4.3.18 Utility Interruption

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the power failure hazard in Essex County.

2020 HMP Update Changes

- All subsections have been updated using best available data.
- Previous events between 2014 and 2019 were researched, with a comprehensive list of previous events in Appendix X.
- In the 2015 HMP, this hazard focused on "Power Failure". For the 2020 update, this section was updated to expand the interruption of additional utilities (e.g., potable water and natural gas) due to increased municipal concern.
- Previous occurrences were updated with events that occurred between 2014 and 2019.

4.3.18.1 Profile

Hazard Description

Utility interruption is defined as any disruption or loss of a public service which includes, but is not limited to: electrical service, potable water, and natural gas caused by disruption of power transmission caused by accident, sabotage, natural hazards, or equipment failure (also referred to as a utility failure or utility outage). A significant utility interruption is defined as any incident of a long duration, which would require the involvement of the local and/or State emergency management organizations to coordinate provision of food, water, heating, cooling, and shelter.

Widespread power outages can occur without warning or as a result of a natural disaster. Generally warning times will be short in the case of technological failure, such as a fire at a sub-station, traffic accident, human error or terrorist attack. In cases where a power failure is caused by natural hazards, greater warning time is possible. For example, high wind events such as tornados and hurricanes often cause widespread power failure and are often forecasted before they affect a community. Additionally, severe winter weather conditions such as ice storms, blizzards, and snowstorms often cause power failure. Incidents such as these often have plenty of warning time, thus utility response crews can stage resources to prepare for utility failure.

Power failures can cause secondary hazards and have an effect on the health of residents. One potential secondary hazard is chemical accidents that occur after power is restored to industrial facilities. Power interruptions at chemical handling plants are of particular concern because of the potential for a chemical spill during restart (EPA 2001). Chemical spills in turn can have significant health and environmental impacts.

Another secondary hazard that can result from power failure is a loss of communications capability by first responders, which may in turn have negative impacts on public safety. Amateur radio operators may be used to supplement emergency communications during events of power outage. Power outages can also lead to instances of civil disturbance, including looting. Power failure may also lead to an increase in traffic accidents. Traffic accidents may increase because of the lack of traffic control devices such as stoplights and railroad crossing advisory signals. Power outages lasting a long duration will force law enforcement officials to man traffic control points to prevent accidents.

Power failure can have vast secondary impacts on the health of the community. During periods of extreme heat or extreme cold, vulnerable populations such as the elderly and medically frail can be affected and are susceptible

to hypothermia or heat stroke. Additionally, power failure can lead to food spoilage, which has negative impacts on public health.

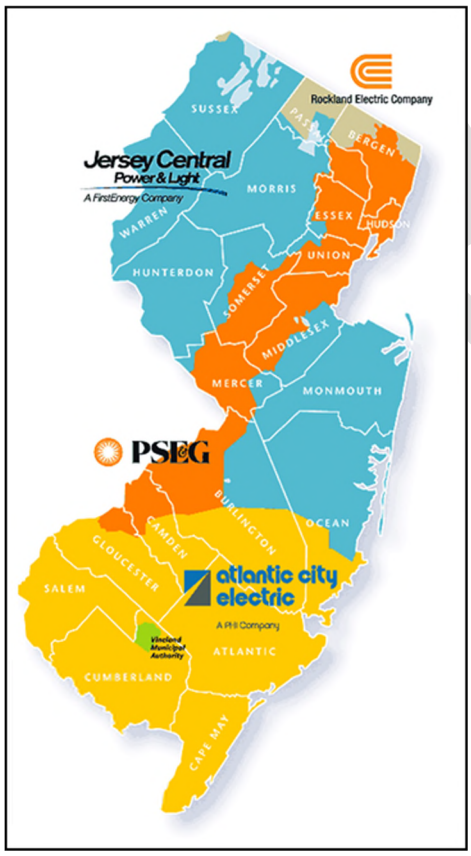
Wastewater and potable water utility interruption may occur as a result of a power failure or due to equipment failure. These critical utilities are essential to community continuity, emergency services and recovery. Their interruption of service may have cascading economic, environmental, and emergency response impacts.

Interruption of water utilities can lead to disruption in daily life for the residents (i.e., loss of potable water) and can have also have serious impacts on firefighting and emergency response capabilities. Failures can occur from natural hazards or due to aging utility infrastructure. After a water main break occurs, Fire Departments in Essex County do not have any water tenders and must rely on tenders from other counties to provide bulk water supply to be used in firefighting operations.

Location

Power failures in New Jersey are usually localized and are usually the result of a natural hazard event involving high winds or ice storms. New Jersey's power systems are overseen by the State of New Jersey Board of Public Utilities. Under New Jersey law, consumers can shop for electric suppliers through a variety of third-party vendors. While the *supply* portion of energy is open to competition, the *delivery* of electricity is limited geographically to the following service providers:

Figure 4.3.18-1. Electric Service Delivery Companies in New Jersey



Source: New Jersey Clean Energy Program 2013

- Atlantic City Electric
- Jersey Central Power and Light (JCP&L)
- Rockland Electric Company
- Public Service Electric and Gas (PSE&G)

These service providers are responsible for maintaining power throughout their respective regions. Figure 4.3.18-1 shows the locations of electric service delivery providers across New Jersey. This figure indicates that PSE&G deliveries electricity to the majority of Essex County, while JCP&L deliveries electricity to the southwestern portion of the County.

Water interruptions can range from localize events to larger scale water outages. Water interruptions can occur from a direct impact from a natural hazard or a failure due to the age of the utility infrastructure. Water supply throughout Essex County is provided through both private and municipally operated water providers.

- North Jersey District Water
- Passaic Valley Water Commission
- Suez Water Company
- New Jersey American Water Co.
- City of Newark Water
- Essex Fells Water Company

Through the November 2019 stakeholders' meetings, Essex County learned that PSE&G has implemented procedures to pre-emptively shut down utility gas distribution should a hurricane or severe

weather system be forecasted within their service area. These procedures are intended to reduce sustained damages to utility distribution infrastructure. There can be adverse effects on residents of the area who have utility gas powered generators for their homes. Should the power go out, and utility gas distribution be shutdown, then customers could be completely without power.

Extent

The extent and severity of a utility interruption depends on the cause, location, duration, and time of year. It can range from a small, localized event to a countywide power outage. Impacts from a utility failure can be significant to the County and its residents. Utility interruptions typically occur because of, or in combination with, aging infrastructure, other emergency or disaster incidents, such as severe weather and flooding, and can exacerbate such emergencies. It also depends on the utility distribution system affected.

Power failures lead to the inability to use electric-powered equipment, such as: lighting; heating, ventilation, and air conditioning (HVAC) and necessary equipment; communication equipment (telephones, computers, etc.); fire and security systems; small appliances such as refrigerators, sterilizers, etc.; and medical equipment. This all can lead to food spoilage, loss of heating and cooling, basement flooding due to sump pump failure, and loss of water due to well pump failure.

Utility gas failures can lead to a drastic reduction for residents of Essex County to heat their homes as previously mentioned. Current procedures of shutting off utility gas distribution before severe weather events could also hinder the ability to provide backup power if residents have generators power by utility gas.

Interruptions of water supply can lead to decreased potable water supply and also a decreased firefighting capability. Essex County currently does not have any water tender apparatus for fire suppression, so in the event of a water interruption, outside resources from other agencies and counties must be utilized. There are several areas within Essex County currently that do not have infrastructure in place for fire suppression including: South Mountain Reservation, Hilltop Reservation, Mills Reservation, Eagle Rock Reservation, and along Interstate Highways.

Previous Occurrences and Losses

Many sources provided utility interruption information regarding previous occurrences and losses associated with events that caused outages throughout Essex County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2014, FEMA included the State of New Jersey in one power outage-related disaster (DR) or emergency (EM) declaration. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Essex County was included in this disaster.

For the 2020 HMP update, power outage events were summarized from 2014 to 2019; refer to Table 4.3.18-1.

Table 4.3.18-1. Utility Interruption Events in Essex County, 2014 to 2019

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Essex County Designated?	Location	Description
March 29, 2015	Water Main Break			Millburn Township	A water main break occurred within Millburn Township with impacts to commercial and residential properties
July 1, 2016	Thunderstorm Wind	N/A	N/A	South Orange, Fairfield, Caldwell, Cedar Grove	A passing cold front triggered a few severe thunderstorms over northeast New Jersey. Power lines were reported down in South Orange. $0.75K in property damages were reported. There were multiple reports of trees and power lines down throughout Fairfield. $3K in property damages were reported. There were multiple reports of trees and wires down in Caldwell. A large tree was uprooted onto 3 cars and a home in Cedar Grove. $45K in property damages were reported.
March 14, 2017	Winter Storm	N/A	N/A	Essex County	Rapidly deepening low pressure tracked up the eastern seaboard on Tuesday March 14 bringing blizzard conditions to Western Passaic county. Heavy snow and sleet along with strong winds occurred across the rest of Northeast New Jersey. The storm cancelled numerous flights at Newark airport with some mass transit services suspended. Large trees fell onto homes in Bergen county and approximately 4,500 power outages resulted from the strong winds and heavy snow. Trained spotters and the public reported 8 to 13 inches of snow and sleet.
January 4, 2018	Winter Storm	N/A	N/A	Essex County	The development of the blizzard/winter storm began along the southeast coast on Wednesday January 3, 2018. An amplifying upper level trough spawned the development of low pressure off the coast of Florida. The low pressure rapidly intensified on Wednesday night through Thursday January 4, 2018 as it moved north-northeast along the coast. The low passed just east of the benchmark Thursday afternoon. The central pressure when the storm developed was around 1004 millibars at 1 pm Wednesday. 24 hours later, the central pressure fell to around 950 mb, approximately a 54 millibar drop. The rapid intensification of the storm led to heavy snow, strong winds, and near-blizzard conditions across portions of Northeast New Jersey. Thousands of flights were cancelled at Newark Airport on January 4, 2018. Homes and businesses lost power and there were numerous accidents on area roadways. The public reported 6 inches of snow in West Caldwell. Winds gusts 30 to 40 mph at the Caldwell Airport during the afternoon and evening on January 4, 2018. The FAA Contract Observer at nearby Newark-

Table 4.3.18-1. Utility Interruption Events in Essex County, 2014 to 2019

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Essex County Designated?	Location	Description
					Liberty Airport reported 8.4 inches of snowfall. Winds also gusted to 44 MPH at 4:38 PM at the airport.
March 7, 2018	Winter Storm	N/A	N/A	Essex County	A strong low pressure system developed along the Middle Atlantic coast during the morning of Wednesday, March 7, 2018. The low tracked along the coast through the early morning hours on Thursday, March 8, 2018. The storm brought heavy wet snow, strong gusty winds, and even some thundersnow across northeast New Jersey. Snowfall rates ranged from 1 to 3 inches per hour at times in the heaviest snow bands. Trained spotters and the public reported 1 to 2 feet of snow. 23.0 inches was reported in North Caldwell and 19.7 inches in Roseland. The heavy wet snow and strong winds also brought down trees and some power lines.
November 15, 2018	Winter Storm	N/A	N/A	Essex County	A wave of low pressure developed along the Middle Atlantic coast during Thursday November 15, 2018. The low was associated with a closed upper level trough across the Midwest. As the trough translated eastward into Friday November 16, 2018, the low pressure moved up the northeast coast. The antecedent air mass ahead of the low was cold and dry for the middle of November with temperatures during the morning and afternoon of November in the upper 20s and low 30s. The moisture associated with the trough and low pressure was able to produce moderate to heavy bands of snow as the precipitation began across the entire Tri-State area due to the cold air in place. Once the low drew warmer air from the south, the precipitation gradually changed to a wintry mix and then plain rain, especially for the New York City metro and Long Island. The moderate to heavy wet snowfall significantly impacted the evening rush hour with 1-2 inch per hour snowfall rates. Hundreds of trees, tree limbs, and branches were brought down by the weight of the snow, which caused many power outages. Numerous accidents were reported and many motorists were stranded on roads until the early morning hours the next day. There were over 1,000 flights cancelled at the New York City metro airports (Kennedy, La Guardia, and Newark). The FAA contract observer at nearby Newark Airport reported 6.4 inches of snow. Trained spotters, social media, and the public reported 4 to 6 inches of snow. Impacts were widely felt across eastern Essex county with major disruption to the evening commute. Trees branches

Table 4.3.18-1. Utility Interruption Events in Essex County, 2014 to 2019

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Essex County Designated?	Location	Description
					and limbs were downed due to the weight of the heavy wet snow. Nearby Newark airport reported 1-2 inch per hour snowfall rates at times during the evening commute.
March 2-3, 2019	Water Interruption	N/A	N/A	Cedar Grove Township	North Jersey District Supply made overnight repairs to a 72" transmission line which required the water supply to be shut down. The Township made preparations by flooding water tanks and having plans in place to interconnect to the Township of Little Falls and the Borough of North Caldwell's water system. A 5000 Gallon Tanker was brought in and on standby for fire suppression.

Source: NCEI 2019; FEMA 2019

Note: With documentation for New Jersey and Essex County being so extensive, not all sources have been identified or researched; therefore, Table 4.3.18-1 may not include all events that have occurred throughout the County.

Probability of Future Occurrences

While the probability of future utility interruption incidents in Essex County is difficult to predict, the historic record indicates that significant failures have occurred as a result of high winds, lightning, severe weather, winter weather, technological failures, and age of utility infrastructure. As infrastructure ages beyond its intended lifespan, it is likely to become less reliable leading to a higher likelihood of failure Data were not readily available on the frequency of smaller utility interruptions across the County; however, it is reasonable to assume that utility failure events of shorter duration will continue to occur in the future. In addition, future changes in climate may also impact the frequency and probability of future utility failure occurrences.

In Section 4.4, the identified hazards of concern for Essex County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee and Planning Committee, the probability of occurrence for utility interruptions in the County is considered 'frequent'.

Climate Change Impacts

Several implications for climate change are related to the utility interruption hazard. Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

The New Jersey Climate Adaptation Alliance is a network of policymakers, public and private-sector practitioners, academics, non-governmental organizations (NGO), and business leaders aligned to build climate change preparedness in the state of New Jersey. The Alliance is facilitated by Rutgers University, which provides science and technical support, facilitates the Alliance's operations and advances its recommendations. A document titled *Change in New Jersey: Trends and Projections* was developed to identify recommendations for State and local public policy that will be designed to enhance climate change preparedness and resilience in New Jersey (Rutgers 2013).

Temperatures in the Northeast United States have increased 1.5 degrees Fahrenheit (°F) on average since 1900. Most of this warming has occurred since 1970. The State of New Jersey, for example, has observed an increase in average annual temperatures of 1.2°F between the period of 1971-2000 and the most recent decade of 2001-2010 (ONJSC, 2011). Winter temperatures across the Northeast have seen an increase in average temperature of 4 °F since 1970 (Northeast Climate Impacts Assessment [NECIA] 2007). By the 2020s, the average annual temperature in New Jersey is projected to increase by 1.5°F to 3°F above the statewide baseline (1971 to 2000), which was 52.7°F. By 2050, the temperature is projected to increase 3°F to 5°F (Sustainable Jersey Climate Change Adaptation Task Force 2013).

Both northern and southern New Jersey have become wetter over the past century. Northern New Jersey's 1971-2000 precipitation average was over five inches (12%) greater than the average from 1895-1970. Southern New Jersey became two inches (5%) wetter late in the 20th century (Office of New Jersey State Climatologist). Average annual precipitation is projected to increase in the region by 5% by the 2020s and up to 10% by the 2050s. Most of the additional precipitation is expected to come during the winter months (New York City Panel on Climate Change [NPCC] 2009). In addition, heavy precipitation events have increased in the past 20 years.

Climatologists predict an increase in the number and intensity of severe weather events. More storms with higher winds will increase the chance that the power infrastructure will be impacted. Extreme temperatures are predicted to increase as well. During the hot summer months, the potential for power overload will increase as demand for power increases. Additionally, climatologists predict an increase in precipitation, which may lead to more winter weather thus causing additional power failures.

4.3.18.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses Essex County's vulnerability, in a qualitative nature, to the utility interruption hazard.

Impact on Life, Health and Safety

The entire population in Essex County is vulnerable to utility interruption events. Refer to Section 3 (County Profile) for a summary of population statistics for the County.

Utility failure is particularly problematic for homes that are heated with electricity. Widespread power outages during the winter months can directly impact vulnerable populations such as the elderly and medically frail. According to the 2013 – 2017 American Community Survey, 213,021 (76.0%) homes across Essex County are heated with utility gas, 21,836 (7.8%) homes are heated with fuel oil and kerosene; and 37,940 (13.5%) are heated by electricity. JCP&L and PSE&G currently maintain databases for homes/facilities with individuals that need power supplied for medical reasons. Utility interruption events have potential health impacts including injury and death. Other issues from power outages include food safety from lack of refrigeration and carbon monoxide poisoning from misuse of generators.

Individuals with medical needs are vulnerable to power failures, because medical equipment such as oxygen concentrators requires electricity to operate. The elderly and low-income populations of Essex County are also vulnerable to the effects of power failure, as power failure has the potential to expose them to extreme heat or extreme cold. During power failure events, water purification systems may not be functioning. Further, populations on private wells will not have access to potable water. Many power outage events are caused by storm events that can lead to flooding. Without electricity, residents would be unable to pump water from their basements potentially causing structural and content damage to their homes.

Individuals powering their homes with generators are subjected to carbon monoxide poisoning if proper ventilation procedures are not followed. Improperly connected portable generators are capable of 'back feeding' power lines which may cause injury or death to utility works attempting to restore power and may damage house wiring and/or generators (NJOEM 2019).

As noted above, interruptions of water supply can lead to decreased potable water supply and a decreased firefighting capability. There are several areas within Essex County currently that do not have infrastructure in place for fire suppression increasing the vulnerability of these residents to the wildfire hazard: South Mountain Reservation, Hilltop Reservation, Mills Reservation, Eagle Rock Reservation, and along Interstate Highways. Interruption of potable water distribution also has a considerable impact on the firefighting capabilities of many fire departments within Essex County. Essex County's fire departments rely on the pressurized water system that supplies the fire hydrant connections for fire suppression. Most of the firefighting apparatus in the County relies on these fire department connections for adequate fire suppression. Should frequent or widespread water interruption occur, there will be an increased risk for structural fire and wildfire occurrence within the County.

Water systems and thus distribution may also be impacted by other hazards such as extreme weather events. A good example is Superstorm Sandy where storm surge damaged critical water supply infrastructure along the coast and high winds impacted energy distribution across the State which in turn impacted the ability to supply water. As a result, NJDEP has developed new guidance aimed to ensure that repairs, reconstruction, new facilities and operations/maintenance are focused on enhancing the resilience of critical infrastructure (NJDEP 2017).

Impact on General Building Stock

All of the building stock in the County is exposed to the utility interruption hazard. Refer to Section 3 (County Profile) which summarizes the building inventory in Essex County. Impacts sustained from utility interruption are likely to be secondary impacts. Should potable water distribution be reduced or not available, then structures could be at increased risk for structural fire since current fire suppression is dependent accessing water supply from hydrants.

Impact on Critical Facilities

All critical facilities in the County are exposed to the utility interruption hazard. It is essential that critical facilities remain operational during natural hazard events. Backup power is recommended for critical facilities and infrastructure. Loss of power can have serious impacts on the health and welfare of residents, continuity of business, and the ability of public safety agencies to respond to emergencies. Interruption of utility gas or water distribution could also reduce the effectiveness of critical facilities to operate at full capacity.

Impact on Economy

During a utility interruption event, the County may experience losses because of an interruption of critical services. Further, increased costs such as providing shelters, and costs related to cooling and heating centers may be incurred. Extended power outages will require officials to shelter victims who require heat and power for activities of daily living.

A prolonged power failure in Essex County may impact the County's economy. The County possesses an extensive transportation network, including many rail and fixed route bus services, as well as demand responsive, ridesharing, and shuttle services (Essex County Transportation Plan 2008). Transportation systems available in Essex County include large, interconnected rail, roadway, and water transportation networks. Major highways accessible to Essex County includes the Garden State Parkway; New Jersey Turnpike; Interstates 78, 80, and 280; Routes 1-9, 21, 22, 23, 24, and 46; and the Eisenhower Parkway. Public roads have a total mileage of 1,673 miles; total interstate mileage is 27 miles; state highway mileage is 59 miles; county road mileage is 233 miles; and municipal road mileage of 1,330 miles. The County also has three of the nation's major transportation centers, which includes Newark Liberty International Airport, Port Newark, and Penn Station (Essex County 2014). All these systems and supporting resources provide services locally, regionally, nationally, and internationally. Disruption in any of these services would mean that many workers, residents, and travelers would not be able to go where needed.

Power interruptions can cause economic impacts stemming from lost income, spoiled food and other goods, costs to the owners/operators of the utility facilities, and costs to government and community service groups. FEMA's benefit-cost analysis methodology measures the loss of electrical service on a per-person-per-day-of-lost-service basis for the service area affected.

Interruption of utility gas or potable water distribution could also cause significant economic impacts such as: additional costs for bringing in water tenders to maintain fire suppression capabilities; opening additional warming centers should electric and utility gas utility be interrupted to residential areas; and distribution of potable water for public consumption. There could be significant costs associated with reimbursing fire departments from other counties within New Jersey to travel, staff, and maintain water tenders within Essex County during the duration of a water outage event.

Potential modeling of economic impacts from utility interruption would be calculating interruption of service costs which is derived from a standard value per person per day multiplied out by the number of customers

served. This would help to provide a estimate of the impact of the interrupted utility service, but may not be representative of the complete economic impact of a prolonged utility interruption.

The FEMA BCA Toolkit version 5.3 uses the following standard values per person per day:

- Electric: $148.00
- Potable Water: $105.00
- Wastewater: $49.00

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development and Change in Population

As discussed in Sections 3 and 9, areas targeted for future growth and development have been identified across Essex County. Any areas of growth could be potentially impacted by the utility interruption hazard because the entire County is exposed and vulnerable. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

According to population projections from the State of New Jersey Department of Labor and Workforce Development, Essex County will experience an increase in population through 2034 (approximately 40,000 people between 2017 and 2034). An increase in population within Essex County could potentially lead to a higher likelihood of utility failure due to an increased demand on aging infrastructure. If utility infrastructure is not maintained and enhanced to accommodate for future demands, then there is a higher likelihood for more frequent utility interruptions. Increased frequency of utility interruptions will lead to an increased risk for socially vulnerable populations and also a heighted risk for structural and wildfire because of the current reliance of fire hydrants for fire suppression in Essex County.

Climate Change

Several implications for climate change are related to the power failure hazard. Providing projections of future climate change for a specific region is challenging. Shorter term projections are more closely tied to existing trends making longer term projections even more challenging. The further out a prediction reaches the more subject to changing dynamics it becomes.

Climate Change in New Jersey: Trends and Projections describes changes in temperature, precipitation, and sea level rise. Each section of the report summarizes observed recent changes in climate in New Jersey. Observations are based on recorded climate data collected by the ONJSC and other institutions, and on other reports summarizing climate change in the northeastern United States. Each section also presents a synthesis of the most current projections for future climate changes based on climate science modeling and techniques. The projections reflect potential average climate over a span of future years (2020, 2050, and 2080). The projections in the report illustrate the potential climate changes that could impact the northeastern United States based on future emissions scenarios (A2, A1B, and B1 – high, medium, and low scenarios). Each emissions scenario would result in a range of potential climate outcomes in the State (Rutgers 2013).

Climatologists predict an increase in the number and intensity of severe weather events. More storms with higher winds will increase the chance that the power infrastructure will be impacted. Extreme temperatures are predicted to increase as well. During the hot summer months, the potential for power overload will increase as demand for power increases. Additionally, climatologists predict an increase in precipitation, which may lead to more winter weather thus causing additional power failures and utility interruptions.

Change of Vulnerability Since the 2015 HMP

Overall, the County's vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to the utility interruption events.