://www.phe.gov/Preparedness/planning/hpp/reports/Documents/2017-2022-healthcare-pr-capabilities.pdf>
- xx <https://www.pema.pa.gov/Preparedness/Planning/Documents/Commonwealth-Emergency-Operations-Plan-2019.pdf>
- xxi <https://www.pema.pa.gov/County-EMC/Pages/default.aspx>
- xxii <https://www.pema.pa.gov/Response/Documents/Mission%20Request/PEMA-Request-Form-Addendum-Generators.pdf>
- xxiii <https://www.health.pa.gov/topics/prep/Pages/HCC.aspx>
- xxiv <https://www.health.pa.gov/topics/facilities/Pages/Facilities-Licensing.aspx>
- xxv <https://www.health.pa.gov/topics/prep/Pages/Preparedness.aspx>
- xxvi <https://www.pema.pa.gov/Preparedness/Planning/Documents/Commonwealth-Emergency-Operations-Plan-2019.pdf>
- xxvii <https://www.pema.pa.gov/Preparedness/Planning/Documents/Commonwealth-Emergency-Operations-Plan-2019.pdf>
Page 18
- xxviii <https://www.puc.pa.gov/about-the-puc/>
- xxix <https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/difference>
- xxx <https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf>
- xxxi <https://www.eia.gov/todayinenergy/detail.php?id=7670>
- xxxii <https://www.eia.gov/todayinenergy/detail.php?id=7670>
- xxxiii <https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c33.pdf>
- xxxiv <https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c33.pdf>
- xxxv <https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c34.pdf>
- xxxvi <https://www.eia.gov/consumption/commercial/data/2012/c&e/cfm/e10.php>
- xxxvii <https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c33.pdf>
- xxxviii <https://www.eia.gov/consumption/commercial/data/2012/c&e/pdf/c34.pdf>
- xxxix https://www.fema.gov/media-library-data/1566392446802-cb3f4603ff821158811d3f55f370238e/Healthcare_Facilities_and_Power_Outages.pdf
page 5
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