

**PIERCE COUNTY
HAZARD IDENTIFICATION & RISK ASSESSMENT

ENERGY EMERGENCY HAZARD**

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Identification Description

Definition

An Energy Emergency is a situation in which the unavailability or disruption of the supply of energy poses a clear and foreseeable danger to the public health, safety, and welfare. An Energy Supply Alert is a situation which threatens to disrupt or diminish the supply of energy, to the extent that public health, safety, and welfare may be jeopardized. Both are declared by the governor through executive order. By declaring an Energy Supply Alert, the state recognizes that emergency conditions have worsened, and that expanded measures are needed to address the crisis.¹

Types

Energy resources include: electricity; petroleum distillates such as gasoline, diesel fuel, aviation fuel, heating oil; propane; and natural gas. Short term losses of energy services are not typically considered an emergency, however a simultaneous failure of a back-up (i.e. a generator) that keeps a critical system functioning could result in a short-term emergency.

Pierce County citizens, businesses and government agencies rely on different energy resources depending on their location, type of business or industry, and preference. Distribution is facilitated through both private and public entities using various means and infrastructure. In addition, nearly all rely at least partially on electricity to function on a daily basis. Gasoline and diesel fuel are other critical energy resources that are relied on heavily. Natural gas and propane provide heating and cooking fuel for many and heating oil is still used in some homes across the County.

No matter which type of resource is involved, it is the inability to provide or have access to sufficient quantities to meet public, commercial and government demand that creates the emergency. It may not just disrupt the normal day-to-day lives of Pierce County citizens; it may also threaten their physical, psychological and economic wellbeing. This is particularly relevant to vulnerable populations, who tend to be more affected by minor fluctuations in their environment. The effects of the emergency can be compounded when more than one resource is restricted or when it is accompanied by severe weather or other emergency/disaster conditions.

Profile

Location and Extent

An energy emergency can happen anywhere and potentially everywhere in Pierce County. They most frequently come in the form of extended electrical outages due to severe weather. High winds or heavy snows associated with seasonal storms can cause significant damage to utility systems resulting in potentially extensive and long-term service interruptions.²

A second likely scenario would be a shortage, reduced availability or substantial increase in the cost of an energy resource. These can occur for various reasons ranging from environmental

effects, political fluctuations, market manipulations and an overall reduction in supply. Seventy percent of Washington's electricity is hydroelectric.³ A severe drought could reduce the production capability of the State's water ways, forcing a reliance on more expensive forms of power generation. This will likely cause an initial shortage followed by a potentially significant increase in cost. The drought in California in the year 2000 along with market manipulations caused an 800% increase in wholesale prices of electricity.⁴ People in lower socioeconomic categories and small businesses would be affected first and most significantly. If this scenario persists for an extended period of time, its effects will be felt across all segments of the County's populations, businesses and government agencies.

A worst-case scenario would be a loss of electric power for an extended period combined with a reduction or loss of fuel sources that currently power transportation systems and the redundant electricity generation systems that keep critical infrastructure functioning. Transportation, sewage treatment, water production, medical systems, government systems, financial systems, emergency response and more could all be severely impacted. This scenario would likely have lasting effects, which would be felt across the County for months or years after resources were restored.

An example of this, would be the system failure and permanent damage to the infrastructure occurring from an extreme space weather event. Space weather events are those that happen in space yet may impact operations here on earth. Several types exist including geomagnetic storms and solar radiation storms. While the potential is at its highest during the height of the solar cycle, which occurs every 11 years, it can occur at any time.⁵ Geomagnetic storms disrupt the earth's magnetic field and can stimulate electrical currents known as Geomagnetically-Induced Currents (GIC's).⁶ Solar radiation storms are charged particles and protons that usually disturb radio communications and Global Positioning System (GPS). A large-scale incident can result in the damage to electronics, memory and imaging systems on satellites, and complete radio blackouts. Such an incident may cost billions of dollars of damage and take months or longer to repair.⁷

Occurrences

The most frequent type of energy incident in Pierce County is a power outage. Small, short term outages (lasting only hours) occur routinely across the County. There have been some significant outages that were longer lasting and required some response by local, county and state government agencies.

In 1929, severe drought caused water levels to be at an all-time low. This dramatically reduced the power generation capability of the LaGrande Dam on the Nisqually River and the Cushman Dam on the Skokomish River. By December, electricity was so short that Tacoma street lights were turned off, shops and illuminated signs were left dark and "Camp Lewis" turned off barracks lights at 4:00 PM. The situation became so dire that on 16 December the US War Department, at the request of President Hoover, dispatched the aircraft carrier USS Lexington from the Bremerton shipyard to generate electricity to keep Tacoma alive (see figure EE-1).⁸

In 1980, Mount Saint Helens erupted. Ash caused short circuits in electrical transformers and caused blackouts for days.

In 1989, a severe space weather event hit the North American continent. The worst hit was Canada where millions of people were without power for nine hours. New Jersey lost a transformer worth \$12 million dollars.⁹ This geomagnetic storm had the greatest impact on the energy industry in history.¹⁰ As a result of situations such as these, FEMA has taken an active approach in learning about space weather to prepare citizens.¹¹

Figure EE-1 The Carrier Lexington Providing Electricity to the City of Tacoma¹²



In the fall of 2000, major producers of electricity on the West Coast created an energy emergency through market manipulation, artificially inflating prices that grossly increased the cost/kilowatt hour. The WA Governor required conservation efforts by public agencies, urged the public to reduce electric demand, and directed utilities to prepare for rolling

blackouts although blackouts did not occur. Doing so was highly detrimental not only to the financial well-being of power distributors, but also to that of the individual homeowner, business owners and especially to industries that relied on large quantities of very cheap power.

In December of 2006, the Hanukkah Eve Windstorm left thousands of Pierce County residents without power for days due to extensive damage to power lines. Fifteen people died and some areas went without power for as many as eleven days.¹³ Daily temperatures that time of the year range between the low 30s to the mid-40s¹⁴ creating serious County-wide concerns for the health and safety of residents.

In early 2008, the country saw a significant spike in fuel prices reaching nearly \$4.50 per gallon. It lasted for nearly three months.¹⁵ This caused an overall cost of living increase throughout the country affecting low income families and small businesses. Some of the businesses did not survive.

In December of 2008, a significant winter storm hit western Washington knocking out power to portions of the County. Some areas were without power for up to a week.

In late January of 2009, the main cable that supplies electricity to Anderson Island broke, leaving residents and businesses without power for weeks. County resources were deployed to the island to support the community until power could be restored.

In January of 2012, one of the largest snow storms to hit western Washington in decades blew in depositing significant amounts of heavy wet snow. Immediately following, the temperature dropped causing heavy ice deposits to form on the already snow laden trees, power lines and roofs. Over 200,000 people ended up without power, some for up to three weeks. Rural areas were the last to have power restored.

In 2018, the Enbridge Pipeline disruption created a short-term natural gas shortage; Cascade Natural Gas 7 Puget Sound Energy asked customers to cut back use of natural gas. Impacts to regional trash pickup in service areas that use natural gas in trucks, some hospital's linen services, oil refineries refining process, and creating fertilizer that farmers in Eastern WA depend on.

Recurrence Rate

Major energy outages during severe weather events are an occasional hazard of living in Pierce County. They happen throughout the County every few years. The recurrence rate is five years or less.

More critical are the occasional situations like the one brought on by the 1929 drought or the cable breaking between the mainland and Anderson Island. Large occasional incidents like those have a recurrence rate of fifty years or less.

Extreme space weather events can range between less than 1 per solar cycle to as many as 4, depending on the type of storm. The most dangerous are Geomagnetic Storms which have a frequency of 4 extreme events every eleven years (per solar cycle).¹⁶

Significant increases in the cost of fuel resources have not impacted Pierce County as significantly as they did in 2008. These occurred again in 2011 and 2012. The subsequent spikes did not reach the same levels as before and the overall impact did not appear to be as severe. The economy and consumer seemed better prepared for the follow-on spikes.¹⁷ That said, another prolonged period of high energy costs will likely impact the more vulnerable populations and small businesses of the County.

Impacts

Health and Safety of Persons in the Affected Area at the Time of the Incident

An extended loss of electrical power can pose some significant challenges for people within the affected areas. Rural communities experience more frequent power outages and have resources to get by for a time. For example, a farmer is more likely than an apartment dweller to have a backup generator. Children, the sick and the elderly are more vulnerable to the impacts of power outages as well as the poor.

Depending on the time of year and the temperatures, loss of power can pose significant heating and cooling problems. Those without wood, gas fireplace or a generator have no safe means to heat their homes. Over time, hypothermia can become a real concern.

Previous power outages have also seen individuals die of carbon monoxide poisoning in their homes as they attempt to heat with alternative means such as an open fire in the house. The longer the outage lasts during colder periods, the higher the potential for this kind of thing happening.

Refrigerators require electricity to function. Perishable foods in the refrigerator can become unsafe to eat within hours without power. Food in a freezer may be viable for up to two days. Resupplying or replacing food during the crisis can be difficult as stores rely on electricity to run their refrigeration units as well. Additionally, shelf stocks in grocery stores tend to deplete quickly, leaving many people without a reliable way to feed themselves and their families.

Even if stores have food, without cash or checks, customers may not be able to purchase it. Many people rely on electronic financial systems to do most or all of their transactions. Without power, access to money in this form is impossible.

Water availability may be an issue for families residing in rural areas. Many homes in rural Pierce County draw their water from wells. In most cases the pump that pulls the water is driven by electricity. Once the power goes out, the pump stops and so does the water supply. If there is a loss of fuel supplies at the same time, water in the urban areas may be impacted as well as sewage treatment when generators fail, and critical systems shut down. These are extreme examples but not outside the realm of possibilities in a worst-case scenario.

Loss of power will eventually result in a loss or serious degradation of communication ability for people if they do not have a landline phone in their homes. Cellular phones, tablets and computers all require power. Eventually their batteries will run down, and the devices will no longer work.

During the 2012 snowstorm, gas stations were forced to shut down because there was no power to run their pumps leaving no way to refuel cars or generators. In some areas, people with generators were left without power as their fuel ran out and they were unable to find any locally. An inability to refuel cars stranded some people and cost others their only heat or source to power personal communication devices.

A fuel shortage or significant spike in cost can have many of the same impacts on families. As was observed in 2008, the cost of nearly everything went up when fuel prices climbed. People in lower socioeconomic groups and those with fixed incomes will be most significantly impacted. If the shortage or spike lasts for months, the financial impact may be nearly irreversible for some of these people. The homeless may be even more impacted as higher fuel prices increase the cost of living. This typically reduces charitable contributions, which are necessary to help the homeless and very poor. That occurs simultaneously with an increased need for government services, putting an additional strain on government programs.

Health and Safety of Personnel Responding to the Incident

Utility workers will always have a risk of electrocution.

The exception to the above is the potential for widespread civil unrest if an energy emergency lasts for an extended period. The population will grow increasingly frustrated and desperate if services cannot be restored and necessities are difficult to obtain. This desperation may lead to organized and unorganized civil disturbances that can grow quickly if not effectively handled. In May of 2012, widespread unrest occurred in Pakistan after months of significant energy shortages. Protestors damaged infrastructure, office buildings, government agencies and blocked roads.¹⁸ Although a local reaction this significant is not likely early on, law enforcement and emergency responders must prepare for extended periods of deprivation that may result in civil unrest. See the Civil Disturbance chapter for more detail.

Continuity of Operations and Delivery of Services

The nature of the energy emergency may directly influence continuity of operations for the County. A shortage in propane, natural gas or heating oil should not significantly impact County operations or its delivery of services to residents.

A short-term outage of electricity should have a minor impact for agencies or services that lack a back-up power source for their systems. Agencies or services with back-up power and fuel or generation capability should be unaffected in the short-term. A long-term outage of electricity will have a progressively increasing impact on operations and service delivery for agencies without back-up power. At some point, many scenarios suggest that agencies may be forced to seek portable power generation if available or relocate to temporary facilities that can provide the electrical power necessary to resume at least some level of operations. Agencies with organic power generation capability should be generally unaffected.

A shortage or reduced availability of gasoline or diesel fuel should not initially cause County agencies to stop operations or prevent delivery of services. If the shortage continues, lack of fuel availability may force agencies to prioritize services in order to maximize what fuel is available. Emergency medical services, fire, law enforcement and transportation may be impacted to the greatest extent and could be forced to curtail or modify service delivery to reduce overall fuel consumption.

The worst-case scenario for the County is a long-term electrical outage combined with a shortage or loss of available gasoline or diesel fuel sources. The longer this situation lasts the greater the impact will be on County operations and especially its ability to deliver critical services. Back-up power generation capability will eventually fail as generators run out of fuel. Hospitals, emergency services, emergency communication and other critical County capabilities will be reduced significantly without external assistance. Community health risk increases as sewage treatment and water delivery systems begin to fail. County agencies that rely on automated systems to maintain operations will be forced to reduce or stop operations until system power can be restored. The County's ability to support vulnerable populations will likely be significantly impacted the longer this scenario continues.

The latter scenario is the least likely to happen but presents the greatest potential to significantly impact on County operations and the ability to deliver critical services to residents. It is likely that this type of energy emergency will be combined with a natural disaster or other significant emergency. That combination of effects can accelerate the impacts on already strained County

resources and force difficult decisions in an effort to maintain the most critical services to support the greatest number of people.

Property, Facilities, and Infrastructure

A shortage or reduced availability of fuel resources should not have a significant impact on property, facilities or infrastructure across the County. On the other hand, a solar storm could impact the electric grid, damaging transformers, telecommunication lines and pipelines of which many portions may no longer be fixable.

A long-term electrical outage will impact infrastructure that is not supported by back-up power generation systems and may also require the closure of some County facilities that do not have back-up systems. As mentioned above, a long-term electrical outage combined with a shortage of fuels can have significant impacts on facilities and County infrastructure. Sewer, water treatment, water pumping, transportation and communication infrastructure can cease to function if the emergency lasts for an extended amount of time. Some infrastructure may even be seriously damaged by an extended power outage.

Figure EE-2 Solar Panels, the New Face of Power Generation



Environment

The lack of energy by itself will not be detrimental to the environment. Rather it will be the impact of failing systems and individuals attempting to overcome the lack of energy. Systems such as wastewater treatment, off-gas scrubbers from coal or oil-fired industrial furnaces, electrostatic air filtration systems and others require large amounts of energy to function. A reduction or loss of energy resources can cause these systems to fail, which may result in unfiltered discharge of toxic substances into the local environment.

If there is a wintertime failure of systems that provide heat to residents, there will likely be an increase in wood burning to compensate. Airborne particulate matter will likely increase as more and more fireplaces and wood stoves are used to heat homes. Additionally, the longer the interruption lasts, the more wood will be required to heat homes. This may result in a significant increase in wood cutting in local forests as well as urban areas. Over time, large wooded sections in both rural and urban areas could be significantly damaged.

If the emergency is caused by reduced availability of gasoline or diesel fuel, hoarding may become a problem. The environmental concern is the storage of potentially large quantities of fuel in containers that were not designed for it. Spills and leaks of fuel into the ground water and river systems may be an issue. If these things happen, they will increase the overall recovery cost of the emergency.

Economic and Financial Condition

A long-term energy emergency can impact the local economy long beyond the actual end of the emergency. Whether it is the loss or reduction of a single energy resource or a combined loss of multiple resources, there will be economic impacts that can last for a long time. Analyses from electrical outages across the country indicated that a 30-minute loss of power can result in an average fiscal loss of nearly \$16,000.00 for a medium or large industrial company. That loss climbs to \$94,000.00 for an eight-hour interruption.¹⁹ An analysis of various storm related electrical outages put the total annual loss to the US economy between \$20 billion and \$55 billion.²⁰ The total economic impact on energy technologies and infrastructure from a major solar storm event has been estimated by NASA to cost \$2 Trillion within the first year. The damage of infrastructure could take weeks, months or even years to repair.²¹

Businesses that cannot open or have to limit their open hours due to rationing, will lose revenue. Small businesses are particularly vulnerable to this impact, especially if the outage lasts for an extended period. There will be cases that businesses will have to permanently close, because they are unable to financially recover from the outage. This could lead to a cascading effect whereby the loss of business will mean the loss of jobs for individuals who would normally spend their income on goods that other businesses supply.

Loss of power can lead to spoilage in grocery stores and restaurants. These businesses must replace those items at a significant cost. Families will have to restock freezers and refrigerators when fresh items become available. Lower income families and small grocery stores will feel the effects of this most significantly. Social assistance requirements will likely increase following an extended loss of power.

Loss of business means loss of tax revenue for governments at the same time there is an increase in the number of people needing financial support. The potentially corresponding increase in social assistance requirements and recovery costs can lead to a financial drain on County government. This may lead to subsequent cost saving decisions that can impact on programs, services, employees and County residents.

Public Confidence in the Jurisdiction's Governance

One of the assumed roles of government is the protection of the infrastructure and systems that make modern society operate. A major disruption can bring about the loss of support by the people. The County's readiness to address the issues associated with an energy emergency and to provide services, while quickly restoring "normal" life for residents, will be the driving force that shapes public opinion and confidence. Without this, the public's confidence in the jurisdiction's ability to govern could be eroded. The jurisdiction's public information efforts will be one of their most effective tools to shape opinions during an emergency. If that emergency is a loss of power, many of the systems to accomplish that task may not be functioning (TV, radio, computer, etc.). This will significantly increase the challenge of keeping the public informed of recovery efforts.

Resource Directory

Regional

- **Pierce County Department of Emergency Management**
<http://www.co.pierce.wa.us/Index.aspx?NID=104>
- **Puget Sound Energy**
<http://www.pse.com/Pages/default.aspx>
- **Tacoma Public Utilities**
<http://www.mytpu.org/>
- **Washington Utilities and Transportation Commission**
<http://www.naturalgas.org/>
- **Washington State Energy Office**
<https://www.commerce.wa.gov/growing-the-economy/energy/washington-state-energy-office/>

National

- **FEMA Region X Power Grid Risk Profile: A Risk Analysis Profile from the Region X Threat and Hazard Analysis Report (March 2019)**
http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/mitigationplanning/Shared%20Documents/PrivateSector/FEMA_RegionX_Power_Grid_Risk_Profile_2019_Final.pdf
- **Federal Energy Regulatory Commission**
<http://www.ferc.gov/>
- **NaturalGas.org**
<http://www.naturalgas.org/>
- **North American Electric Reliability Corporation**
<http://www.nerc.com/>
- **U.S. Department of Energy**
<http://www.energy.gov/>
- **National Space Weather Program**
<http://www.nswp.gov/>
- **Health and Human Services emPOWER Program**
<https://empowermap.hhs.gov>

Endnotes

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- ⁸ Michael Sean Sullivan, The News Tribune, In Late 1929, Tacoma Had No Electricity; The US Lexington Brought the Power, <http://www.thenewstribune.com/2012/12/22/2411474/when-a-giant-ship-powered-tacoma.html>
- ⁹ U.S. Department of Energy. (March 2013). Insurance as a Risk Management Instrument for Energy Infrastructure Security and Resilience. Page 46. Retrieved March 13, 2015 from http://energy.gov/sites/prod/files/2013/03/f0/03282013_Final_Insurance_EnergyInfrastructure.pdf
- ¹⁰ Committee on the Societal and Economic Impacts of Severe Space Weather Events: A Workshop, National Research Council, Severe Space Weather Events-Understanding Societal and Economic Impacts, 2013, http://www.nap.edu/openbook.php?record_id=12643&page=4
- ¹¹ Federal Emergency Management Agency, Space Weather, February 2013, <http://www.ready.gov/space-weather>
- ¹² Lexington in Tacoma, photo from NavSource Online, <http://www.navsource.org/archives/02/02.htm>
- ¹³ Washington Military Department, Windstorm Response After Action Report, March 2007, page ii, http://www.emd.wa.gov/publications/documents/FINAL_AAR_040407.pdf
- ¹⁴ <http://washington.stateguidesusa.com/answers-to-my-questions/what-are-the-average-monthly-temperatures-in-washington?/>
- ¹⁵ Gas Buddy Online, http://gasbuddy.com/gb_retail_price_chart.aspx
- ¹⁶ Ronald Turner, National Response to a Severe Space Weather Event, March 2012, <http://www.agu.org/journals/sw/swa/review/swa/feature/article/print.php?id=2011SW000756>
- ¹⁷ James Hamilton, OilPrice.com, The Diminishing Effects of Gas Price Spikes on the Economy, <http://oilprice.com/Energy/Gas-Prices/The-Diminishing-Effects-of-Gas-Price-Spikes-on-the-Economy.html>
- ¹⁸ The Economist, Pakistan's Energy Crisis, Power Politics, Page 1, <http://www.economist.com/blogs/banyan/2012/05/pakistan%E2%80%99s-energy-crisis>
- ¹⁹ Allianz, Power Trip, page 1, <http://www.agcs.allianz.com/insights/expert-risk-articles/energy-risks/>
- ²⁰ Richard J. Campbell, page 1.
- ²¹ Office of the Federal Coordinator for Meteorological Services and Supporting Research National Space Weather Program Council, Report on Space Weather Observing Systems: Current Capability and Requirements for the Next Decade, April 2013.