



### 4.3.18 Utility Interruption

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A utility interruption could include power failure, potable water service outage, telecommunications infrastructure failure, natural gas infrastructure failure, or sewer infrastructure failure. For the purpose of this plan, utility interruption focuses on power failure, because it is the major cause of utility failure and has had widespread impacts on Chester County. A power failure is defined as any interruption or loss of electrical service from disruption of power transmission caused by accident, sabotage, natural hazards, or equipment failure. A significant power failure is defined as any incident of a long duration that would require the involvement of the local or state emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter. Interruptions in other basic utilities (such as data/telecommunications, water, natural gas, or sewer) can have a detrimental impact on Chester County. Utilities that employ aboveground wiring (power and data/telecommunications) are vulnerable to the effects of other hazards such as high wind, heavy snow, ice, rain, and vehicular accidents.

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the utility interruption hazard for the Chester County Hazard Mitigation Plan (HMP).

#### 4.3.18.1 Location and Extent

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Utility interruptions occur throughout Chester County, but are usually of small scale and short duration. Utility interruptions in Chester County are primarily power failures and are often a secondary impact of another hazard event. For example, severe thunderstorms or winter storms could bring down power lines and cause widespread disruptions in electricity service. Strong heat waves may result in rolling blackouts causing loss of power for an extended period. Local outages may be caused by traffic accidents or wind damage.

Local companies—such as Pennsylvania Power and Light (PPL) Corporation, which provide electricity to Chester County—are capable of handling minor interruptions (Section 4 of this plan describes other utilities in the county). Interruptions are possible anywhere utility service has been installed. Some utility facilities are especially vulnerable. For instance, potable water interruption is possible when water intakes and many water control facilities are in the 1-percent annual chance floodplain. A flood of this magnitude may seriously impair water service. Section 4.3.6 provides more detail on possible flood impacts.

#### 4.3.18.2 Range of Magnitude

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Generally speaking, the most severe utility interruptions are regional power outages. Regional loss of power affects lighting; heating, ventilation, and air conditioning (HVAC) and other support equipment; communications; fire and security systems; and refrigeration, which can in turn cause loss of water and sewer service, and food spoilage. These effects are especially severe for individuals with functional needs and the elderly.

At a minimum, power outages can cause short-term disruption in the orderly functioning of businesses, government operations, and private citizen functions and activities. Examples of everyday functions that would be affected by power outages include traffic signals, elevators, and retail sales. A worst-case scenario for utility interruption in Chester County would be a countywide power outage during winter months, forcing the evacuation of vulnerable populations.

Sabotage also plays a role in some utility outages. Sabotage may be the direct result of a malicious attack against utilities or may be the secondary effect of the theft of copper wiring. In a report published in October 2010 titled “An Updated Assessment of Copper Wire Theft from Electric Utilities,” the U.S. Department of Energy’s (DOE)



Office of Electricity Delivery and Energy Reliability reported that United States-based utilities suffer copper thefts costing several million dollars annually (DOE 2010). The estimated 456,000 minutes of outages have been experienced by utilities nationwide as a result of copper theft, or about 7,600 hours (American Public Power Association [APPA] 2012).

4.3.18.3 Past Occurrence

Every year, Chester County is susceptible to minor utility interruptions either through technological failure or as the result of inclement weather. Table 4.3.18-1 below shows major utility interruptions in the county since 2002. In all, the county experienced over 75 incidents that included downed utility lines from 2002 to July 2017. Events that simply included downed trees and power lines are not listed in Table 4.3.18-1.

Table 4.3.18-1. Utility Interruptions from 2002–2017

Dates of Event	Event Type	Losses / Impacts
April 19, 2002	Thunderstorm, Wind	Severe thunderstorms tore down trees and power lines in East Pikeland Township in the northeast part of Chester County, and Kenneth Square Borough and West Goshen Township in the southeast part of the county. PECO Energy reported about 2,600 of its customers lost power in Chester and Delaware Counties.
May 12, 2002	Thunderstorm Winds	A severe thunderstorm knocked down large tree limbs and wires from West Chester east to the Delaware County border. Philadelphia Electric Company (PECO Energy) reported about 13,000 of its customers lost power in Chester and Delaware Counties.
May 13, 2002	Thunderstorm Winds	PECO Energy reported about 2,600 of its customers lost power in Chester County.
May 14, 2002	Thunderstorm Winds	PECO Energy reported about 37,700 of its customers lost power in Chester and Delaware Counties.
June 27, 2002	Thunderstorm Winds	PECO Energy reported about 20,000 of its customers lost power because of the thunderstorms in their southeastern Pennsylvania service area, including Chester County.
July 5, 2003	Thunderstorm Winds	PECO Energy reported about 79,000 of its customers lost power in its service area, including Chester County.
September 23, 2003	Thunderstorm Winds	PECO Energy reported about 28,000 of its customers lost power in Chester and Delaware Counties. All power was restored by the afternoon of the September 24.
May 2, 2004	Thunderstorm Winds	PECO Energy reported 20,301 homes and businesses lost power.
August 4, 2004	Thunderstorm Wind	A squall line of severe thunderstorms knocked down several trees throughout Chester County. About 8,500 homes and businesses lost power in Chester and Delaware Counties.
November 25, 2004	Thunderstorm Wind	In Kenneth Square, three spans of power lines and two poles were knocked down. PECO Energy reported about 11,000 homes and businesses lost power in their service area.
May 28, 2005	Thunderstorm Wind	PECO Energy reported about 20,000 of its customers lost power because of the severe thunderstorms in its southeastern Pennsylvania service area, with Chester and Bucks Counties reporting the most outages.
June 6, 2005	Thunderstorm Wind	PECO Energy reported about 60,000 homes and businesses lost power throughout its southeastern Pennsylvania service area, including Chester County.
July 8, 2005	Flash Flood	About 2,500 homes and businesses lost power throughout southeastern Pennsylvania.
July 27, 2005	Thunderstorm Wind	About 10,000 homes and businesses lost power in the county. Power was not totally restored until July 28.



Dates of Event	Event Type	Losses / Impacts
July 18, 2006	Thunderstorm Wind	A severe thunderstorm caused considerable wind damage throughout Chester County as well as the death of two people. Thousands of trees were damaged and most of the power was not restored in the county until the weekend of July 22 and 23. PECO Energy reported 180,253 customers lost power in Chester County. Overall, 482,068 customers lost power, the largest outage ever for a thunderstorm event in their history and the largest outage for the utility since Isabel in 2003.
August 29, 2006	Thunderstorm Wind	A severe thunderstorm tore down large tree limbs and wires in Charlestown Township. PECO Energy reported about 8,500 homes and businesses in southeastern Pennsylvania lost power, including Chester County.
April 15, 2007	Heavy Rain	PECO Energy reported about 80,000 of its southeastern Pennsylvania customers lost power. More than 50 major roads were closed in southeastern Pennsylvania because of downed trees. In Southeastern Pennsylvania, five SEPTA Regional Rail Service Lines had service interruptions on the 16th. Pennsylvania Power and Light reported about 77,000 of its customers lost power in Eastern Pennsylvania and about 65,000 homes and businesses lost power in the Lehigh Valley.
May 27, 2007	Thunderstorm Wind	Pennsylvania Power and Light reported about 10,000 of its customers in the Lehigh Valley and the northern Philadelphia suburbs in Montgomery and Bucks Counties lost power.
June 10, 2008	Thunderstorm Wind	A severe thunderstorm left 55,000 homes and businesses without power in the county and 18,000 still were without power the next day.
July 23, 2008	Thunderstorm Wind	Most of the wind and lightning damage occurred in southeastern Pennsylvania where PECO Energy reported about 35,000 homes and businesses lost power.
July 27, 2008	Hail	The combination of lightning and damaging winds caused about 62,000 homes and businesses to lose power. Most of the outages (about 49,000) were in PECO Energy's service area in southeast Pennsylvania.
June 9, 2009	Hail	PECO Energy reported about 10,000 homes and businesses lost power that morning in southeastern Pennsylvania.
August 2, 2009	Thunderstorm Wind	PECO Energy reported about 54,000 of its southeastern Pennsylvania customers lost power due to the lightning and damaging winds.
June 24, 2010	Thunderstorm Wind	Nearly 80,000 homes and businesses lost power and it took until June 28 for power to be fully restored.
July 25, 2010	Thunderstorm Wind	About 60,000 homes and businesses lost power, with the greatest concentration in Lehigh County in the Lehigh Valley and Chester County in southeastern Pennsylvania.
June 9, 2011	Thunderstorm Wind	The combination of damaging winds and lightning caused about 3,500 homes and businesses to lose power throughout Chester County.
August 28, 2011	Flash Flood	About 500,000 PECO Energy and 420,000 PPL customers lost power in eastern Pennsylvania. For both utilities this ranked within the top five outages of all time. Preliminary damage estimates were around \$6 million.
July 7, 2012	Hail	Pennsylvania Power and Light reported about 67,500 of its customers lost power. It took until July 10 for full restoration.
July 26, 2012	Thunderstorm Wind	Over 17,000 homes and businesses lost power because of downed trees, tree limbs and wires. More than 10,000 still did not have power on the morning of July 27.
September 18, 2012	Thunderstorm Wind	The combination of the strong winds and squall line knocked out power to approximately 85,000 homes and businesses in eastern Pennsylvania.
October 29, 2012	Flood	PECO Energy, which serves customers in southeastern Pennsylvania, broke their all-time outage record of 850,000 customers without power.
June 25, 2013	Thunderstorm Wind	PECO Energy reported about 5,000 homes and businesses lost power.
November 1, 2013	Thunderstorm Wind	PECO Energy reported about 1,700 of its customers lost power in Chester County.
February 3, 2014	Heavy Snow	Many municipalities declared snow emergencies. Approximately 60,000 PECO Energy customers lost power in the Philadelphia metropolitan area.



Dates of Event	Event Type	Losses / Impacts
February 4, 2014	Ice Storm	In Chester County, whole municipalities lost power, as did 87 percent of the county overall.
June 19, 2014	Lightning	About 30,000 homes and businesses lost power in the county.
July 3, 2014	Thunderstorm Wind	PECO Energy reported about 59,000 of its customers in Chester County lost power.
July 8, 2014	Thunderstorm Wind	Approximately 80,000 homes and businesses lost power with 30 roadways closed because of downed trees. Chester County had about a third (17,000) of the remaining southeast Pennsylvania outages on the afternoon of the 9th. West Caln Township still had 5,000 homes and businesses without power that night.
November 2, 2014	Strong Wind	About 22,600 homes and businesses lost power, 20,000 in PECO Energy's service area in southeastern Pennsylvania.
February 1, 2015	Winter Weather	Winds caused about 8,000 homes and businesses to lose power in southeast Pennsylvania.
February 15, 2015	Strong Wind	PECO Energy reported that 13,000 of its customers lost power. PPL reported 1,600 of its customers in the Poconos lost power. Winds also ushered into eastern Pennsylvania one of the coldest air masses of the entire winter season.
March 5, 2015	Heavy Snow	PECO Energy reported 3,000 of its customers lost power.
June 23, 2015	Thunderstorm Wind	In Chester County, close to 75,000 customers lost power, and Verizon Wireless cell phone service was also lost on June 23 and 24.
July 22, 2017	Thunderstorm Wind	A stalled frontal boundary was the focus for several rounds of thunderstorms that produced damaging winds and flooding in spots. Over 8,000 people lost power.

Source: NOAA NCEI 2020

#### 4.3.18.4 Future Occurrence

Minor power failure (in other words, short outage events) may occur several times a year for any given area in the County, while major events (long, widespread outage events) take place once every few years. Power failures often occur during severe weather; therefore, they should be expected during those events. Based on the assumption that the County will experience severe weather annually, in addition to outages from other causes, the future occurrence of utility interruptions in Chester County should be considered *highly likely* as defined by the Risk Factor Methodology probability criteria.

#### 4.3.18.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets that are exposed or vulnerable in the identified hazard area. This section discusses the potential impact of the utility interruption hazard on Chester County in the following subsections:

- Impact on (1) life, health, and safety; (2) general building stock and critical facilities; (3) the economy; (4) the environment; and (5) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding of this hazard over time

#### Impact on Life, Health, and Safety

Utility interruptions most severely affect individuals with access and functional needs (such as children, the elderly, and individuals with special medical needs). Special medical equipment will not function without power. Likewise, a loss of air conditioning during periods of extreme heat or the loss of heating during extreme cold can be especially detrimental to those with medical needs, children, and the elderly. Table 4.3.18-2 shows the demographic change in the county for children and the elderly from 2000 through 2018. The population under the age of 5 and under 18 years have decreased, while the population over the age of 65 has increased, as shown



in Table 4.3.18-2. The population under the age of 18 has decreased by 3.5 percent. Data on individuals with special medical needs were not available. Additionally, first responders’ safety may be at risk during on-scene operations and they may not be able to respond in a timely manner due to electrical or utility fires. First responders may need to take on additional duties due to a higher than normal call volume and demand, traffic control, and responding to transportation incidents.

**Table 4.3.18-2. Demographic Trends for Vulnerable Populations**

Vulnerable Population	2000 Census	2010 Census	2018 Census Estimate	2000 to 2018 Change
Children under 5 years	29,251	31,126	29,076	175
Under 18 years	112,376	123,950	119,547	7,171
65 years and over	46,801	63,875	79,856	33,055

Source: U.S. Census Bureau 2020

### Impact on General Building Stock and Critical Facilities

All facility infrastructure considered critical are vulnerable to utility interruptions, especially the loss of power. The establishment of reliable backup power at these facilities is extremely important to continue to provide for the health, safety, and well-being of Chester County’s population.

### Impact on the Economy

No data regarding economic impacts from utility interruptions in Chester County are available. However, utility interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners or operators of the utility facilities, and costs to government and community service groups. Calculation of potential impacts of utility interruptions is heavily dependent on the number of rate-paying utility connections affected. The Federal Emergency Management Agency (FEMA) Benefit-Cost Analysis (BCA) Toolkit v.5.3.0 has standard values based on the daily cost per rate-paying connection. The daily cost-per-connection value is shown in Table 4.3.18-3.

**Table 4.3.18-3. FEMA BCA Toolkit v5.3.0 Daily Standard Values of Utility Services**

Utility	Daily Value (per connection/per day)
Electric	\$148.00
Potable Water	\$105.00
Wastewater	\$49.00

Source: FEMA 2017

### Impact on the Environment

The most significant impact associated with utility interruptions is when the interruption involves a release of hazardous materials. This hazardous material may be released in a pipeline accident or when a material is in transit. Section 4.3.16, Environmental Hazards, includes a complete discussion on the impacts of a hazardous materials release. Pipelines carrying flammable materials also have the possibility of exploding or starting a fire (Pennsylvania Emergency Management Agency [PEMA] 2018).

A number of secondary impacts are associated with utility interruptions. First, interruptions could affect the ability of the government to function, especially if backup power generators or supply is inadequate or



unavailable. Utility interruptions also can reduce the efficient and effective communication that is essential to first responders. Heating loss and severe cold can also impact the health and safety of at-risk populations like young children, the elderly, and individuals with disabilities (PEMA 2018).

### **Future Growth and Development**

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Areas targeted for potential future growth and development in the next 5 to 10 years have been identified across Chester County (further discussed in Section 2.4 of this HMP). Any areas of growth could be potentially impacted by the utility interruption hazard because the entire county is exposed and potentially vulnerable. An increase in development and population will increase demand for power supply and has the ability to increase the likelihood of utility interruption incidents.

### **Effect of Climate Change on Vulnerability**

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According to the Fourth National Climate Assessment, two climate-change scenarios were modeled, and temperature change in the northeastern United States is estimated to increase between 3.98 - 5.09°F by 2036-2065, and between 5.27 - 9.11°F by 2071-2100. The annual mean temperature change in Pennsylvania is projected to increase between 5.9 - 6.3°F by 2041 - 2070. Some areas of the world may experience greater temperature changes than others. It is important to note that frequency estimates may not be an accurate representation of future conditions due to the unknown impacts of climate change (PEMA 2018).

Increased average temperatures as a result of climate change make the occurrence of extreme heat more likely. While increased average temperatures would make the occurrence of extreme cold less likely, some climatologists have suggested that warming in the Arctic could impact the position of the jet stream, allowing for more extreme cold weather events to occur. While some research supports this concept, others do not and the impact of climate change on cold weather events is not fully understood (Climate Central 2013). Extreme heat and cold result in greater strain on utilities, increasing the likelihood of utility interruption.

Climatologists expect an increase in the number and intensity of severe weather events. This will include wind events such as hurricanes, tornadoes, and wind associated with thunderstorms, among other phenomena. More storms with higher winds will increase the chance that the utility infrastructure will be impacted by these storms. Additionally, climatologists expect an increase in precipitation, which could come in the form of heavy downpours or winter weather thus causing additional utility interruptions. Increased risk of drought may also threaten water utilities.

### **Additional Data and Next Steps**

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For future plan updates, Chester County can track data on power outage events and obtain additional information on past and future events, particularly in terms of any injuries, deaths, shelter needs, pipe-freeze incidents, and other impacts. These data will help to identify any concerns or trends for which mitigation measures should be developed or refined. In time, quantitative modeling of estimated power outage events may be feasible as data are gathered and improved.